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Ranking Financial Institutions Based on of Trust in online banking Using ARAS and ANP Method

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ABSTRACT: Various models have been developed by scientists about e-trust that are not comprehensive and only refer to some components. In this study, initially the works of other scientists and their models were analyzed and then a new conceptual model is presented. This conceptual model contains seven different antecedents which affect the customer's e-trust in online banking. In order to determine and prioritize the relationship between model components and identify their effects on customer's trust in online e-banking, we have used the ARAS method, which ranks the financial institutions on the basis of proposed criteria affecting customers' trust in e-banking.
Keywords: Analytic Network Process, ARAS method, conceptual model, trust internete-banking(ANP).

INTRODUCTION

This study is about prioritizing factors affecting e-trust in e-banking. In traditional commerce, the trust-building process was affected by the characteristics of customers, salespeople, the company, and interactions between the two parties involved (Burt and Knez, 1996).It is applicable in the context of electronic commerce or e-banking.

During the late 20th critical technological changedwhich were the appearanceof electronic commerce or the exchange of products and services and payments via telecommunication systems have been developed (Kalakota ans Whinston, 1997).Nevertheless, the appearance of electronic commerce is more apparent in the banking and financial services industry. Using telecommunication systems and these technologies, a bank can get in touch with the customers and provide them withboth general information about its services and the chance of accomplishing interactive retail banking transactions. In the contrary, B2C e-commerce and e-banking has not been accepted by the customers equally (Hoffman et al., 1999), primarily because of the risk concerns and trust-related issues (Lee and Turban, 2001). In essence, there is not enough trust inmany financial transactions and exchanges on the Internet in orderto complete the transactions. Trust is important when it is practically impossible to fully regulate the business agreements and where it is consequently necessary to rely on the other party not to take unfair advantage and not to engage in opportunistic behavior (Deutsch, 1960). Trust is not only a short-term issue but also the most significant long-term barrier for realizing the potentials of B2C e-commerce. Trust is also a significant antecedent of customers' willingness to engage in a transaction with web merchants.

Since customers deeply don't have sufficient trust, so focusing on identifying the antecedents of trust and knowing the priority of them is important to find a solution to eliminate the causes. There should be enough trust between buyers and sellers in order to accomplishing the perfect connection. In electronic banking, the suppliers of the services should prepare the faultless conditions so they can make the customersto be sure about the exchange.

In order to prioritize the antecedents of e-trust we usedDecision ARAS methodwhich describes alternative under consideration, to the sum of the values of normalized and weighted criteria, which describes the optimal alternative, is degree of optimality, which is reached by the alternative under comparison

Our methodology.We identified "determining of ranking factors e-trust in e-banking" as our goal. There are 7 criteria and 14 sub-criteria which affect our goal from literature search modified and expanded by our experts.

literature review

the definition of trust

In order to discuss about the antecedents of e-trust, we should know about the definition of trust first. The definitions of trust relevant to e-commerce and e-banking are cited asbelow (Shumaila Y. Yousafzai, John G. Pallister, Gordon R. Foxall):

Trust is "the belief that a party's word or promise is reliable and a party will fulfill their obligations in an exchange relationship.

Trust exists "when one party has confidence in an exchange partner's reliability and integrity" (Morgan and Hunt, 1994).

Trust is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustee, irrespective of the ability to monitor or control that other party" (Morgan and Hunt, 1994).

Trust is a "psychological state comprising the intention to accept vulnerability based upon positive expectation of the intentions or behavior of another" (Rousseau et al., 1998).

Trust on an online vendor is the "willingness to make one-self vulnerable to actions taken by the trusted party based on the feeling of confidence and assurance".

Trust is "the subjective assessment of one party that another party will perform a particular transaction according to his or her confidant expectation, in an environment characterized by uncertainty" (Ba and Pavlou, 2002).

According to the present authors' literature surveys, there are different studies which show the factors affecting on e-trust. These antecedents are being discussed as criteria which have some sub-criteria, too. These factors are considered from different views: personal variables, substructure variables which the banks have and customer's perceived understanding, they are represented as below:

Web characteristics

Ye Diana Wang and Henry H. Emurian cited that web characteristics, (C1), can be a component which is affecting the e-trust. It can increase consumers' trust or, more precisely, trust perception (Wang and Emurian). These trust-inducing characteristics are classified in four broad dimensions: Graphic design dimension, (C1a): This dimension draws attention to the graphical design features on the web sites that normally impress consumers at first (Kim and Moon, 1998). Structure design dimension, (C1b): This dimension defines the whole organization and approachability of information which is displayed on the web site in order to advance the online trust, the ease of navigation and approachability of the information were frequently mentioned as a necessity (Neilsen, 1998). Content design dimension, (C1c): This dimension refers to the informative constituents that can be contained on the web site, both textual and graphical (Egger, 2001; Neilsen, 1999). Social-cue design dimension, (C1d): This dimension is relevant to embedding social cues, such as face-to-face interaction and social presence. It means consumers' trust has been influenced by the interactivity of communication media (Basso et al., 2001).

Perceived privacy and perceived security

Margulies declared that, ―privacy represents the control of transactions between person and others in order to enhance autonomy and/or minimize vulnerability‖ (Margulis, 1977). For this research, perceived privacy, (C2), is defined as the ―customers' perception regarding their ability to monitor and control the information about themselves.Security is being defined as a threat which creates ―circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, and modification of data, denial of service, and/or fraud, waste, and abuse‖ (Kalakota and Whinston, 1997). Perceived security, (C2), is the ―customers' perception of the degree of protection against these threats‖ Three major components of trustworthiness are: integrity, (C2b), (trustee honesty and promise keeping), benevolence, (C2a), (trustee caring and motivated to act on the trustee's interest) and competence, (C2a), (ability of the trustee to do what the trustee needs) from Mayer and his colleagues' view (Mayer et al., 1995; Shumaila Y. Yousafzai, John G. Pallister, Gordon R. Foxall).

Perceived risk

Risk is a factor which has influence on trust on online transaction (Yao-Hua Tan a, Walter Thoen b). Mitchell (V. Mitchell) considers perceived risk, (C4), to be an antecedent of trust. Three important risks which are concerned with e-banking are as below (N. Lim, 2003). Perceived financial risk, (C4a), which is called economic risk, too is about the possibility of fiscal loss which may happen through online transactions. Perceived functional risk, (C4b), is related to delivered products which are not working satisfactory or just for a short time can be applied

(Jacoby and Kaplan,1972). Perceived privacy risk, (C4c), is about customers'data and use them in other purposes without customers'awareness (E.A. Nyshadham).

Satisfaction

Researchers have focused on antecedents of customer satisfaction, (C5a), with online banking because customer satisfaction is generally assumed to be a significant determinant of repeat sales, positive -word-of-mouth, and consumer loyalty (Bearden and Teel, 1983). Ease of use (C5a), transaction speed (C5b), design (C1b), security (C3), content of the website (C1c) (Cheolho Yoon 2010) are the components of customer's satisfaction on online banking.

Consumer disposition to trust

A consumer's disposition to trust (C6) directly affects the consumer's trust. Consumer disposition to trust applies to a customer's individual characteristics that lead to expectations about trustworthiness, a consumer-specific antecedent of trust. A general intention to display loyalty in humanity and to accept a trusting stance with each other is a consumer's anticipation to trust. Due to different developmental experiences, personality types and cultural backgrounds of customers, they vary in their intrinsic disposition to trust (Fukuyama, 1995). If a high tendency to trust others in general is existed, this disposition is probably to directly affect his or her trust in a certain selling party, inasmuch as a consumer with a low tendency to trust others in general is probably to build a proportionately lower trust in a certain selling party (Dan J. Kim a, Donald L. Ferrin b, H. RaghavRao c). We can suppose online shopping or electronic transactions like e-banking as a behavior. Subjective norm, (C6a), a function of normative beliefs, represents a person's perception of whether meaningful referents approve or disapprove of a behavior. The Theory of Planned Behavior further presents that intention to accomplish a behavior is the closest cause of such a behavior (Ajzen, 1991). A person's behavior is determined by his intention to perform the behavior and that this intention is, in turn, a function of his attitude toward the behavior and his subjective norm. The best predictor of behavior is intention and this intention is determined by their subjective norms (Ajzen, 1988).

The role of familiarity

Familiarity, (C7), deals with an understanding of the current actions of other people or of objects. Familiarity in this context is a specific activity-based cognizance based on previous experience, (C7a). A consumer's familiarity (FAM) with a selling party positively affects the consumer's trust (Luhmann N. Trust and power. Chichester, UK).

It is important to know what factors influence the customer's trust on e-banking. Such understanding of the antecedents of customer's trust will provide the researchers to know the factors which construct the trust in on line transactions. This process will improve financial services in the internet finally. This paper intends to follow these goals:

G1. Propose a conceptual model of e-trust for electronic banking.
G2. UseARAS method analysis in order to prioritize the antecedents.
G3. Identify important factors in their priorities.

3. A conceptual model for e-trust for electronic banking

C1				C2		C3	C4			C5		C6	C7
Web characteristic				perceived privacy		perceived security	perceived risk			satisfaction		Disposition to trust	familiarity
C1a	C1b	C1c	C1d	C2a	C2b	C3a	C4a	C4b	C4c	C5a	C5b	C6a	C7a
Graphic design	structure design	content design	social-cue design	Perceived benevolence	perceived integrity	perceived competence	financial risk	functional risk	privacy risk	Ease of use	Transaction speed	Subjective norm	Previous experiences

METHODOLOGY

TheARAS Method

ARAS method (Zavadskas and Turskis, 2010, Zavadskas et al., 2010a; Tupenaiteet al.2010) is based on the argument that phenomena of complicated world could to be understood by using simple relative comparisons. It is argued that the ratio of the sum of normalized and weighted values of criteria, which describes alternative under consideration, to the sum of the values of normalized and weighted criteria, which describes the optimal alternative, is degree of optimality, which is reached by the alternative under comparison.

The first stage is decision-making matrix (DMM) forming. In the MCDM of the discrete optimization problem any problem to be solved is represented by the following DMM of preferences for m feasible alternatives (rows)

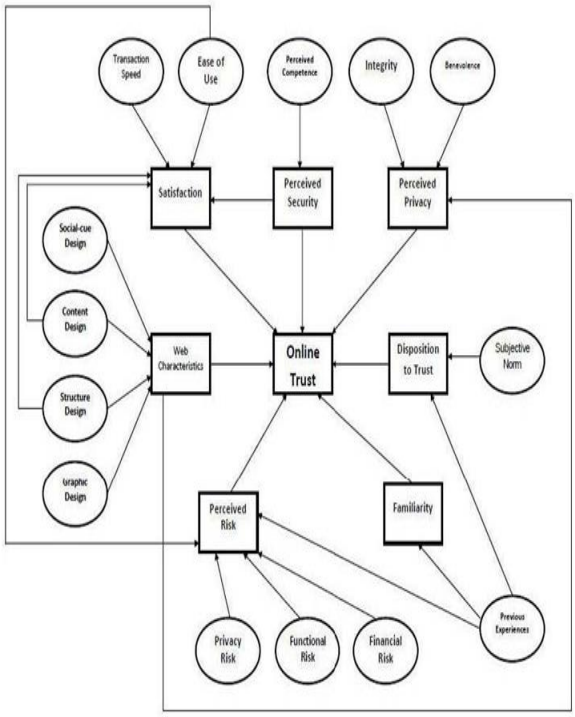

Figure1. The proposed conceptual model for e-trust on online banking

$$X = \begin{bmatrix} x_{01} & \cdots & x_{0j} & \cdots & x_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & \cdots & x_{ij} & \cdots & x_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mj} & \cdots & x_{mn} \end{bmatrix}; \quad i = \overline{0, m}; \; j = \overline{1, n},$$

rated on n sign full criteria (columns):

EQ1

where m – number of alternatives, n – number of criteria describing each alternative, xij– value representing the performance value of the i alternative in terms of the j criterion, x0j – optimal value of j criterion.
If optimal value of j criterion is unknown, then

$$x_{0j} = \max_i x_{ij}, if \max_i x_{ij} \; is \; preferable;$$

$$x_{0j} = \min_i x_{ij}^*, if \min_i x_{ij}^* \; is \; preferable.$$

EQ2

Usually, the performance values xij and the criteria weights wj are viewed as the entries of a DMM. The system of criteria as well as the values and initial weights of criteria are determined by experts. The information can be corrected by the interested parties by taking into account their goals and opportunities.

Then the determination of the priorities of alternatives is carried out in several stages. Usually, the criteria have different dimensions. The purpose of the next stage is to receive dimensionless weighted values from the comparative criteria. In order to avoid the difficulties caused by different dimensions of the criteria, the ratio to the optimal value is used. There are various theories describing the ratio to the optimal value. However, the values are mapped either on the interval [0; 1] or the interval [0; ∞] by applying the normalization of a DMM.

In the second stage the initial values of all the criteria are normalized – defining valuesxij of normalized decision-making matrix X

.

$$\bar{X} = \begin{bmatrix} \bar{x}_{01} & \cdots & \bar{x}_{0j} & \cdots & \bar{x}_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ \bar{x}_{i1} & \cdots & \bar{x}_{ij} & \cdots & \bar{x}_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ \bar{x}_{m1} & \cdots & \bar{x}_{mj} & \cdots & \bar{x}_{mn} \end{bmatrix}; \quad i = \overline{0, m}; \; j = \overline{1, n}.$$

EQ3

The criteria, whose preferable values are maxima, are normalized as follows:

$$\bar{x}_{ij} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}}.$$

EQ4

The criteria, whose preferable values are minima, are normalized by applying two-stage procedure:

$$x_{ij} = \frac{1}{x_{ij}^{*}}; \; \bar{x}_{ij} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}}.$$

EQ5

When the dimensionless values of the criteria are known, all the criteria, originally having different dimensions, can be compared.

The third stage is defining normalized-weighted matrix –. It is possible to evaluate the criteria with weights 0 <wj< 1. Only well-founded weights should be used because weights are always subjective and influence the solution. The values of weight wj are usually determined by the expert evaluation method. The sum of weights wj would be limited as follows:

$$\sum_{j=1}^{n} w_j = 1 .$$

$$\hat{X} = \begin{bmatrix} \hat{x}_{01} & \cdots & \hat{x}_{0j} & \cdots & \hat{x}_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ \hat{x}_{i1} & \cdots & \hat{x}_{ij} & \cdots & \hat{x}_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ \hat{x}_{m1} & \cdots & \hat{x}_{mj} & \cdots & \hat{x}_{mn} \end{bmatrix}; \; i = \overline{0, m}; \; j = \overline{1, n} .$$

EQ 6-7
Normalized-weighted values of all the criteria are calculated as follows:

$$\hat{x}_{ij} = \overline{x}_{ij} w_j \; ; \; i = \overline{0, \; m} \; ,$$

EQ8
Wherethe weight (importance) of the j criterion and xij is the normalized rating of the criterion.
The following task is determining values of optimality function:

$$S_i = \sum_{j=1}^{n} \hat{x}_{ij} \; ; \; i = \overline{0, \; m} \; ,$$

EQ9
Where Si is the value of optimality function of i alternative.

The biggest value is the best, and the least one is the worst. Taking into account the calculation process, the optimality function Si has a direct and proportional relationship with the values xij and weights wj of the investigated criteria and their relative influence on the final result. Therefore, the greater the value of optimality function Si, the more effective alternative is. The priorities of alternatives can be determined according to the value of Si.

Consequently, it is convenient to evaluate and rank decision alternatives when this method isused. The degree of the alternative utility is determined by a comparison of the variant, which isanalyzed, with the ideally best one S0. The equation used for the calculation of the utility degree Ki of an alternative ai is given below:

$$K_i = \frac{S_i}{S_0} ; \; i = \overline{0, \; m} \; ,$$

EQ10

Where Si and S0 are the optimality criterion values, obtained from Eq. (9).
It is clear, that the calculated values Ki are in the interval [0, 1] and can be ordered in an increasing sequence, which is the wanted order of precedence. The complex relative efficiency of the feasible alternative can be determined according to the utility function values.

Analytic Network Process

The Analytic Network Process (ANP) is a general theory of relative measurement used to derive composite priorities ratio scales from individual ratio scales that represent relative measurements of the influence of elements

that interact with respect to control criteria. The ANP captures the outcome of dependence and feedback within and between clusters and elements is a special case of the ANP. It provides a general framework to deal with decisions without making assumptions about the independence of higher level elements from lower level elements and about the independence of the elements within a level. It is a useful tool for prediction and for representing a variety of competitors with their surmised interactions and their relative strengths to wield influence in making a decision. This technique is a coupling of two parts. The first consists of a control hierarchy or network of criteria and sub-criteria that control the interactions. The second is a network of influences among the elements and clusters. The network varies from criterion to criterion and a different super-matrix of limiting influence is computed for each control criterion. Finally, each of these super-matrixes is weighted by the priority of its control criterion and the results are synthesized through addition for all the control criteria (Thomas L.saaty). The best method decision makers can introduce the concepts of affecting or being affected on, between clusters and between elements concerning a particular element is using Inner dependency which is used for links between elements within the same cluster and outerdependencywhich used for links between a criteria element in one cluster and its sub-criteria in another cluster (Thomas L.saaty).

Based on ANP technique, measuring Factors influencing on Trust in online banking were conducted.

Table 1

criteria	C1a	C1b	C1c	C1d	C2a	C2b	C3a	C4a	C4b	C4c	C5a	C5b	C6a	C7a
weight	0.043	0.052	0.044	0.072	0.066	0.163	0.049	0.089	0.056	0.216	0.021	0.024	0.056	0.049

Whereas the goal was to investigate the performance of financial institutions in gaining customers' trust on the basis of e-banking, 20 financial institutions were chosen to be studied according to the developed criteria.Primary information about assessment of the banks using ARAS technique is as follows:

Table 2

	Criteria													
criteria	C1a	C1b	C1c	C1d	C2a	C2b	C3a	C4a	C4b	C4c	C5a	C5b	C6a	C7a
Optimization Direction	max	max	max	max	max	max	Max	min	min	min	max	max	max	max
weight	0.043	0.052	0.044	0.072	0.066	0.163	0.049	0.089	0.056	0.216	0.021	0.024	0.056	0.049
0 – Optimal value	10	10	10	10	10	10	10	1	1	1	10	10	10	10
b1	3	5	9	7	7	3	7	8	8	6	8	6	9	9
b2	7	6	3	4	8	9	5	8	8	8	9	5	9	8
b3	8	6	2	7	7	5	2	2	2	2	6	6	6	6
b4	8	9	5	5	4	9	2	6	9	9	5	8	8	6
b5	9	9	8	6	3	8	9	1	1	1	9	9	9	9
b6	8	8	2	5	8	9	2	6	9	8	4	6	3	6
b7	9	3	5	6	5	8	5	6	7	3	6	7	2	3
b8	8	3	6	8	6	9	2	9	8	9	2	8	3	6
b9	9	2	2	9	1	7	3	9	9	9	8	9	2	5
b10	8	3	3	6	5	8	2	5	5	3	9	6	3	4
b11	2	2	2	7	2	2	3	9	9	9	2	2	2	2
b12	3	3	6	8	9	8	5	7	7	3	6	9	5	7
b13	2	2	1	3	2	3	3	2	1	1	3	4	3	3
b14	5	5	5	6	5	9	6	8	9	5	6	6	2	6
b15	3	3	6	8	6	5	4	9	6	2	6	8	5	6
b16	2	2	5	9	8	6	6	7	5	3	3	5	6	6
b17	5	5	4	5	9	7	8	8	5	2	6	6	2	6
b18	6	6	6	6	7	8	7	9	4	3	5	1	6	3
b19	2	2	2	5	5	5	4	5	5	4	4	5	4	4
b20	3	3	3	9	5	6	5	6	2	5	7	8	7	5

Conducting ARAS algorithm after normalizing the primary data, results in

The ranking of the banks on the basis of criteria given before, results of which are presented in the table below:

Table3

criteria	C1a	C1b	C1c	C1d	C2a	C2b	C3a	C5a	C5b	C6a	C7a	C4a	C4b	C4c	s	k
Optimization Direction	max	max	max	max	max	max	max	max	max	max	max	min	min	min		
Weight	0.04	0.05	0.04	0.07	0.07	0.16	0.05	0.02	0.02	0.06	0.05	0.09	0.06	0.22		
Optimal – 0 value	0.004	0.005	0.005	0.005	0.005	0.011	0.005	0.002	0.002	0.005	0.004	0.016	0.009	0.028	0.106	1.000
b1	0.001	0.003	0.004	0.004	0.004	0.003	0.003	0.001	0.001	0.005	0.004	0.002	0.001	0.005	0.041	0.384
b2	0.003	0.003	0.001	0.002	0.004	0.010	0.002	0.002	0.001	0.005	0.003	0.002	0.001	0.004	0.043	0.406
b3	0.003	0.003	0.001	0.004	0.004	0.006	0.001	0.001	0.001	0.003	0.002	0.008	0.004	0.014	0.055	0.520
b4	0.003	0.005	0.002	0.003	0.002	0.010	0.001	0.001	0.001	0.004	0.002	0.003	0.001	0.003	0.042	0.392
b5	0.003	0.005	0.004	0.003	0.002	0.009	0.004	0.002	0.002	0.005	0.004	0.016	0.009	0.028	0.095	0.890
b6	0.003	0.004	0.001	0.003	0.004	0.010	0.001	0.001	0.001	0.002	0.002	0.003	0.001	0.004	0.039	0.368
b7	0.003	0.002	0.002	0.003	0.003	0.009	0.002	0.001	0.001	0.001	0.001	0.003	0.001	0.009	0.042	0.398
b8	0.003	0.002	0.003	0.004	0.003	0.010	0.001	0.000	0.001	0.002	0.002	0.002	0.001	0.003	0.038	0.354
b9	0.003	0.001	0.001	0.005	0.001	0.008	0.001	0.001	0.002	0.001	0.002	0.002	0.001	0.003	0.032	0.299
b10	0.003	0.002	0.001	0.003	0.003	0.009	0.001	0.002	0.001	0.002	0.002	0.003	0.002	0.009	0.042	0.394
b11	0.001	0.001	0.001	0.004	0.001	0.002	0.001	0.000	0.000	0.001	0.001	0.002	0.001	0.003	0.020	0.185
b12	0.001	0.002	0.003	0.004	0.005	0.009	0.002	0.001	0.002	0.003	0.003	0.002	0.001	0.009	0.047	0.442
b13	0.001	0.001	0.000	0.002	0.001	0.003	0.001	0.001	0.001	0.002	0.001	0.008	0.009	0.028	0.059	0.552
b14	0.002	0.003	0.002	0.003	0.003	0.010	0.003	0.001	0.001	0.001	0.002	0.002	0.001	0.006	0.040	0.375
b15	0.001	0.002	0.003	0.004	0.003	0.006	0.002	0.001	0.001	0.003	0.002	0.002	0.001	0.014	0.045	0.426
b16	0.001	0.001	0.002	0.005	0.004	0.007	0.003	0.001	0.001	0.003	0.002	0.002	0.002	0.009	0.043	0.407
b17	0.002	0.003	0.002	0.003	0.005	0.008	0.004	0.001	0.001	0.001	0.002	0.002	0.002	0.014	0.049	0.461
b18	0.002	0.003	0.003	0.003	0.004	0.009	0.003	0.001	0.000	0.003	0.001	0.002	0.002	0.009	0.046	0.435
b19	0.001	0.001	0.001	0.003	0.003	0.006	0.002	0.001	0.001	0.002	0.002	0.003	0.002	0.007	0.033	0.310
b20	0.001	0.002	0.001	0.005	0.003	0.007	0.002	0.001	0.001	0.004	0.002	0.003	0.004	0.006	0.042	0.392

Considering the significance of trust among the sub-criteria for in online banking the importance can be prioritized as

B5＞B13＞B3＞B17＞B12＞B18＞B15＞B16＞B2＞B7＞B10＞B20＞B4＞B1＞B14＞B6＞B8＞B19＞B9＞B11

According to the results, with the effectiveness coefficient of 0.890-0.552 and0.520 respectively, financialinstitutions 5-13- and 3 were able to attract the most trust form the customers in e-banking.

And also financial institutions number 11-9- and 19 were the lowest in gaining trust in e-banking with the effectiveness coefficient of 0.185- 0.299 - 0.310 respectively.

CONCLUSIONS

The conceptual framework and operational model for the antecedents of trust in online banking have been presented. Using ARAS, the structure and interrelationships have not only beenrecognized, the key criteria that influence on online banking with regard to trust have also been determined. Results indicate that the three most successful banks in this study can be a headway for other banks.

First, a new model for online banking with emphasis on antecedents of trust issues has beendeveloped. Such a framework has never been found in the previous literature. Second, theARAS method was applied in ranking criteria and sub-criteria, it is rarely found from the previous studies. ARAS can deal with the complicated and intertwined problems and simply rank the choices according to some given criteria.

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