

## User Acceptance of Biometric Authentication in Malaysian ATMs

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**Abstract:** This research is carried out to examine key factors user acceptance of Automatic Teller Machines (ATM) biometric authentication technology in Malaysian conventional banks. The target population was Malaysian commercial bank customers. The participants were randomly selected. The findings show that both performance expectancy and social influence have significant effects on user adoption of ATM biometric authentication. Therefore, the system developer should develop a biometric ATM system that would be able to validate an ATM user's identity by comparing the captured gait, palm, voice and signature data with the user's gait, palm, voice and signature template stored system database.

**Key words:** ATM, biometrics, performance expectancy, social influence, behavioural intention to use

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### INTRODUCTION

Malaysia is among the first country worldwide to use biometrics in its ID identification cards. Conventional ATM system authenticates user identity by using a card and a password (Amurthy and Reddy, 2012) which is found to suffer from limitations such as passwords can be stolen, lost or duplicated (Boateng and Molla, 2006). On top of that, conventional authentication also causes high errors and enrolment failures (Boateng and Molla, 2006; Reddy *et al.*, 2008).

As a result, Malaysian conventional banks are about to place additional biometric authentication at the Automatic Teller Machines (ATM) machines. Biometric techniques are used to improve ATMs security. At the time of the ATM transaction, the user's biometric images can be captured at the ATM terminal (Onyesolu and Ezeani, 2012; Sheeba and Bernard, 2012). The encrypted image can then be transmitted to the bank's central server. Matching can be done to verify the biometric images are belonging to the bank customer (Onyesolu and Ezeani, 2012; Sheeba and Bernard, 2012). Biometric ATM authentication authenticate a ATM user's identity with great robustness and excellent security (Onyesolu and Ezeani, 2012; Ratha *et al.*, 2001; Sheeba and Bernard, 2012).

There is a lack of studies in Malaysia and around the world that studied user acceptance of ATM biometric authentication technology. Previous literature, Gao and Deng (2012) investigated Chinese users' acceptance of mobile e-Books, Yamin and Lee (2010) studied Malaysian students' acceptance of e-Mail system and Irvine *et al.* (2013) examined the Canadian teachers' acceptance of e-Learning portal. All these studies seems to overlook the

user acceptance of ATM biometrics authentication which is an increasingly important mechanism to verify user identity in banking industry.

**Objective of the study:** This study is carried out to examine key factors user acceptance of ATM biometric authentication technology in Malaysian conventional banks.

### Literature review

**ATM biometric authentication:** Two main ATM biometric authentications (Deane *et al.*, 1995; Sheeba and Bernard, 2012):

- Physiological (fingerprint verification and iris analysis)
- Behavioural (handwritten signature verification)

Deane *et al.* (1995) and Sheeba and Bernard (2012) found that the physiological or biometric authentication has greater acceptance nowadays than in the past due to improved security level and cheaper cost.

**Behavioural intention to use ATM biometric authentication:** Behavioural intentions have been seen as an effective way to evaluate the acceptance of ATM biometric system (Arekete *et al.*, 2014). Behavioural intention to use ATM biometric authentication is not limiting to the "intention to accept" but also include continual usage of ATM biometric authentication in the coming future. The influence of factors such as social influence, attitude, performance expectancy, effort expectancy and anxiety on behavioural intention to use

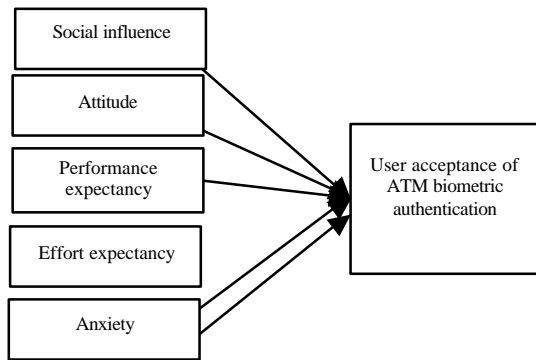


Fig. 1: Research framework

ATM biometric authentication technology has been under-researched and there is a lack of explanatory models on this research area in commercial banks in Malaysia. Therefore, the following hypotheses are tested in this study (Fig. 1):

- H<sub>1</sub>: social influence affects ATM biometric authentication
- H<sub>2</sub>: attitude affects ATM biometric authentication
- H<sub>3</sub>: performance expectancy affects ATM biometric authentication
- H<sub>4</sub>: effort expectancy affects ATM biometric authentication
- H<sub>5</sub>: anxiety affects ATM biometric authentication

**MATERIALS AND METHODS**

The target population of this study was commercial bank customers in Malaysia. The participants were randomly selected. The data was collected using survey questionnaire which was developed from extensive literature reviews. The first section of the questionnaire inquires about participants’ profile while the second section asks about factors that influence the use of ATM biometric authentication. Of the 200 copies of the questionnaire administered, 139 complete questionnaires were collected and analysed by using statistical software.

**RESULTS AND DISCUSSION**

Table 1 shows that 51.1% of the survey respondents are females while 48.9% are males. Table 2 shows that 69.8% of the respondents are young adolescents under the age of 30 years old. About 24% of the respondents are middle-age adults of 31-40 years old.

Table 3 shows that gait (Mean ratings = 6.78) is ranked as the most important ATM biometric authentication method by the respondents. Palm is

Table 1: Gender

| Gender | Frequency | (%)   | Valid (%) | Cumulative (%) |
|--------|-----------|-------|-----------|----------------|
| Male   | 68        | 48.9  | 48.9      | 48.9           |
| Female | 71        | 51.1  | 51.1      | 100.0          |
| Total  | 139       | 100.0 | 100.0     |                |

Table 2: Age

| Age (years) | Frequency | (%)   | Valid (%) | Cumulative (%) |
|-------------|-----------|-------|-----------|----------------|
| Under 21    | 39        | 28.1  | 28.1      | 28.1           |
| 21-30       | 58        | 41.7  | 41.7      | 69.8           |
| 31-40       | 33        | 23.7  | 23.7      | 93.5           |
| 41-50       | 9         | 6.5   | 6.5       | 100.0          |
| Total       | 139       | 100.0 | 100.0     |                |

Table 3: Biometric measures

| Variables   | N   | Min. | Max. | Mean | SD    |
|-------------|-----|------|------|------|-------|
| Fingerprint | 109 | 1    | 9    | 1.82 | 1.770 |
| Voice       | 51  | 1    | 8    | 3.98 | 2.005 |
| Palm        | 48  | 1    | 8    | 4.06 | 1.850 |
| Face        | 67  | 1    | 8    | 2.99 | 2.114 |
| Retina      | 49  | 1    | 7    | 2.29 | 1.581 |
| Iris        | 54  | 1    | 8    | 3.31 | 2.126 |
| Signature   | 65  | 1    | 8    | 3.94 | 2.627 |
| Gait        | 40  | 1    | 8    | 6.78 | 1.954 |

ranked as the second most biometric authentication method (Mean ratings = 4.06), voice is ranked as the third important biometric authentication method (Mean ratings = 3.98) and signature is ranked as the fourth important biometric authentication method (Mean ratings = 3.94).

Table 4 shows that performance expectancy is ranked as the most important factor affecting user acceptance of ATM biometric authentication (Standardized beta coefficient = 0.285). Social influence is ranked as the second most important factor affecting user acceptance of ATM biometric authentication (Standardized beta coefficient = 0.208). Both factors account for 49.1% of the variance in user behavioural intention to use ATM biometric authentication in near future.

Respondents respondents in this study would prefer to be identify and authenticate though their gaits, palms, voices and signatures. Therefore, the system developer should develop a biometric ATM system that would be able to validate an ATM user’s identity by comparing the captured gait, palm, voice and signature data with the user’s gait, palm, voice and signature template stored system database. In addition to gait, palm, voice and signature data, the system developer should develop a system that requires an user to key in personal identification number, user name and smart card number so that a one-to-one comparison to determine whether the biometricdata belong the genuine ATM user. Identity verification prevents multiple people from sharing one identity. Besides identity verification, the system developer should also develop a sophisticated ATM system that can perform the identity identification to confirm an individual’s identity.

Table 4: Multiple linear regression

| Model                  | Unstandardized coefficients |       | Standardized coefficients |          |          | R <sup>2</sup> |
|------------------------|-----------------------------|-------|---------------------------|----------|----------|----------------|
|                        | B                           | SE    | Beta                      | t-values | p-values |                |
| Constant               | 0.626                       | 0.463 | -                         | 1.353    | 0.178    | 0.491          |
| Social influence       | 0.241                       | 0.097 | 0.208                     | 2.493    | 0.014    |                |
| Attitude               | 0.018                       | 0.115 | 0.015                     | .161     | 0.873    |                |
| Anxiety                | 0.085                       | 0.083 | 0.081                     | 1.035    | 0.303    |                |
| Effort expectancy      | 0.106                       | 0.112 | 0.087                     | .948     | 0.345    |                |
| Performance expectancy | 0.326                       | 0.108 | 0.285                     | 3.011    | 0.003    |                |

Dependent variable: behavioral intention to use ATM biometric authentication

Performance expectancy is the most important factor affecting user acceptance of ATM biometric authentication. Performance expectancy refers to the degree of utilizing an ATM biometric authentication which will provide benefits to the users. The higher the perceived relative advantages, the greater behavioural intention to adopt ATM biometric authentication. Therefore, when banks design and implement ATM authentication technology functions, the user's requirement needs to be considered. Banks can improve their biometric authentication technology based on users' suggestions. In addition, users' knowledge about ATM biometric authentication technology and key benefits in using ATM biometric authentication have to be enhanced through marketing campaigns.

Social influence is the second important factor affecting user acceptance of ATM biometric authentication. This finding implies that the social pressures would drive the individual to adopt ATM biometric authentication technology. Marketing practitioners could invite earlier adopters of ATM biometric technology to share their opinions and reviews with prospective adopters. They could publish the positive comments of early ATM biometric authentication adopters to boost greater user adoption on ATM biometric authentication.

Effort expectancy is not an important factor that affects user acceptance of ATM biometric authentication. This finding reaffirms Sumak *et al.* (2010) and Yu (2012) study that effort expectancy is not important in promoting user adoption. Perhaps respondents in this study are comfortable with the current usable and easy-to-use ATM banking interfaces and they do not foresee any difficulty in using ATM biometric authentication. Similarly, anxiety is also not an important an important factor that affects user acceptance of ATM biometric authentication. This finding further confirms that users are very confident about their ability of using ATM biometric authentication technology.

### CONCLUSION

Respondents in this study does not view attitude as an important factor affecting user acceptance of ATM

biometric authentication. This implies that they are more concerned about the perceived benefits of the technology compared to the perceived enjoyment of the biometric authentication technology. Therefore, bankers should ensure that the benefits of ATM biometric authentication are clearly communicated to the users via advertisements, online FAQs or interpersonal consultation at bank counters.

### IMPLICATIONS

Both performance expectancy and social influence positively affect ATM biometric authentication. Therefore, ATM developers need to meet the daily task demands of users in the design of new ATM biometric authentication measures.

Theoretically, this study integrates key factors such as social influence, attitude, performance expectancy, effort expectancy and anxiety to explain user adoption of ATM biometric authentication. On important finding of this study is that social influence also significantly affects user adoption. This contributes to the knowledge base that the researchers need to also pay attention to the impact of human factor on the user acceptance of biometric authentication. Thus, future research can study user adoption of banking services such as electronic fund transfer and online banking from both technical and human aspects.

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