Impact and Potential Assessment on the Introduction of Smart Card Transport System in Bangladesh

Tsuyoshi KANO[1] and Daiki ISE[2]

[1]Representative, Bangladesh Office, Japan International Cooperation Agency (JICA)
(Uday Tower 7F, Plot No.57 & 57/A, Gulshan Avenue (south), Circle-1Dhaka-1212, Bangladesh)
E-mail:Kano.Tsuyoshi@jica.go.jp
[2]Transport and ICT Division 2, Economic Infrastructure Department, JICA
(Nibancho Center Building 5-25, Niban-cho, Chiyoda-ku, Tokyo 102-8012, Japan)
E-mail:Ise.Daiki@jica.go.jp

The Japan International Cooperation Agency (JICA) led a pilot project for the introduction of a smart card bus fare collection system in Bangladesh. The project resulted in not only improved efficiency through systemisation and customer satisfaction, but also a rise in sales as a secondary effect and a continuation as a commercial base business even after the completion of JICA's project. Based on these results, this paper discusses the necessity of an incentive mechanism for employees who may lose vested interest by the introduction of the smart card, the effectiveness of establishing transparent ticketing system, the reasons for smooth introduction of the smart card, and the market potential.

Key Words : Bangladesh, smart card, transportation, ICT, corruption, bus, clearing-house

1. INTRODUCTION

Dhaka, the capital city of Bangladesh, is one of the most congested cities in the world, with a population of about 15 million citizens and a density of 44,000 people per square km[1)] (seven times higher than Tokyo). Since the Strategic Transport Plan (STP) 2005, a 20-year strategic transport plan for the Dhaka Metropolitan Area, showed that public buses, a major means of transportation in Dhaka, are not able to meet the demand for transportation because of further inflow to Dhaka, the city's government decided to introduce additional means of mass transportation, such as Mass Rapid Transit (MRT) and Bus Rapid Transit (BRT). Whereas these new means of mass transportation are expected to improve serious traffic jams, they will need time to start the operation. Therefore, public buses will be the main means of transportation for the time being.

With regard to bus operator, government owns Bangladesh Road Transport Corporation (BRTC) and some private companies provide services. Since the main competitive advantage to these buses is low price, as described in Table 1, both the profit mechanisms and maintenance conditions are very poor.

Table 1 Fare Table of BRTC (1BDT ≒ 0.013 USD)

Fare Category	Ordinary Bus (BDT)	Air Conditioned Bus (BDT)
Starting Fare (first 5km)	5.0	10.0
Additional Fare (per km)	1.5	2.0

Ticket sales are operated only by cash purchase at the bus station or at the time of boarding and no commuter pass option is available. Traffic jams frequently occur because of the time it takes for passengers to purchase tickets at boarding, while bus stops.

On the other hand, the Bangladesh government is proceeding with the systemization of public service. Digital Bangladesh policy for 2021 promotes the introduction of information and communication technology (ICT), with both direct effects, such as the increase of exports through ICT offshore business, and indirect effects, such as the improvement of organizational transparency and the strengthening of competitiveness in rural areas through computerization.

Against the above background, JICA led a pilot project to introduce a smart card transportation fare

collection system with BRTC for the purpose of discovering challenges, and assessing impact and potential on business.

2. PROJECT TARGET AND METHOD

(1) Target

Residents who potentially use the buses of two out of ten BRTC lines in Dhaka, and BRTC staff.

(2) Implementation Method
a) Duration

October 2011 (2011/10) to November 2012 (2012/11).

b) Implementation Procefure

1. Planning of the pilot project (2011/10)
2. Determination of which pilot lines through a current situation survey (2011/10–2012/3)
3. Procurement of materials, such as smart cards and smart card readers, system development, preparation of manual, and training of staff (2011/11–2012/3)
4. Implementation of the pilot project and monitoring (2012/4–2012/10)
5. Data collection and analysis (2012/4–2012/11)
6. Evaluation of the smart card fare collection system and suggestions for the clearing-house system (2012/5–2012/9)

(3) Fare Collection System

In order to begin introducing the fare collection system, the servers were set to Dhaka Transportation Coordination Authority (DTCA), the coordination body of transportation in Dhaka, foreseeing future necessity of introduction of similar system to the other means of transportation mode, such as MRT and BRT.
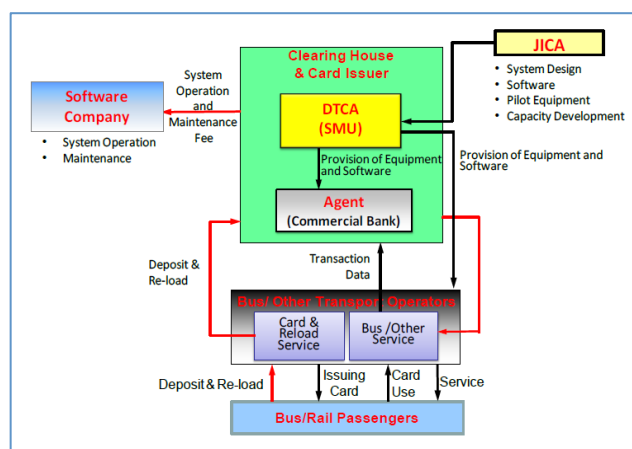

Fig.1 System Structure

Handy type smart card readers were selected due

to cost saving over fixed mount type readers. In addition to that, since this was a new system in Bangladesh, operators on buses with smart card readers were needed to explain to customers the concept and its operation.

(4) Operation
a) Distribution of smart cards

30,000 FeliCa-based smart cards were distributed to users upon registration.

b) Funding method

Users load funds to their cards at the ticketing booth through cash payment.

c) Fare collection at boarding

An operator with a card reader boards each bus. Users touch the reader with their cards when each user boards the bus. The system then places the temporary hold on funds until the last stop of the line.

d) Clearing to exit

Users touch the reader with their cards again upon disembarking, immediately the system releases the hold, collection only the actual expenses. After that, to avoid any confusion for next boarding, the receipt with balance is automatically outputted from the reader.

e) Data communication

Collected data that accumulates in the card reader is automatically sent to a server via a mobile phone network.

f) Report of daily sales

The daily sales is calculated at the server once a day, and the sales report is prepared and uploaded to the website. Additionally, email is sent to the BRTC management.
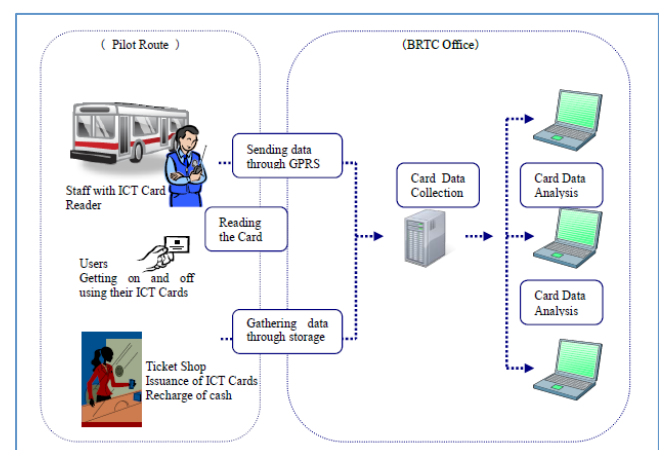

Fig.2 Data process of smart card

3. RESULTS

(1) Increase of Sales in Pilot Lines[2]

Analysis showed that daily sales per bus increased 6,800 BDT to 11,609 BDT, representing a 71% increase in sales compare to before the introduction, whereas the number of users and average distance did not change. This result surprised concerned persons, because there is no obvious relationship between sales amount and the change of payment method.

Table 2 Collection fare by smart card (1BDT ≒ 0.013 USD)

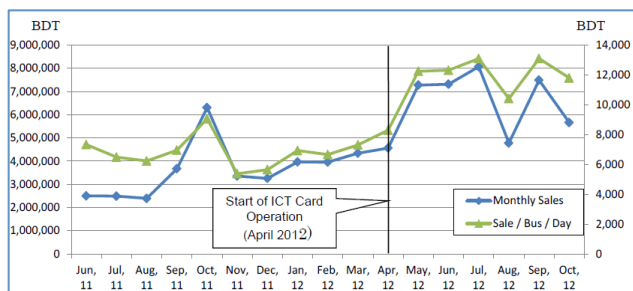| Month	Collected Fare by ICT Card per Month		Total (BDT)
	Line 1 (BDT)	Line 2 (BDT)	
April	385,125		385,125
May	721,170		721,170
June	660,135	10,036	670,171
July	1,211,355	184,595	1,395,950
August	1,020,545	149,013	1,169, 558
September	1,710,300	319,091	2,029,391
October	1,433,310	271, 187	1,704,497
Total	**7,141,940**	**933, 922**	**8,075,862**

Fig.3 Sales change by bus (1BDT ≒ 0.013 USD)

(2) Decision to Continue Operations of the Smart Card

After completion of this pilot project, the BRTC decided to continue, and is continuing, the smart card operation with its own budget as a result of the sales increase and high user satisfaction. The Ministry of Communication, the supervisory agency of the BRTC, has also suggested that the BRTC introduce smart card fare collection system to all lines. In addition, this ICT transport fare collection system has become the current de facto standard in Bangladesh.

(3) Request for further introduction

The Ministry of Communication also requested that the JICA implement another pilot project for the Bangladesh Railway (BR) and establish an inte-grated clearing-house—an automated fare collection and clearing system used in different transport modes—to expand the smart card fare collection system.

(4) Internal Backlash from Staff

While this system was highly welcomed by users as described above, some BRTC staff who might lose vested interest by the introduction of the smart card alleged that there were problems with the system, and sought to prevent its introduction on all lines. Although it is difficult to determine whether these behaviours were solely the result of a resistance to change, backlash has arisen several times. As with similar situation, a backlash may affect the continuation of operations.

4. DISCUSSION

(1) Systemization and Transparency as Seen in Sales Increase

With regard to the reasons for the daily 71% sales increase per bus despite a similar number of users and average distance, it is supposed that the fare collection rate has improved because of a reduction in misconduct that existed in cash purchases of tickets. According to the results of the questionnaire on operational challenges for ten private bus companies, it became apparent that the serious problems with fare collection are misconduct in ticket sales, which include misuse, false reporting, ticket forgery, and embezzlement.
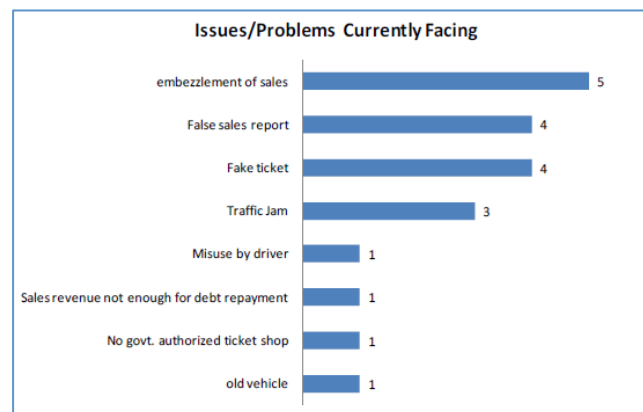

Fig.4 Issues/Problems Currently Faced by Bus Operators

Since corruption perceptions index of Bangladesh is 136th out of 177 countries on a global scale[3], corruption is recognized as a serious problem. It is clear that improvements in transparency as an anti-corruption measure in this case were seemingly substantially contributed through the introduction of the ICT system. However, although it is not yet known whether using ICT to promote transparency

can create a sustained culture of transparency[4], systemization will not be a versatile solution for anti-corruption in this case. As seen in the staff backlash, it is difficult to sustain operations without consideration of the background, situation, and reasons for corruption.

(2) Necessity for Incentive Mechanism as Seen in Staff Backlash

The salary structure problem was apparent in the staff backlash because of the suggestion to introduce the smart card system to all BRTC lines. It is supposed that the staff understand the merit of smart card but not welcomed by staff who are considered underpaid in normative terms. However, these challenges cannot be overcome without the cooperation of staff. Therefore, it is imperative that managers consider incentive mechanisms for staff instead of simply ignoring the corruption issue. It is also necessary to encourage better understanding and incorporation into anti-corruption strategies of the role of incentive[5].

For example, after introducing this system, passengers who have ridden the bus incorrectly (e.g., for $2) instead of the official price ($3) will have to pay the official price. As a result, the total amount of sales will increase (from $2 to $3), and even if BRTC distributes all of the increased revenue ($1) to staff, profit will not change ($2). However, it is difficult to expect that the management team will determine distribution of increased profits to staff, and it could simply lead to incomplete innovations that profit only the management team. To avoid such situations, a simultaneous management innovation that includes salary structure and an incentive mechanism based on sales is needed. Actually, the management team has seriously begun to consider an incentive system to encourage staff for further introduction. Since the management team can extract sales contribution of each staff by analyzing sales data, utilizing this result will helpful to consider the incentive.

The JICA can contribute to find out solutions by proposing an incentive mechanism for staff and open managerial innovation, contributing to the sustainability of the smart card operation, which is socially acceptable include staff.

(3) Comparison with the Introduction of Smart Transport Cards in Other Countries

It is surmised that the reasons for the success of this project include its continuous operation by the BRTC and the current de facto standard of transportation cards in Bangladesh, as follows:

- A bottom-up approach indicated the actual performance of the pilot project, obviating oft-delayed high-level policy decisions,
- A design which eyed the future introduction of the system to other forms of transportation in Dhaka from the initial stage, and
- Cooperation with an IT company which had experience offering bus ticketing services, and perceived ideas to solve operational challenges.

The bottom-up approach was especially effective compared with that used in other countries, where decision-making regarding specifications became a political and diplomatic issue.

A potential risk in the future is the introduction of various types of smart cards. In the Japanese case, there are more than 10 types of smart card for transportation without enough integration. Finally, to improve the convenience of card users, a system integration which enables users to use their smart cards interchangeably with other transportation systems have been introduced from March 2013[6]. As a result, although users are coming to use a single smart card for other transportation operators, each transportation operator must have borne the expense of modifying their clearing systems.
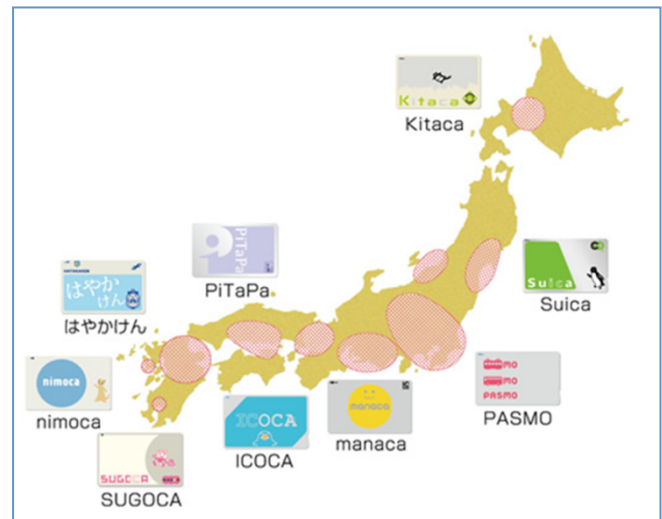

Fig.5 Smart cards in Japan [7]

By contrast, in the case of Hong Kong, there is only one card, called Octopus. The FeliCa-based Octopus card is disseminated and managed efficiently as one national smart card. To avoid excessive system complexity and in consideration of future expenses, it is suggested that a single nationwide card system, such as Octopus, is more adequate for Bangladesh.

(4) Potential and Sustainability of the Market

Regarding smart card penetration, currently only 30,000 cards have been distributed. However, it is

expected that 510,000 users will use the MRT, which will introduce the smart card fare collection system in 2021[8]. Although this number is far less than the 80 million smart cards that have been distributed in Japan[9], it is obvious that the potential of Bangladesh as a market is huge because 1) many infrastructure projects are planned, such as the BRT and MRT; 2) the number of citizens in the Dhaka metropolitan area is about 15 million; and 3) buses are one of the main forms of public transportation with 17 million users[10].

However, in terms of sustainability, political risk is one of the most critical issues. For example, due to political unrest before the election held in January 2014, many strikes occurred and most public transportation stopped. As a result, many transportation companies incurred financial damage. Furthermore, the fare levels of public transportation are controlled by the government, and cannot easily be modified for economic reasons.

5. FURTHER COOPERATION

To promote the dissemination of smart cards, the following approaches are planned.

(1) Pilot Introduction to the BR
In addition to its program for the BRTC, the JICA has implemented a pilot project for the BR to assess interoperation needs among multiple transportation operators.

(2) Establishment of the Clearing House
The JICA plans to implement a technical cooperation project for establishment of a clearing-house from April 2014. In this project, the DTCA will establish the clearing-house—an automated fare collection and clearing system used in different transport modes—based on a request from the Ministry of Communication.

(3) Introduction to the BRT
The ADB (Asian Development Bank) is supporting the BRT. The BRT will be the first urban transportation system to incorporate a smart card fare collection system from the beginning of operations.

(4) Introduction to the MRT
The MRT is planned to start the operation in 2021 through a Japanese ODA loan, to respond to the increasing demand for transportation in the Dhaka metropolitan area. A 20-kilometer high-speed urban railway is to be constructed in the city of Dhaka, to contribute to the national economic growth of Bangladesh through the reduction of traffic congestion[8]. Once MRT operation commences, potential smart card users will be increased along with MRT lines' expansion plan.
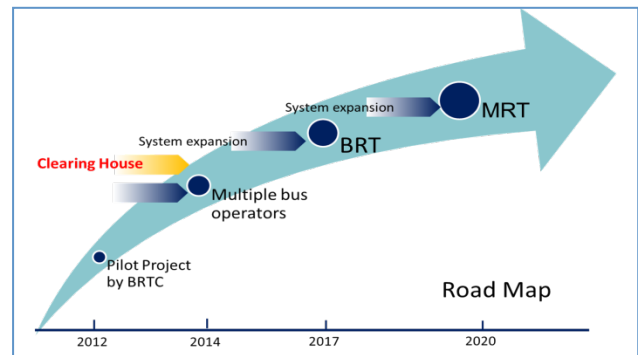

Fig.6 Road map for smart card

6. CONCLUTION

1. The introduction of the transportation smart card is effective to improve sales because of a reduction in misconduct. However, this systemization will not be a versatile solution.
2. While the improvement of transparency through systemization can be one measure of management improvement, sustainability will not be attained without management innovations and incentive mechanisms for staff.
3. The actual performance-based, bottom-up approach used the pilot project is effective for organizations with a tendency toward lengthy deliberations to decide specifications. Moreover, to save future expansion costs, a single integrated card system is preferable.
4. Since the current urban transportation situation in Dhaka is still in the initial stages, the potential of the market is huge. On the other hand, political and financial risks exist.
5. The JICA will take the initiative for further dissemination of the smart card system in Dhaka with the view to contribute effective and efficient urban transportation system.

REFERENCES

1) Demographia : Demographia World urban Areas, pp.20, 2014
2) Japan International Cooperation Agency : Project Activity Completion Report of Project for Improving Fare System of Mass-Transportation in Dhaka City Area Through ICT, Chapter 4, pp. 1-17, 2012
3) Transparency International : http://www.transparency.org/, 2013
4) Berot, J. C, Jeager, P.T., Grimes, J.M., Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies, Government Information Quarterly, Vol.27, pp.267-273, 2010
5) Kaufmann, D., Revisiting anti-corruption strategies: tilt towards incentive-driven approaches, Corruption and integrity improvement initiatives in developing countries, pp. 80, 1997
6) JR-East : http://www.jreast.co.jp/press/2012/20121213.pdf, 2013
7) JR-Central : http://toica.jr-central.co.jp/howto/sharing/, 2013
8) Japan International Cooperation Agency : Ex-Ante Evaluation (for Japanese ODA Loan) on Dhaka Urban Transport Development Project (I), pp.1-6, 2013
9) NIKKEI Newspapers : http://www.nikkei.com/article/DGXNASDG2301B_T20C 13A3CC0000/, 2013
10) Hoque, M.M, Ahsan, H.M., Barua, S., Alam, D., BRT in Metro Dhaka: Towards Achieving a Sustainable Urban Public Transport System, Academia.edu, pp.1-11, 2013