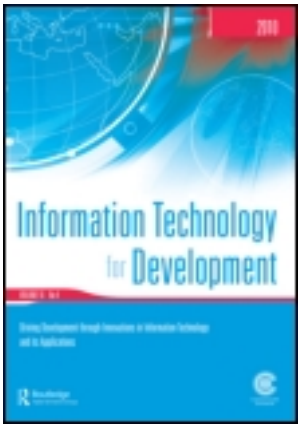

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Measuring impacts of e-government support in least developed countries: a case study of the vehicle registration service in Bhutan

Mayumi Miyata [a]

[a] Japan International Cooperation Agency (JICA), Nibancho Center Building 5-25, Niban-cho, Chiyoda-ku, Tokyo, 102-8012, Japan

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Measuring impacts of e-government support in least developed countries: a case study of the vehicle registration service in Bhutan

Mayumi Miyata

Japan International Cooperation Agency (JICA), Nibancho Center Building 5-25, Niban-cho, Chiyoda-ku, Tokyo, 102-8012, Japan

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e-Government initiatives are increasingly mainstreamed in the development agenda, as means through which developing countries can achieve development objectives faster and, as experience from the developed world suggests, for less cost. However, little research has been carried out on the impact of such initiatives in the developing world, especially the least developed countries, and little attention has been placed on cost aspects. This research studies one such initiative, the computerization of vehicle registration, in one such country, Bhutan. After assessing impact on both efficiency and governance, it finds that improvements in governance and quality aspects greatly outweigh cost-aspects. Using activity-based costing method for internal costs, and assessing quality aspects through staff interviews and customer surveys, significant improvements were found in lead time and adherence to rules felt by citizen users. However, little benefit was found in terms of cost reduction.

Keywords: least developed countries; e-government; public sector reform; ICT for development; government performance evaluation

1. Introduction

Since the Okinawa summit in 2000, where the digital divide was highlighted as an important development agenda, the number of information and communication technology (ICT)-related projects soared in developing countries. This growth in interest was encouraged by the claim that "although the costs of building national information infrastructures and joining the global information infrastructure are high, the costs of not doing so are likely to be much higher" (UNCSTD, 1997, p. 7). Following success stories from industrialized countries, ICT has been widely introduced in the administration of developing countries, to serve as an effective tool for improving public service delivery. e-Government initiatives are no longer new to many of them, including least developed countries (LDCs).

However, little assessment on the impact of e-government projects in LDCs can be found, despite an alarming proportion of ICT projects reported to have failed, or to have not achieved the initial objectives (Heeks, 2002b). How could policy makers of LDCs promote e-government projects without clear evidence on expected results? In order to make a wise decision on whether to invest in e-government projects, it is of paramount importance to know what is expected at the end. In LDCs, where information infrastructure is poor, communication facilities and services are expensive, and the population is scattered, the impact of e-government projects will likely be different from that of similar projects in more developed countries.

Email: mayumi_miyata@hotmail.com
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In the developed world, where labor costs are high and ICT equipment and services are affordable, the introduction of ICT-based systems for public service delivery can be justified on two grounds: that citizens are provided a faster, more convenient service, and that costs can be reduced (Behn, 2007; OECD, 2003). In the developing world, however, where labor costs may be lower and ICT equipment less affordable, the cost benefit is unlikely to be so significant. The challenge, therefore, is to assess whether and how the adoption of ICT leads to improved public service delivery, and thus to determine if investment in such a system in a developing country can be justified. This study argues that the justification for e-government initiatives in LDCs cannot be based on the efficiency savings expected in the government's budget, but rather on the improved quality and governance of public service delivery.

This research investigates the above argument through an impact assessment of an e-government project in a non-island LDC, by taking the example of the vehicle registration and drivers' licensing services in Bhutan.[1] Bhutan was selected on the basis that, of all non-island LDCs, it had the highest penetration of fixed telephone lines (Table 1) at the time of research, which implies that telecommunication backbone infrastructure was better established. In addition, Bhutan is a relatively small country with a stable administration, where data collection was manageable, and ICT was new at the time, where any effect would be more easily noticeable.

The assessment framework was formulated to evaluate key indicators in two dimensions, the economic impact, and the impact on governance. The economic aspect focuses on direct and indirect economic gains, i.e. cost and time, while the other aspect deals with governance issues, such as accountability, transparency and fairness, i.e. internal control and the extent to which customers are treated equally. The key indicators are selected for assessment as they formed the primary rationale of the government in introducing ICT in the public sector. The Royal Government of Bhutan (RGOB) places high priority on good governance and has achieved a high reputation globally. "Good governance" is one of the five pillars of its national development philosophy "Gross National Happiness," alongside "human development," "culture and heritage," "balanced and equitable development" and "environment conservation" (Planning Commission, 1999). According to the "Worldwide Governance Indicators" of the

Table 1. Top 10 LDCs in the penetration of main telephone lines (2004).

	Main (fixed) telephone lines per 100 inhabitants	Internet users per 100 inhabitants	GDP per capita (US$)
	Year		
	2004	2004	2003
Maldives*	10.92	6.59	2434
Samoa*	9.17	3.08	1781
Tuvalu*	7.72	20.57	–
Bhutan	4.78	3.16	860
Kiribati*	4.76	2.21	467
S. Tomé & Principe*	4.7	13.32	345
Yemen	3.89	0.88	598
Vanuatu*	3.21	4.75	1127
Gambia	2.9	3.31	137
Sudan	2.71	0.79	472

Note: Ten out of 49 countries listed as LDC, in order of highest number of main telephone lines per 100 inhabitants. Countries with asterisk marks (*) in shadows are small island developing countries. The list of LDCs is provided by the United Nations Office of the high representative for least developed countries, landlocked developing countries and small island developing states. Statistics are taken from ICT Statistics Database provided by ITU (available at http://www.itu.int/ITU-D/ICTEYE/Indicators/Indicators.aspx).

World Bank (2007), Bhutan is placed as high as 80.2 percentile rank (1–100) in the category "Control of Corruption," 63.8 in "Rule of Law" and 56.9 in "Government Effectiveness," whereas the averages for countries in the same income group were 23.9, 23.3 and 21.8, respectively. The use of ICT has been encouraged for the effective delivery of public services, as part of a broad effort to maintain good governance (Cabinet Secretariat, 1999).

2. Impacts of ICT on public service in developing countries

Existing literature exhibits limited results on the impact of e-government projects in respect of efficiency and governance in developing counties. On the efficiency front, although it is generally recognized that ICT can improve the efficiency of public service delivery in developing countries (Mansell, 1999; Schware, 2000; UNDP, 2001), one is more likely to find anecdotal evidence of improved government services, for instance, in the state of Andhra Pradesh, India (Basu, 2004; Schware, 2000; Singla, 2005). Other studies have tended to focus on the causes of failure in ICT projects, and ideas for avoiding such failures (Cain, 1999; Heeks, 2002b). On the contrary, many studies assessing impacts have been carried out in developed countries (eGEP, 2006a).[2]

Only a few measured impacts of reduced cost can be found from developing countries. The World Bank conducted an impact assessment study of e-government applications in India and Chile, one of the few of its kind in developing countries (Bhatnagar, 2007). This study is a most systematic assessment with monetized measurements comparing five projects. It investigated direct economic impacts from reduction in operating costs, collection of tax revenue and transaction fees and showed positive results in many cases. However, it was unable to confirm a direct causal relationship, as it was difficult to differentiate economic gains brought about through computerization, from other factors. In particular, impact on cost reduction was not observed, as no manpower was cut in any project as a result of computerization. Another cost assessment was carried out on the e-procurement system called "ComprasNet (www.comprasnet.gov.br)" in Brazil, with a result of 20% cost savings per year (Von Haldenwang, 2004).

For LDCs, no such assessment is available. There is little hard evidence to support the claim that ICT contributes to efficiency gains in LDCs, and experts are seriously questioning the economic gains of e-government projects in LDCs. For example, Heeks (2002a) explains that cost-cutting effect from e-government projects in Africa is questionable when costly ICTs, two or three times more expensive than in the West, are replaced with low-waged civil servants, estimated at one tenth or less. Von Haldenwang (2004) also points out that efficiency gains from e-government may be limited or "in some areas even non-existent" (p. 424), while recognizing scarcity of evidence based on cost-benefit analyses.

On the governance side, there are mixed positions on whether ICT contributes to enhanced fairness, or increased accountability, to public services in the context of developing countries. The positive indication is in the view that ICT can enhance accountability of a government and thus empower its citizens (Basu, 2004). For example, sharing and publishing information through ICT increases transparency of governments and also strengthens the surveillance by the people of the government (Bhatnagar, 2003; Gerster & Zimmermann, 2003). The negative or neutral position takes the view that ICT would not change the nature of the organization, but rather may even reinforce its nature (Barata & Cain, 2001; Heeks, 1998a). It is reported, for instance, that a government keen to maintain its regime has used web technology to control flows of information and to watch citizens' activities (Wong & Welch, 2004).

Similarly, opinion is divided regarding the effectiveness of ICT in combating corruption. Bhatnagar (2003) gives various examples where ICT was found to have played a role in reducing corruption, and argues that it can be useful under certain conditions. Other studies show that

pre-existing corruption can impair the effect of ICT, or that new types of corruption are invented with the introduction of ICT (Barata & Cain, 2001; Heeks, 1998b). A case study in one LDC, Jordan, also reveals "a dubious impact on good governance" with challenging risks (Ciborra & Navarra, 2005). In summary, it is not the technology by itself that contributes to accountability of public services, but rather the commitment of the government or the strategic intent on how to use it (Dhameja & Medury, 2004; Heeks, 1998a). This case study offers evidence in support of this position.

3. Case study: vehicle registration and drivers' licensing services in Bhutan

Vehicle registration and drivers' licensing services are provided by the Road Safety and Transport Authority (RSTA) under the Ministry of Information and Communications (MoIC) in Bhutan. RSTA holds four regional offices in Thimphu (the capital city), Phuentsholing, Gelephu and Samdrup Dzongkhar, where the public can go to register their vehicles and apply for a driving license. Vehicle registration is decentralized to regional offices, while driving licenses are issued only at the head office. In other words, vehicle registration certificates are signed by Regional Transport Officers (RTOs), the head of regional offices, while driving licenses are only authorized by the Director of RSTA. This is mainly because printing and laminating facilities are not available in other regions and also because illegal duplication is taken more seriously for licenses as they frequently serve as identity cards. This meant that all regional offices had to send license application forms with photo to the head office, taking at least 2 weeks from the farthest office. Vehicle registration certificates need to be renewed every year and driving licenses need to be renewed every 5 years.

The RSTA has been facing difficulties with increasing volume of work. The number of applications increased in recent years, especially in Thimphu and Phuentsholing. In fact, registered vehicles in Bhutan have increased almost 2.5 times in 9 years, from 13,584 in 1997 to 33,241 in 2006 (MoIC, 2007). Faced with difficulties procuring more manpower, the management of RSTA looked upon ICT as their solution from early days. Shortly after RSTA's establishment in 1999, a simple standalone database was introduced by a local software developer, but it had limited impact on RSTA since it was only used by the head office to store drivers' license information. This is not surprising considering the limited number of computers RSTA had at the time, and the fact that the internet service in the country started only in 1999. In 2003, equipped with more computers and bandwidth, RSTA head office introduced a local area network (LAN) to provide connection to the license database. However, all procedures were paper-based in regional offices, with king-sized notebooks (about A2 size) which allocated one vehicle/license record per page, and which were often difficult to read, torn or misplaced. In 2004, to expand the use of ICT in a holistic way, an ICT-enabled vehicle registration and drivers' licensing services reform project was launched with the support of Department of Information Technology (DIT). A system analysis was conducted, after which a new information system (IS), Registration and Licensing Information System (RaLIS), was designed and developed to improve the public service, to increase internal efficiency, and to provide accurate data required for transport policy. It took several months to install the new system starting from November 2004 to July 2005.

This reform was selected as the case study for three reasons: (a) it is a public service directly delivered to the people where their feedback is possible; (b) drivers licensing and vehicle registration procedures were well established, with a fixed internal costing structure and (c) the study can provide a useful benchmark for other countries, as such services exist in any country.

4. Research design

The methodological discussions in the domain of ISs research suggest three main approaches as positivist, interpretative and critical as well as the combined ones (Myers, 2009). This research

takes the combined approach, deploying both qualitative and quantitative methods, as suggested by Kaplan and Duchon (1988). The design is founded on the view that deliberate attention should be paid to soft aspects, especially citizens' perspective, in assessing benefits of e-government (Jones, Irani, & Sharif, 2007), as well as to context-dependent and multi-level impacts for IS researches in developing countries (Sahay & Walsham, 1995). Equally, a comparable evaluation with measurable indicators, such as the cost, is essential for understanding the different implications in the developed and developing worlds.

This research is designed to compare the indicators set in Table 2 to assess efficiency and governance aspects, before and after the reform. These indicators are in line with other e-government-related evaluation or benchmarking studies (Alshawi & Alalwany, 2009; Behn, 2007; Bhatnagar, 2007; eGEP, 2006c; Gupta & Jana, 2003; Heeks, 2006) and were selected as the most relevant for the purpose and nature of this case study. For example, indicators such as the cost and the quality of e-government services as perceived by customers are used in this study, as suggested by Heeks (2006) as "the standard indicators for government and e-government performance" (p. B-5), while some others are designed for on-line services, and so are irrelevant, and therefore not used, for this study. The benefits of e-government in "openness", "transparency and accountability", as eGEP (2006c) framework suggests, are measured with relevant indicators for this case. Bhatnagar's (2007) study also shows an assessment framework using multiple dimensions, including economic (direct and indirect), governance, quality of service, process improvements, development goals and attitude of civil society toward computerization of public service delivery, with a relevant mix of measurements. Most of these dimensions were covered by this study.[3]

Both internal and external indicators were studied to assess the changes within the organization and the changes brought to the users, i.e. the citizens. For internal efficiency, internal cost per service is calculated to see whether the project contributed to reduced costs of public service. Secondly, staff's time per task is examined to see whether staff could save time from computerization and allocate time on more value-added work rather than routine processing. External efficiency looks into whether the service has become faster for the customers. One of the two indicators is the lead time per service, which indicates the duration from application to completion of a service (e.g. renewal of registration certificate). The other indicator is customers' time taken in office, which may be different from lead time since some of the services do not conclude within a day. For example, lead time could be 3 months before getting a driving

Table 2. Indicators and methods of the research.

Category		Indicator	Unit	Research method
Efficiency	Internal	Internal cost per service delivery	Ngultrum (local currency)	Activity-based costing of four major processes
		Staff's allocation of working time	Hours	Staff interviews and site observation
	External	Lead time per service type	Hours/duration	Staff interviews and site observation
		Customer's time taken in office	Hours/duration	Customer satisfaction survey
Governance	Internal	Sense of internal control by the management	– (qualitative)	Interviews to RSTA staff, Anti-Corruption Commission, reference to audit reports
	External	Sense of fairness felt by customers	Five levels	Customer satisfaction survey

license, but the customer might have spent only 3 h in the office at the time of its application and on later collecting it. For assessing internal control over governance, qualitative information was collected through interviews with the staff members and the management, on the changes observed in internal control, such as corrupt actions, unfair practices or instances of misconduct. To study the change in fairness and accountability felt by the citizens, a questionnaire survey was used, in which citizens were asked about the quality of RSTA's service, and whether RSTA staff are treating all customers equally in such aspects as penalty collection, order of processing, driving tests and general application of rules and regulations, etc. These questions on fairness and accountability are created based on the complaints RSTA received in a preliminary test survey, so that the customers' perceptions on fairness and accountability are well considered.

5. ABC model

Activity-based costing (ABC) method was used to assess internal cost per service to look into the cost-cutting effect to the operation cost of RSTA in delivery licensing and vehicle registration services. This method enables the researcher to compare costs per process, internalizing indirect costs, such as depreciation cost of computers, distributed among processes based on activity drivers, such as number of transactions (Kaplan & Cooper, 1998). As the prevalent public accounting system does not allow for separating the operating cost per public service under study, ABC was chosen for its ability to gauge the impact of computerization specifically with regard to that section of services where the reform was implemented. In addition, ABC is being recognized as a comparatively suitable means for costing e-Government expenditure (eGEP, 2006b). ABC models are built on bottom-up approach for four main processes for this case study.

The four core processes chosen were selected on the basis that they are high frequency, are not seasonal or time-bound, and are computerized. They are (1) the issuance of learner licenses, (2) the issuance of driving licenses including driving tests, (3) the registration of new vehicles and (4) the (annual) renewal of vehicle registrations (Table 3).

The cost breakdown of the four processes is grouped into two categories, direct and indirect costs, as shown in Figure 1. Since the difference in cost before and after the reform is important, only cost elements affected by the reform are considered (shaded transaction types in Figure 1). For example, printing cost or general administration fee is not calculated because the amount would be the same before and after the reform.

The ABC model is shown in Figure 2. The direct cost, which is remuneration, is calculated based on a bottom-up approach. The unit cost per process is the sum of all activity costs which are performed by different personnel, calculated by multiplying the applicable salaries (per minute) by time (in minutes) consumed. To measure the unit cost, four processes were broken down into activities, and the time taken for each activity was gauged with a stop watch during working hours. The annual activity-based costs are then calculated by multiplying the unit cost by the number of transactions per year.

In ABC, indirect costs are allocated based on cost drivers. The basic principle for deciding allocation ratio is according to the usage, which is one of the frequently used principles in ABC (Nokes, 2000). Before the reform, mail was used for sending license application forms to the head office. Thus, 100% of the cost is allocated for (2) New/renew license process. Table 4 shows allocation ratios for additional cost the reform had incurred, i.e. internet connection cost, depreciation cost of RaLIS and IT staff labor cost. Internet connection is required for RaLIS database to be synchronized among regional offices and is charged monthly in the head office and charged per minute in regional offices. Data were transferred twice daily, before and after the working hours, from regional offices. Since transferred data are taken up

Table 3. Average number of transactions by the type of applications.

Transaction type	Regional office: Thimphu			Computerized transactions	Average number of transactions per day	Proportion of transactions (%)	Proportion of computerized transactions (%)
	16 August 2004	15 November 2004	14 February 2005				
Driving test	22	7	12		13.7	10.2	–
Emission test	0	16	0		5.3	4.0	–
Fitness test	14	58	6		26.0	19.5	–
Learner license	13	8	21	✓	14.0	10.5	19.1
New/renew license	17	18	11	✓	15.3	11.5	20.9
Duplication license	2	1	3	✓	2.0	1.5	2.7
Endorsement license	3	3	1	✓	2.3	1.7	3.2
New vehicle registration	12	4	7	✓	7.7	5.7	10.5
Renewal vehicle registration	17	25	46	✓	29.3	21.9	40.0
Duplication Bluebook	1	1	1	✓	1.0	0.7	1.4
Ownership change, conversion	2	0	3	✓	1.7	1.2	2.3
Offence	17	14	29		20.0	15.0	–
Total number of transactions	106	155	140	–	133.7	100.0	–
Total number of computerized transactions	67	60	93	220	73.3	54.9	100.0

Note: The daily transaction records of third Mondays of August, November 2004 and February 2005 are extracted from the revenue and accounting system of RSTA, as aggregated data were not accessible. The third Mondays of August, November 2004 and February 2005 were selected for three reasons: (i) records were available from July 2004 which is the beginning of the fiscal year (at the time of March 2005), (ii) three records with 3 months intervals were chosen to average seasonal fluctuations depending on the transaction type (for example, fitness test is a time-bound service), (iii) consistently Monday was chosen as it is the most visited day in a week. Shadowed four processes are selected for the ABC study.

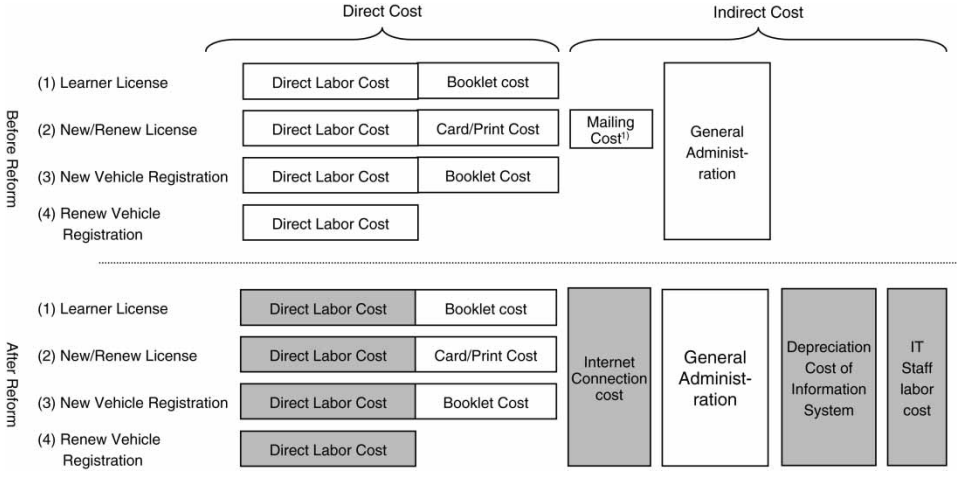

Figure 1. Cost structure before and after the reform. (1) Mailing cost is necessary for sending license applications and photos to the head office. This cost is incurred only when new license cards are to be issued (new or renew) at regional offices, because a plastic card printer is only available at the head office. *Colored components are costs which change after the reform.

mostly by big photo image files required for license, 65% of the internet connection cost was allocated for (2) New/renew license process, leaving 5% to each of the other processes. Depreciation cost is allocated based on the average distribution among computerized transactions calculated in Table 3. Two IT staff members were newly recruited for RaLIS operation and

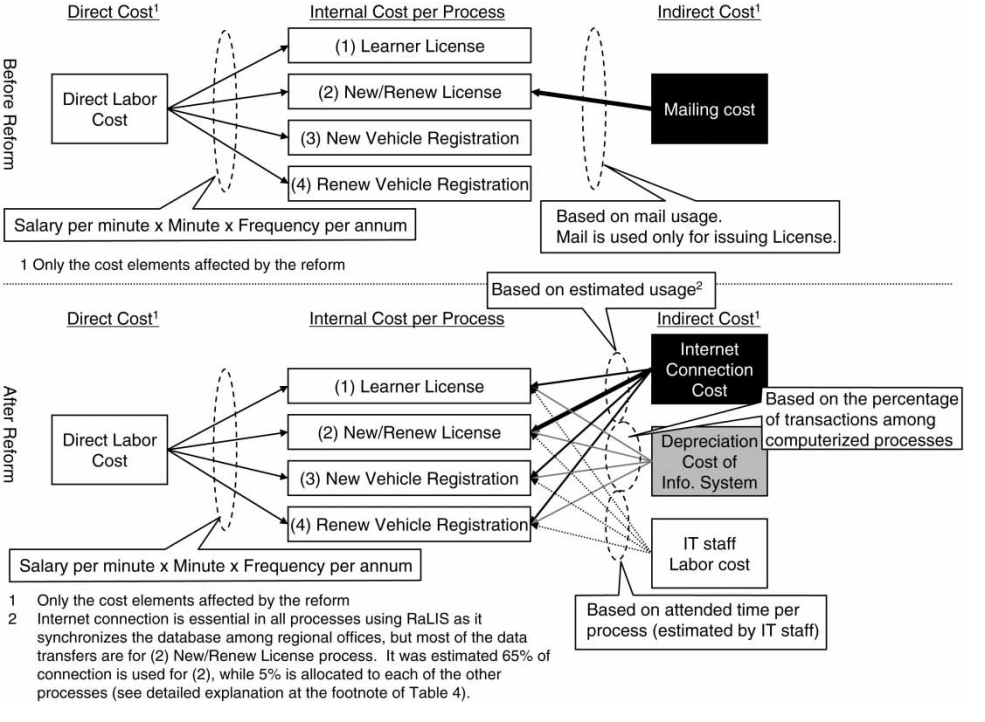

Figure 2. Activity-based costing models.

Table 4. Allocation ratios of indirect costs incurred by the reform.

	Indirect cost		
	Internet connection cost	Depreciation cost	IT staff labor cost
	Allocation ratio		
RaLIS-related transactions	Estimated usage ratio[1] (%)	Proportion of computerized transactions[2] (%)	Time allocation ratio (%)
Learner license	5.0	19.1	5.0
New/renew license	65.0	20.9	32.0
Duplication license	5.0	2.7	10.0
Endorsement license	5.0	3.2	10.0
New vehicle registration	5.0	10.5	15.0
Renewal vehicle registration	5.0	40.0	10.0
Duplication Bluebook	5.0	1.4	5.0
Ownership change, conversion	5.0	2.3	5.0
Common office IT-related tasks	–	–	5.0
Tasks other than IT related	–	–	3.0
Total	100.0	100.0	100.0

[1]The transaction volume is not considered here as each data file is very small which gives negligible impact to the overall internet cost. On average, each transaction data without photo image comprise less than 5 KB, whereas photo image can be more than 1 MB. However, the other transactions cannot be functional without the internet connection; thus, equal amount is distributed among the other processes.
[2]Proportion of computerized transactions is taken from Table 3 (the far right column).
Note: Shadowed four processes are selected for the ABC study.

maintenance, adding indirect cost to the service. By observation and their own approximation, their time allocations among various tasks were estimated for each process, to determine the cost distribution.

6. Data collection

The field survey was conducted three times, in March 2005, August 2005 and December 2007. Both surveys in 2005 collected baseline data. In December 2007, after 2 years since the full roll-out of RaLIS, a survey was conducted to examine the real impact of the reform. Data collected in each field survey are summarized in Table 5. An overview of questionnaire survey for citizens' satisfaction is provided in Table 6.

7. Indicators of impact on efficiency

7.1 *Internal efficiency*

Internal efficiency was investigated by two indicators, internal cost per service delivery and staff's allocation of working time. As a result of the reform, internal cost per service delivery increased, whereas staff's time allocation for routine processing of licensing and registration has reduced.

Table 5. Data collected during three field surveys.

Category	Indicators	Research method	Collected data: Pre-reform data (baseline)	Collected data: Post-reform data
Efficiency				
Internal	Internal cost per service delivery	Activity-based costing of four major processes	*Period:* February to March 2005 *Method:* Observe and count time taken per activity in Thimphu HQ and RO	*Period:* December 2007 *Method:* Observe and count time taken per activity in Thimphu HQ and Phuentsholing RO
	Staff's allocation of working time	Staff interviews and site observation	*Period*: February to March 2005 *Method*: Interview and observation of Thimphu and Phuentsholing RO staff	*Period*: December 2007 *Method*: Interview to all RTOs and observation at Thimphu
External	Lead time per service type	Staff interviews and site observation	*Period:* February to March 2005 *Method:* Interview and observation of Thimphu and Phuentsholing RO staff	*Period:* December 2007 *Method:* Interview to all RTOs and observation at Thimphu
	Customer's time taken in office	Customer satisfaction survey	*Period:* August 2005 *Method:* See Table 6	*Period:* December 2007 *Method:* See Table 6
Governance				
Internal	Sense of internal control by the management	Semi-structured interviews to RSTA staff	*Period:* August 2005 *Method:* Interview to Joint Director and all RTOs, observation in Thimphu RO	*Period:* December 2007 *Method:* Interview to Joint Director and refer to audit reports
External	Sense of fairness/rule of law felt by customers	Customer satisfaction survey	*Period:* August 2005 *Method:* See Table 6	*Period:* December 2007 *Method:* See Table 6

Note: RO, Regional Office; RTO: Regional Transport Officer (head of ROs).

First, the internal costs of all four major services increased after the reform, as summarized in Table 7. Although direct costs (column (3) in Table 7), which only include labor costs, have fallen by between 10% and 37% (average 30.8%), the total cost per service delivery has risen 43.1% on average, after adding indirect expenses. This is mainly because IT equipment, applications and internet connection fees are very expensive when compared to labor costs. For example, the labor cost is only about 7360 ngultrum on average per month,[4] whereas the monthly internet connection fee costs 34,290 ngultrum, which is more than four times higher (Table 8). The cost of internet connection tends to be high in LDCs due to limited customer base, high set-up costs, and in some instances lack of competition between service providers. Also, all computers and peripherals need to be imported using hard currency, resulting in prices very much higher than domestic prices of commodities.

Table 6. Overview of customers' satisfaction survey.

	First survey	Second survey
Period	22–26 August 2005 (9 a.m.–1 p.m.: window-service hours)	11–14 December 2007 (9 a.m.–1 p.m.: window-service hours)
Location	RSTA Thimphu regional office service windows	RSTA Thimphu regional office service windows
Target	All customers (license holders, vehicle owners or those on errand)	All customers (license holders, vehicle owners or those on errand)
Sampling	Census survey	Census survey
Response	246 respondents out of 562 customers (43.8%)	273 respondents out of 397 customers (68.8%)
Note	Questionnaire sheet was given to all visitors in both local language and English. Illiterate people were interviewed by surveyors.	Same as the first survey

It could be argued that the failure to reduce costs overall was due to reticence to implement any efficiency savings over and above the 30.8% saving in labor costs as described above. However, nothing more could have been done, since RSTA had streamlined administrative procedures to the maximum extent permissible without compromising accountability, and computerization of certain processes was introduced as part of this effort. Despite limited reformed processes defined at the design stage of RaLIS, RSTA went beyond and has dramatically cut down its activities within 2 years since the reform. For example, some approval processes performed by higher officials have been decentralized to lower officials. Before the reform, every renewal registration had to be signed by the RTO, whereas now most of the regular renewals can be signed by a registration officer. This has resolved a bottleneck of renewal process without undermining accountability, by keeping and checking all historical records of transaction stored in RaLIS. Thus, although reform was achieved to its full capacity, cost reduction could not be achieved, due to the high indirect costs.

An encouraging result was found in the next indicator for internal efficiency, namely staff's time allocation for registration and licensing procedures. All RSTA's regional offices have found that less time is now used for routine licensing and registration processes. For example, in Samdrup Jongkhar Regional Office, two officers each assigned for licensing and registration before the reform were cut down to one officer each. Out of two officers freed from routine licensing and registration processing, one was assigned to Base Office, a smaller field extension office, under the Regional Office, whereas the other became a highway inspector and patrol in charge. The RTO of the office at the time described the impact of RaLIS as follows:

> The greatest achievement of the reform is found in reduction of manpower for administrative purposes and re-assignment of tasks as a result. The Samdrup Jongkhar Regional Office had not been able to assign enough staff in the field (such as road site) due to the increasing volume of licensing and registration applications. After the reform, the administrative burden for licensing and registration halved, and road safety related works could be strengthened. Consequently, we could spot unsafe practices, such as drunk or non-licensed driving, thus contributing to increased road safety.

While effective human resource reallocation was sought in smaller Regional Offices where manpower shortage was prevalent even before the reform, such positive impacts could not be found in the head office where human resources had been sufficient and division of responsibility was clear. In the head office, the time saved by reduction of administrative burden was not always directed for more value-added work, but often used for online chatting and private e-mails which are not related to their work. This is a management issue; however, a lesson can be learned that impact of reforms could be undermined without strong management.

Table 7. Internal cost comparison before and after the reform.

Process	Cost per process (Nu.) (1)		Frequency[1] (2)	Variable cost (3) = (1) × (2)	Postal/Internet cost	Depreciation cost	IT staff labor cost	Annual activity cost (Nu.) (3) + (4)	Difference
					(4) Indirect costs				
1. Learner license	Before	11.8	4619	54,504	–	–	–	54,504	60.5% rise
	After	7.4	4619	34,181	21,541	24,074	7680	87,475	
2. Driver license	Before	78.7	5807	457,011	36,000	–		493,011	41.0% rise
	After	58.5	5807	339,710	280,028	26,343	49,152	695,232	
3. New registration	Before	18.9	3250	61,425	–	–	–	61,425	84.1% rise
	After	17.0	3250	55,250	21,541	13,235	23,040	113,065	
4. Renewal registration	Before	10.2	17,753	181,081	–	–	–	181,081	29.6% rise
	After	8.3	17,753	147,350	21,541	50,417	15,360	234,668	

Note: The data collection and calculation were conducted based on the ABC model mentioned earlier.

[1]Frequencies of driver license and new vehicle registrations are the average taken from the statistics of 2005 and 2006 as provided by RSTA. The number of learner license applications is the average of 2005 and 2006 figures extracted from RaLIS, and the number of renewal registration applications is the figure of 2006 extracted from RaLIS (as 2005 data were not reliable).

Table 8. Comparison of indirect costs before and after the reform (1$ = approximately 40Nu.).

Indirect expense factors	Cost (Nu.)
Pre-reform cost	
Cost of mailing documents	
Postal fee (Approximately Nu. 1000 per month in 3 ROs)	36,000 (annum)
Post-reform cost	
Internet connection cost	
Lease line (Thimphu) Nu. 34,290 (~2007.4[1])	411,480 (annum)
Dial-up connection fee on average Nu. 537/month (~2007.4[1]) per RO[2]	19,332 (annum)
Subtotal	430,812 (annum)
Initial investment amount for the information system	
Depreciation of set up costs (set up costs, totaling Nu. 1,260,430 include: RaLIS software development cost, cost of deploying local area network in the HQ and Thimphu RO, plus cost of hardware procured in Regional Offices, i.e. computers, hubs and other peripherals)	126,043 (annum) (10 years, no salvage value, straight-line method)
IT staff labor cost	
System engineer (an IT graduate)	84,000 (annum)
Network administrator (an IT diploma)	69,600 (annum)
Subtotal	153,600 (annum)

Note: RO, Regional Office.
[1]The internet connection cost is based on the published rate before April 2007. The tariff was reduced in April 2007 due to the competition with private Internet service providers.
[2]The average connection fee is based on actual expenditure of 2006 in Phuentsholing RO, where RaLIS rolled out prior to other two ROs. Dial-up connection was used in three ROs.

7.2 *External efficiency*

Two indicators were set to evaluate external efficiency, namely lead time per service type and customers' time taken in office. These two are different since many services are not completed within a day, meaning that customers need to come back to RSTA offices. Lead time refers to the total duration that one transaction takes from application to completion of a service. On the other hand, customers' time taken in office refers to the number of hours each customer actually spends waiting in an RSTA office.

First, lead time per service type has shortened in general, with some variations in saved time (Table 9). Dramatic improvements in lead time were found with licensing-related services, whereas not much difference was found with registration services. On one hand, licensing services saw a cut in lead time of up to 3 months in the Samdrup Jongkhar office, which is the farthest from the head office. This is largely because the old system of transporting application documents to the head office by bus, which normally took 15–20 days one way, had been replaced by sending application data electronically within the same day. In addition, 2 weeks' time was saved at the head office by re-engineering checking and approval activities. The bottleneck still lies in printing and lamination of license cards, which can only be done in the head office due to lack of facilities in other areas.

On the other hand, time saved in registration-related services was less marked, with only up to 3 days saved. This is mainly because registration-related services had already been completely decentralized to regional offices, thus their lead time was already short. In addition, a major hand-writing process, which is to copy registration information on pre-printed certificate booklet, could not be replaced with direct printing from RaLIS. Renewal of registration had taken up to 1 h when it was done all manually, whereas now it takes an average 15 min. For new registrations, customers

Table 9. Change in lead time per service type.

Type of services	Duration shortened by (for each Regional Office)			
	Thimphu	Phuentsholing	Gelephu	Samdrup Jonkar
New license	2 weeks	2 weeks	2–3 weeks	2–3 months
Renew license	2 weeks	2 weeks	2–3 weeks	2–3 months
Duplicate license	2 weeks	2 weeks	2–3 weeks	2–3 months
New registration	None	None	None	None
Renew registration	30–50 min	30–50 min	30–50 min	30–50 min
Ownership transfer, conversion[1]	Maximum 2–3 days	Maximum 2–3 days	Maximum 2–3 days	Maximum 2–3 days
Duplication of registration book[1]	Maximum 2–3 days	Maximum 2–3 days	Maximum 2–3 days	Maximum 2–3 days

Source: Created by the author, by information gathered from RTOs, site observation and Citizen's satisfaction survey.
[1]Ownership transfer, conversion of registration type and duplication of registration book can be done at any Regional Office. Two to three days taken for cross-checking and updating registration records have been cut short, if these transactions took place in RO different from the one originally registered. Otherwise, there is no difference in lead time. After connecting all ROs with RaLIS updated daily, information in different region can be checked from any place; thus, 2–3 days have been cut short.

are asked to return in the afternoon to collect the booklet after submitting their application. This procedure makes no difference for customers, even if processing time was shortened in the office.

As for the second indicator, although the actual change in customer's time taken was not directly measured, an indication of positive change in efficiency was found. In the customer satisfaction survey, waiting time reported was not reliable, showing unreasonable variations in the data. However, customer perception on efficiency of licensing and registration services had significantly improved in 2 years. In the survey, customers were asked to rate the efficiency for each licensing and registration services in five ranges, "very much, somewhat, normal, could be better, not at all." In response, the rating above "normal" in August 2005 was 77.6%, which rose to 84.6% in December 2007 for licensing service; for registration service, it rose from 77.2% to 85.7%.[5] At the same time, when invited to choose which of six aspects required improvement, 40% of respondents still felt there was need for improvement for RSTA in "waiting time when you come to the RSTA counter."

8. Indicators of impact on governance

8.1 *Sense of internal control by the management*

It has been repeatedly reported that control over corrupt or unlawful practices in RSTA has improved after the reform, according to interviews with managerial officers. The Joint Director of RSTA has pointed out that traceability of transactions, enabled by RaLIS, contributed to self-restraint from malpractices. In addition, a part of the credit goes to rigid security features, where officers can only access the service menu to which they are assigned. As a result, the staff can no longer provide services outside their jurisdiction. It also must be added that the Joint Director has been leading the reform and was keen to use the new system to strengthen internal control. He has been keeping his eye on any abnormal transaction in RSTA and he engages himself in checking all license records before they are sent for printing. Without his persistence, the impact in internal control may have not been so tangible.

Most RTOs in Regional Offices also confirmed the same impact, highlighting the value of having accurate and complete records in the system. The paper-based working system prior to the reform had many flaws such as missing pages, incomprehensible handwriting, and irrational

information. It was difficult for RTOs to maintain accountability when they had to make judgments based on unreliable records. For example, when someone loses a driving license and requests a duplicate, it is essential to have reliable previous records of unpaid dues before new issuance. Otherwise, drivers may abuse the duplicate service to avoid paying fines and renewal fees. Such weaknesses can create room for corruption when officers seek to assist malintentioned customers.

Despite such reported improvements, a new type of misuse was found in licensing after the reform. An unusually high number of licensing applications were sent from one particular regional office, which were later found to have been approved without a proper driving test, and most of the applicants were not resident in the region covered by this office. It was found that an officer was executing an authorization process through RaLIS without the approval of the RTO, who, although he holds the power to authorize, had little idea about the new system. RaLIS is designed to transfer data only after RTO performs approval process on the system, but the approval process itself had in reality been delegated to the staff as the RTO was not sure how RaLIS works. It did not become a big issue due to the immediate refusal from the head office; however, it provided an important lesson that ICT-lead reform can create opportunities for new types of misconduct.

In addition, RaLIS contributed in facilitating the government audit, increasing accountability of RSTA. The annual audit report released by the Royal Audit Authority after the reform found lapses between RaLIS and Account data, for example. RSTA replied that the data was still being transferred from the old standalone system and paper-based registration records to RaLIS, and that these lapses in information would be rectified once the data migration is completed. The new IS enabled a third party to cross-check the legitimacy of revenue against services provided. It will also enable RSTA to self-check, trace and reply to audit questions, once the information lapses are resolved.

It is clear, therefore, that the impact of ICT-led reform in internal control depends on the attitude, interests and understanding of the management in utilizing the technology for improving their working system and in being held accountable to the public. The reform opportunities offered by ICT can be a double-edged sword for a government agency: while on the one hand it can serve to increase transparency and accountability, on the other hand it can open the agency up to new forms of mal-practice.

8.2 *Sense of fairness and rule of law felt by customers*

The customer satisfaction survey included two questions regarding fairness and accountability, as found externally by customers. However, statistically significant changes between the responses before and after the reform were found in only one aspect: in staff's awareness of rules and regulations. The other questions on fairness, where customers were asked whether the staff was treating all customers equally, did not show significant level of improvement. Both points were rated in five ranges as described earlier, "very much, somewhat, normal, could be better, not at all", and the answers were further categorized into three categories, positive, normal and negative. As illustrated in the results shown in Table 10, positive trends in both aspects are observed. However, it should be noted that the change observed in staff's awareness on rules and regulations may not necessarily be attributable to the IT adoption, as it is possible that other activities carried out in the 2 years between the two surveys may have influenced the observed change.

Aside from such positive impressions, customers still made some complaints about fairness and accountability in the open-comment section in the survey. For example, some reported that RSTA officers favor friends and relatives, or that strictness on driving test is not standard, etc. It is difficult to precisely measure frequency of impartiality and misconduct before and after the reform. However, the improvement of the customers' impression on the staff's awareness on

Table 10. Change in customer satisfaction survey results.

	Positive (very much, somewhat; %)	Normal (%)	Negative (could be better, not at all; %)	No answer (%)
Do you think RSTA staff is treating all the customers equally?				
First survey (August 2005)	48.0	24.4	21.1	6.5
Second survey (December 2007)	50.5	27.8	17.9	3.7
Do you think RSTA staff is well aware of the rules and regulations they are applying?				
First survey (August 2005)	**54.1**	24.4	13.8	7.7
Second survey (December 2007)	**69.6**	18.3	11.0	1.1

Note: All changes in bold figures are statistically tested by *Z*-test. The average score of the latter question had also proven to improve under Welch's test.

rules and regulation is worthy of note, and can be interpreted as a positive sign for improving quality of the public service in terms of good governance.

9. Conclusion

In this impact assessment of e-government support in an LDC context, a positive impact has been found both in terms of efficiency and governance. This positive impact has been recognized externally by the citizenry, as summarized in Table 11, although care needs to be taken before attributing all the changes exclusively to the reform. The study provides evidence of an ICT-enabled reform which contributed to increased efficiency in the working system, reducing administrative burden of the staff and delivering speedier services. The study reinforced that the technology has a potential to cut corruption and increase accountability if management drives the staff in that direction, as other literature has shown (Bhatnagar, 2007; Dhameja & Medury, 2004; Heeks, 1998a). However, it was also found that ICT may not reduce the internal administrative cost at the infant stage of economic development, due to the cost of ICT-related goods and services, which may be high when compared with the costs of local goods and labor.

Thus, the study findings, summarized in Table 11, support the initial argument that the justification for e-government initiatives in LDCs cannot be based on the efficiency savings expected in the government's budget, but rather on the improved quality and governance in delivering public service.

RSTA is now seen as a model case for ICT-led public service reform in Bhutan. RSTA was congratulated as one of the best examples of public service by the committee on service delivery, of the Good Governance Plus (GG+) initiative of the government (RGOB, 2005b). The committee of service delivery was formed in 2006 investigated how public services can be best improved, especially cutting down the lead time, and RSTA's reform ranked top.[6] In the light of this reputation, the Anti-Corruption Commission (ACC), an independent government body which prevents and investigates corruption and ensures accountability within the government, drew upon RSTA as a case study for their own study on administrative burden. ACC acknowledged and widely distributed RSTA's information booklet on International Anti-Corruption Day. Such acknowledgement is expected to inspire other public service providers to improve their services.

Based on the results of this study, some lessons learned are worthy of consideration for future ICT projects in LDCs. In a situation where internal cost reduction cannot be expected, it is recommended to design a project with a focus on improving speed and quality of service delivery,

Table 11. Summary of survey results.

	Indicators	Summary of survey results	Impact
Efficiency			
Internal	Internal cost per service delivery	• Cost-cutting could not be achieved, with internal costs increasing an average 41% • High indirect costs sets off about 22% of the savings in direct costs	Negative
	Staff's allocation of working time	• Overall reduction of administrative workload has been observed • Small ROs could reallocate manpower to more important tasks • Time saved by administrative burden was not fully leveraged in the head office where manpower had been enough	Fair, both ways
External	Lead time per service type	• Improvements were observed in almost all services to varying degrees • A drastic impact was found in licensing services, with up to 3 months cut in lead time in the farthest RO • Modest impact was gained in registration-related services	Positive
	Customer's time taken in office	• Actual change in time taken by applicants could not be traced accurately • Impression of customers in efficiency of licensing and registration services had significantly improved, according to customer survey	Fair
Governance			
Internal	Sense of internal control by the management	• Reports from the management of RSTA demonstrate an increased sense of internal control • Weaknesses of the paper-based system, such as lost or illegible records, and abuse of the system by some customers were removed • However, a new type of misconduct occurred using the new information system	Both ways
External	Sense of fairness/rule of law felt by customers	• Positive impression on the awareness of rules and regulations among RSTA staff has notably increased.	Positive

and on increasing fairness, openness and accountability, while continuing efforts in reducing internal costs. In order to gain tangible impact on fairness, openness and accountability, it would be better to explicitly define the objective, and indicators, for making the service fair and legitimate at the planning stage, which was not sufficiently done in this case study. As customers' perceptions and expectation on fairness, openness and accountability may vary, visible impact would be difficult to achieve when the targets are unclear. The case study also revealed the importance of internalizing a mechanism to secure accountability in the design, such as incorporating traceability of transactions, and to train all employees involved in service delivery, including aspects of moral code of conduct.

Some measures to reduce internal cost can be considered as follows. One measure could be to use the existing ICT hardware and software for other purposes. For example, the RaLIS later had, at no extra cost, extended some of its view-access rights to the police, to share transport infringement information. Not only widening its user base, RaLIS enabled the police to greatly speed up its

inquiry process. Another consideration could be to optimize process re-engineering. In this case, manual processing was maintained in the writing of vehicle registration booklets, which in fact could be printed directly from RaLIS. Continuous and gradual efforts in improving process would be effective.

Nonetheless, there are limitations of this study, which suggest needs for further research. The first point is on applicability. One cannot safely generalize on the basis of the results of one case study in one country with its unique governance structure. Although this study contributes a sample benchmark of public service delivery reform in a non-island LDC, more case studies on different public services of different countries are needed for wider applicability. Especially, a similar study in a small island LDC would be interesting for comparison. In doing so, the impact assessment framework developed for this study could be further refined for use. Second, there is a limitation in using customer satisfaction survey results to demonstrate change of impartiality to customers. The limitation lies in attribution, where other factors may have induced the changes, as well as in relying on subjective views on fairness felt by respondents. There is also a limitation on objectivity of governance indicators surveyed. For example, "sense of fairness" felt by customers in a questionnaire survey, as fairness can have different meanings for each respondent. Lastly, the study did not consider the economic benefits gained from the time saved by citizens, which is often included in project evaluations. This was partly because the time saved per service by customers could not be traced clearly and partly because there was not enough statistical basis to estimate the average income of vehicle owners and drivers. Moreover, vehicle owners and drivers constitute only a small fraction of Bhutanese society. This component may be useful for more advanced and larger countries where significant level of social gains may surpass increase in internal cost of reform.

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Notes

1. Recent statistics revealed that Bhutan's GDP per capita surpassed USD 1414 in 2006, making it no longer categorized as LDC. Bhutan had USD 834 as GDP per capita in 2003 and was categorized as LDC at the time of this study (GNH Commission, 2009; RGOB, 2005a).
2. A list of e-government reports with measured impacts is provided in eGEP (2006a, pp. 26–29) report.
3. Although this study did not consider the framework provided by the World Bank study, eGEP or Heeks at the time of research design, as it had not been published, the research design deployed for this study follows a similar logic, in a limited scope.
4. The average labor cost per month is the average pay scale for civil servants in Bhutan at the time (RCSC, 2002, Annexure 14/1).
5. The difference was tested statistically using *Z*-test.
6. The report of this committee has not been released, but this information was provided by Joint Director of RSTA and confirmed by the chairman, Director of DIT.

Notes on contributor

Mayumi Miyata is a staff member at the Japan International Cooperation Agency (JICA). Prior to joining JICA, she had been engaged as ICT specialist in a number of projects related to e-government and ICT policy mainly in Bhutan and Cambodia, supported by international development agencies.

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