DEVELOPMENT OF TRUST MODEL FOR PROXY MARKETERS ENGAGED IN E-COMMERCE PLATFORMS

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ABSTRACT

A trust model/mechanism for proxy marketer-based e-commerce system was developed in this work. The system comprised of two modules, the shopping module which has an online shop and virtual warehouse; and the trust module. The online shop and virtual warehouse are used to manage the products on the e-commerce system, the trust mechanism is used to manage client trust in a proxy marketer. Proxy marketers have been introduced into online shopping to ease trust concerns of customers. This has helped with customers' worries of security of online shopping platforms, but has shifted other concerns from the online shops to the proxy marketers. This has created the need to integrate trust mechanisms into online shopping platforms to enable online shoppers evaluate trustworthiness of the proxy marketers they are dealing with. The work offers four tiers of trust rating: context-based trust rating, trust rating per transaction, moving window trust rating and cumulative trust rating. The transaction trust rating handles online clients' concern about proxy marketer's salesmanship, while moving window and cumulative trust ratings handle concerns about his performance consistency or ability to maintain success levels as well as a marketer's ability to recover from moments of ebbing turnover. The work proves that with an effective trust mechanism, proxy marketers can be incorporated into an e-commerce platform for its improved patronage.

Keywords: Trust mechanism, proxy marketers.

1.0 INTRODUCTION

In recent years, there has been widespread adoption of internet across the globe and in respect of this other technologies and applications have equally emerged particularly, e-commerce platforms and e-transactions. The challenge with this is the issue of trust for these proxy marketers and the reward mechanism for the proxy marketers. In Nigeria there equally has been growth in the usage of internet. The growth of the number of Internet users in Nigeria has been meteoric year by year between 2009 and 2017. According to the Internet Live Stat (2017), in 2009, the number of internet users leaped to 31,041,429, with 124,165,716 yet to access the internet. In 2013, there were 65,670,276 internet users and 107,146,241 non-internet users. By March, 2017, the number of internet users in Nigeria was put at 93,591,174, while the number of non-internet users became 98,244,762. So, although internet use in Nigeria has had respectable growth over the last decade, there are still more internet non-users than users, a representation of a huge potential e-market.

The internet users, though fewer, have been heavily involved in online trade. In 2014 alone, Nigeria recorded over $2 million worth of online transactions per week and close to $1.3 billion monthly (Adepetun, Caxton-Martins, Agbor and Segun, 2015). In August, 2017, the Nigeria's e-commerce market value was worth $13billion (Eromosele, 2017). It is, however,

not yet freedom for e-commerce in Nigeria. Many out of the population of internet users earlier mentioned have not yet fully adopted the e-commerce technology.

To elaborate on the low patronage of e-shopping or online shopping, Ahmed and Richard (2015) identified common e-commerce related activities among internet users and the percentage of the internet users that engage in such activities in Nigeria as, products browsing (74%), products selection (56%), online payment (15%) and offline payment (82%). From these statistics it is obvious that though consumers were interested in shopping online, only a handful actually completed the transaction. Ayo, Ekong, Fatudimu, and Adebiyi, (2008) identified the issue of lack of trust as the major factor responsible for the low level of e-commerce implementation in Nigeria. According to Mahmood, Bagchi and Ford (2004), the trust factor has significant positive contributions to consumers' online shopping behaviour. Jiang, Cheng and Wang (2008) argued that consumer trust is a critical enabler of successful online retailing and knowledge is one important factor influencing the level of trust. Notably, addressing the issue of trust in e-commerce platforms can significantly improve on their patronage and market share. However, the introduction of proxy marketers into an e-commerce system presents further challenge on the level of trust even though they operate using their social networks. As such, there is need to equip e-shoppers with a trust mechanism on the shopping platform to enable them evaluate trustworthiness of proxy marketers they are dealing with.

2.0 RELATED LITERATURE

Faruk and Arnab (2016) discussed how trust and reputation is calculated in the social network scenario. A trust management model which will take factors like direct, indirect and global trust of the service to find out the final trust value of the service. An important factor like the trust path distance while calculating the indirect trust was proposed for efficient result Firstly, the user's interest is taken as input and identifies a subset of services that matched with the user's interest. The direct trust of all the services to which the user had past interaction is evaluated if available and the indirect trust of the services with the help of the users friend circle is also evaluated if available. The direct and indirect trust of a particular service is integrated to find out the local trust of that service. Also, the global trust of a service is evaluated. The local trust and global trust of a service is integrated to find out the final trust value of that service. Finally combination of local and global trust was performed to find out the final trust value of a service. The trust model is a centralized trust model.

Asmita, Anirban and Chandan (2016) identified all attributes that a trust model must have for being used by an enterprise information security system. But none of the available models support all of them. The attributes identified were: context dependency, non-transitivity, non-monotonicity, subjectivity, uncertainty, asymmetry, temporal decay, QoS monitoring, hierarchy, feedback credibility, feedback similarity and credibility validity. Trust model plays a crucial role in designing trust policies for different fields like e-commerce, sensor network, pervasive computing and particularly for access control. Not much work has been done towards designing trust based security policies for enterprise information security for which choosing a suitable trust model is a crucial issue.

The model by X. Tang and M. Chen (2011) is a recommendation trust model based on reputation or credibility (i.e., RBRTrust Model) which takes into account the subjective and objective factors which impact trust. The model considers interactive scope, interactive time, interactive context, etc., through local trust, direct trust and recommendation trust to get the

overall trust value. The authors provide a specific method to calculate the trust value, and also describe the overall trust evaluation strategy. This model aims to solve the recommendation trust problems in interoperability environment.

3.0 RESEARCH METHODOLOGY

This section discusses the trust system specifications, system overview and working mechanism.

3.1 System Specification

The trust model tracks, manages and establishes client trust on the proxy marketers while the reward model computes the reward for the proxy marketers. As specification, the shopping platform equipped with the reward system will feature the following:

i. facility for registering participants.
ii. form creation where proxy marketers can register and create their profile.
iii. Create a form for registering of clients.
iv. facilities needed for e-commerce transactions.
v. the system should allow for context-based trust rating.
vi. the system should compute the trust rating for each transaction.
vii. the system should compute the moving window trust rating of the transactions periodically.
viii. the system should compute the cumulative trust rating from all the transactions of each of the proxy marketers.

3.2 System Overview

The trust model/mechanism for proxy marketer-based e-commerce system developed in this work incorporates and manages proxy marketers on an e-commerce platform. The trust model tracks, manages and establishes client trust on the proxy marketers. As depicted in Figure 1, the trust rating was computed in a progression of four levels:

1. Context-based rating: This was to avoid halo/horn effect where the clients rate the proxy marketer by just one pronounced context of strength or weakness. Secondly, it was to make sure that the proxy marketers are only evaluated on aspects relevant to salesmanship.

2. Trust rating for each transaction: This is to make sure every transaction counts regardless of the monetary value.

3. Moving window trust rating: This will be computed after every four transactions using rolling weighted average. The justification for this is if a proxy marketer had a poor start or period, he gets to make up for that with good current scores; or if he has had a really productive period, he doesn't rest on his laurels as recent poor scores can easily erode that.

4. Cumulative trust rating: This will be cumulative weighted average of all transaction trust scores or ratings. This level of trust rating is to give clients an idea of how consistent the proxy marketer is – if he has had good performances, how long has that been?

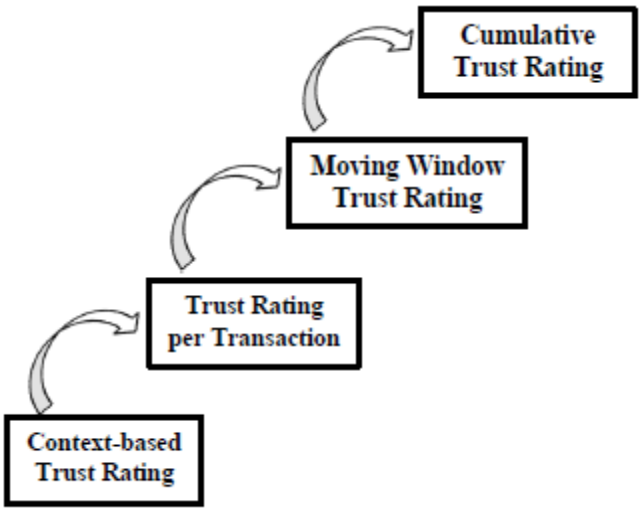

Figure 1: Block diagram showing succession of Trust Computation levels.

3.3 Trust Mechanism

In developing the trust mechanism, first transactions were categorized and weighted based on profit level. Next, mathematical models were developed for the trust computations at the four levels earlier mentioned.

1. Categorization of transactions:

The transactions were categorized into four with each having its own weight as shown in Table 1. The weighting of transactions was modeled after a micro scale industry. The annual turnover or profit for a micro scale industry in Nigeria is at least ₦20 million, which means the monthly profit would be at ₦1.67 million with at least ten employees. With this number of employees, spreading ₦1.67 million over 10 employees yields a monthly profit of about ₦166,667 per employee.

Table 1: Categorization and Weighting of Transactions.

Transaction Category	Transaction Weight (w)	Profit per Transaction (₦)
Category 4	4	30,001 – 42,000
Category 3	3	20,001 – 30,000.99
Category 2	2	10,001 – 20,000.99
Category 1	1	1 – 10,000.99

2. Mathematical Models for Trust Mechanism:

The mathematical models used for the computation of the four levels of trust rating are described as follows:

i. Context-based Trust Rating: Availability, delivery timeliness and interactive skills were the three contexts considered for assessing a proxy marketer. These contexts were specified because clients generally may not be aware of what makes a good marketer. If not specified, clients may rate proxy marketers on some spurious characteristic not at all relevant to a successful transaction. It should be noted that the contexts – availability, delivery timeliness and interactive skills are each measured on a scale of five (5 – Excellent, 4 – Very Good, 3 – Good, 2 – Fair and 1 – Poor).

Equation 3.1 is the general formula used to derive the mathematical model for the context-based trust rating. The questionnaire in Appendix I was sent out to ascertain the percentage of relevance of the contexts to clients. The percentages of relevance for availability, k_a, delivery timeliness, k_t, and interactive skills, k_i sum up to 100% as shown in Equation 3.2. From Equation 3.3, it is seen that availability, a, and delivery timeliness, t, have a coefficient of two while the interactive skill, i, has a coefficient of one. After computing the results from the questionnaire, availability, a, and delivery timeliness, t, were weighted two each and interactive skill, i, was weighted one because of their level of relevance to the clients.

$$r = k_a\,(a) + k_t\,(t) + k_i\,(i) \quad \text{Equation 3.1}$$

$$k_a + k_t + k_i = 100\% \quad \text{Equation 3.2}$$

In this research, $k_a = 40\%$, $k_t = 40\%$ and $k_i = 20\%$, this implies that,

$$r = \frac{2a+2t+i}{5} \quad \text{Equation 3.3}$$

where r = context-based trust rating, a = availability, t = delivery timeliness, i = interactive skill, k_a = percentage of relevance of a to the clients, k_t = percentage of relevance of t to the clients, and k_i = percentage of relevance of i to the clients.

The context-based trust rating is used to calculate the trust rating for the transaction which is the next of trust rating.

ii. Trust Rating per Transaction: The context-based trust rating, r is multiplied by the weight of the transaction, w. The result is then divided by four (4) which is maximum transaction weight. The trust rating for each transaction is used to compute moving window trust rating with a window of four transactions and cumulative trust rating of the proxy marketer. Equation 3.4 shows the mathematical model for computing the trust rating for each transaction.

$$tr = \frac{(rw)}{4} \quad \text{Equation 3.4}$$

where tr = trust rating per transaction, r = context-based trust rating and w = weight of transaction.

iii. Moving Window Trust Rating: The moving window trust rating is computed for the last four transactions of the proxy marketer. Equation 3.5 presents the mathematical model for computing the moving window trust rating. Equation 3.6 is the expanded form of Equation 3.5.

$$mtr = \sum_{x=1}^{4} \frac{tr_x}{4} \quad \text{Equation 3.5}$$

In expanded form,

$$mtr = \frac{tr_1 + tr_2 + tr_3 + tr_4}{4} \quad \text{Equation 3.6}$$

where mtr = moving window trust rating, tr_1 = trust rating for first transaction in the current window/period, tr_2 is the second, and so on.

iv. Cumulative Trust Rating: The cumulative trust rating is computed for all the transactions a proxy marketer has made from inception. The rating provides the historical information on proxy marketers' performance so that there is avoidance of the Matthew effect. The Matthew effect is occurs when proxy marketers are overlooked based on past poor performance even when there has been improvement. Also, it makes the proxy marketers

work hard to maintain or improve their rating. Equation 3.7 presents the mathematical model for computing the cumulative trust rating. Equation 3.8 is the expanded form of Equation 3.7.

$$ctr = \sum_{x=1}^{n} \frac{tr_x}{4} \quad \text{Equation 3.7}$$

In expanded form,

$$ctr = \frac{tr_1 + tr_2 + tr_3 + \cdots + tr_n}{n} \quad \text{Equation 3.8}$$

where ctr = cumulative trust rating, n = number of transactions from inception, tr_1 = trust rating for the proxy marketer's first transaction since employ, tr_2 is the second, and tr_n is his most recent transaction rating.

4.0 TRUST MECHANISM ALGORITHM

The computation of the trust rating for each transaction as shown in Figure 2 is done using the context-based trust rating. The contexts are availability, delivery timeliness and interactive skills of the proxy marketer. Availability and delivery timeliness are each weighted two points while the interactive skill is weighted one point. For the computation of transaction trust, tr, weight, w, and context-based trust, r, are computed first following two major paths respectively. Once a particular transaction is completed from which the profit is got, the customer rates the service by supplying the rating scores for availability, a, delivery timeliness, t, and the marketer's interactive skill, i. Next, context-based trust rating, r, is computed using the formula r = (2a +2t i)/5 as shown in Equation 3.3.

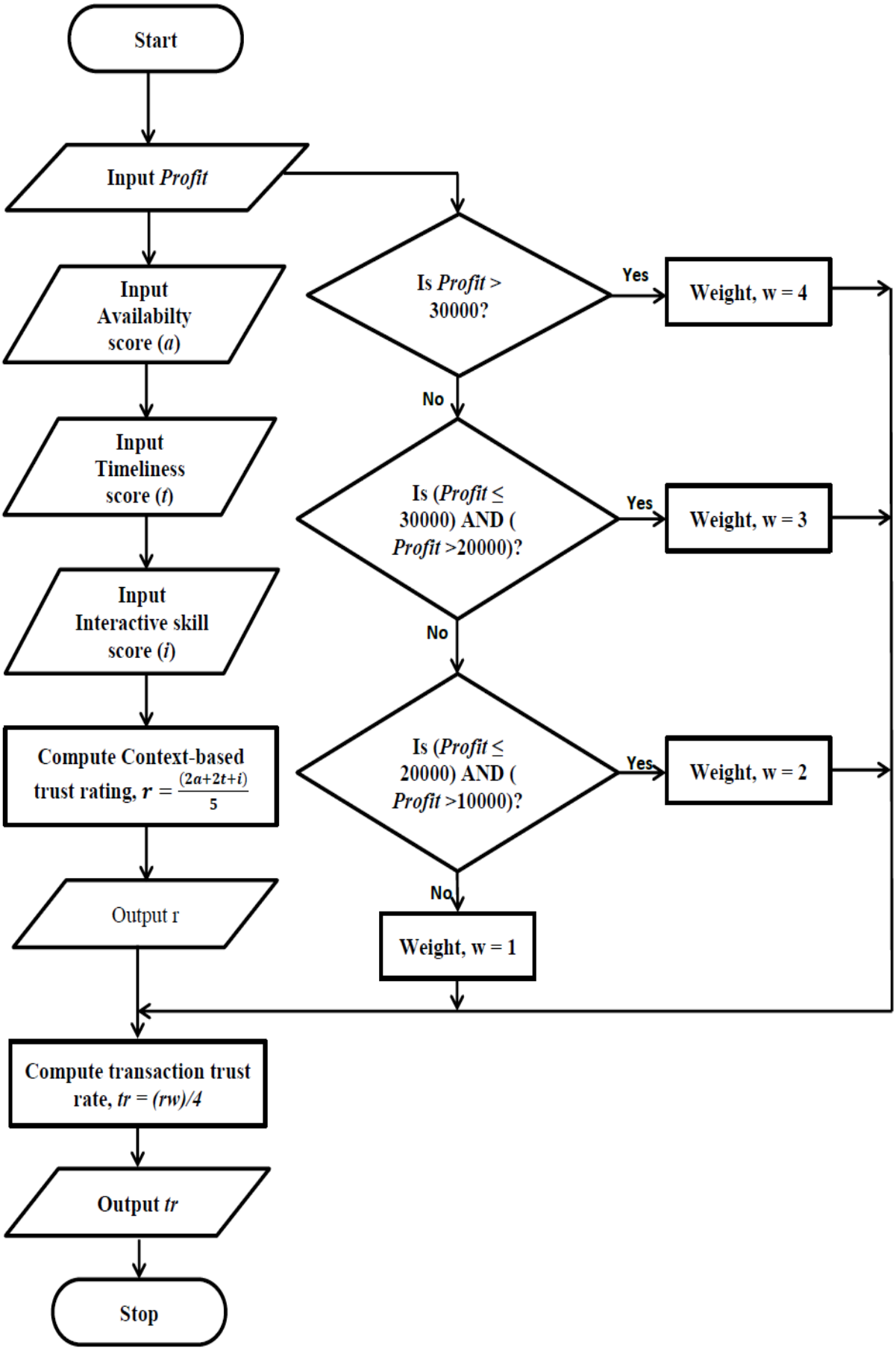

Figure 2: Flowchart for trust rating

The weight, w, is also computed simultaneously once the transaction profit is calculated. In the first decision node, profit is checked if it more than 30,000. If true, the transaction is assigned a weight of 4, if false the next decision node is evaluated. Profit is checked if it is greater than 20,000 and less than 30,000. If this node evaluates to true, the transaction is weighted 3, if not the next condition is tested. If the profit is greater than 10,000 and less than or equal to 20,000, then the weight is 2, else weight of 1 is assigned to the transaction. The transaction trust rate, tr, is computed by dividing the product of the context-based trust rating, r, and transaction weight, w by 4 as shown in Equation 3.4.

5.0 CONCLUSION AND RECOMMENDATION

The trust mechanism developed in this work was aimed at solving trust concerns of online shoppers, especially when proxy marketers are incorporated. The transaction trust rating for instance handles online clients' concern about service delivery attributes of a proxy marketer, moving window and cumulative trust ratings handle concerns about his performance consistency or ability to maintain success levels, concerns about a marketer's ability to recover from moments of ebbing turnover. Integrating transaction weights into the trust computations on the other hand means the online shop's trust of their proxy marketer is also considered since it provides incentive for marketers to target high profit transactions.

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