Benefit and cost analysis of e-learning for knowledge management: the Royal Thai Government

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Abstract: The primary purposes of this paper are to describe and present the cost analysis for developing and implementing an e-learning programme for the Royal Thai Government (RTG). This e-learning initiative was part of an attempt to initiate, capture and nurture knowledge for RTG staff. The study mainly focused on the common skills that could help all public agencies comply with the goals of the Good Governance Act of 2003 (GG). The study considered the necessary cost on both the initial and utilisation stages of e-learning. The cost analysis included comprehensive comparisons between e-learning and the traditional classroom approach. The relevant data were collected through surveys and interviews. The e-learning was more cost-effective, given the size of 1.1 million RTG staff. The cost spent on one user or learner with e-learning decreased substantially as the number of learners increased. The suitable structure for implementing the RTG's e-learning indicated that the Learning Management System (LMS) component to be contracted out. At the same time, the remaining components (i.e. software, multimedia and contents of common skills as well as updating effort) are to be managed by the Office of the Public Sector Development Commission (OPDC). An overall cost-approximation function was also developed for the OPDC future use. Although the results from the cost comparison revealed many advantages, it is important to recognise the e-learning's limitations, including a lack of individual interaction and of personal networking. Finally, the results from this project would be used as a future baseline for the OPDC's planning and budgeting processes.

Keywords: e-learning; knowledge management.

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1 Background

The paper is divided into several areas. They include the background on the key terms such as Knowledge Management (KM), e-learning, basic information on public-sector reforms in Thailand. The discussion contains the project's objectives and scope, its methodology and the results, including various cost comparisons between e-learning and a classroom method, proposed cost-approximation functions and practical benefits from e-learning. The analysis on the impacts from two key variables on the total cost on using e-learning was provided. In addition, the limitations on e-learning are recognised.

The need to practice KM had become more urgent in recent years. In Thailand, the expectation from the general population on the quality of services provided by public agencies had increased. At the same time, due to the pressure on the budget constraint while attempting to maintain and/or increase the quality level as well as continuous improvement on both operational effectiveness and efficiency, the need to manage (implying initiating, sustaining and nurturing) knowledge had ever been more demanding. In addition to serving the citizen needs, the administrators and key staff in each public agency were required to assess and improve their management systems and relevant internal processes, e.g. planning, staff development, procurement and budgeting processes.

The overall aspiration of the public-sector reforms in Thailand was to create public agencies that resembled a learning or knowledge-based organisation. Knowledge could be simply conceptualised as a layer consisting of data/information, expertise/skills, experience and eventually intellectual properties such as trademarks, copyrights, licenses, franchises (Figure 1). KM represents an effort to ensure that knowledge would remain in an organisation (Wiig, 1999). Therefore, it is important to capture and share such knowledge among individuals. Currently, this knowledge has been created through training and development, on-the-job experience, etc.

Figure 1   Knowledge layers and the knowledge management effort for the study
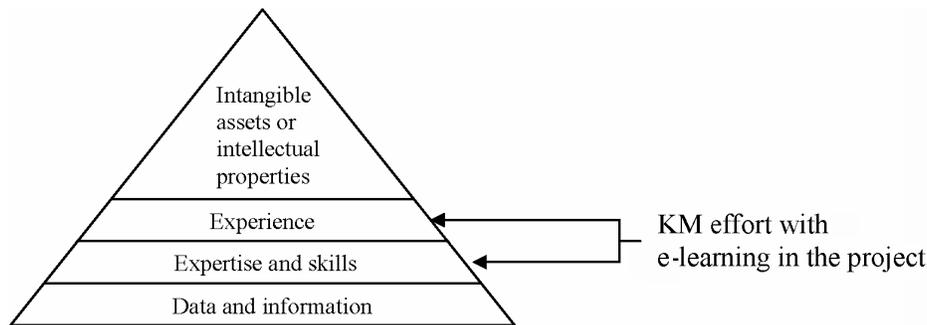
Unlike the business firm, a governmental organisation could be considered as complex, large and spread-out. The RTG consisted of 19 ministries with 1.1 million staff. About 30% of them were assigned and located throughout the country. Therefore, it was obvious that information technologies such as web-based applications needed to be applied in order to minimise physical and communication barriers among governmental staff. In addition, it was unlikely that traditional training or skill development methods (e.g. use of classrooms, handouts, texts, lectures as a primary means of knowledge transfer and sharing) were suitable for speedy upgrade of governmental workforce in response to reforms and higher expectation from citizens. Coupled with the early-retirement packages offered to governmental staff, the ability to prevent sharp performance drop-off and long maturity time (the time taken for a replacement to reach the performance level achieved by a previous staff) had to be taken into consideration. Therefore, the attempt to examine the potential and the possibility to apply the e-learning approach was initiated. The OPDC was assigned the responsibility over this examination.

The OPDC was a designated public agency that aims to assist public agencies in improving their performance levels. The OPDC had played a crucial role in public-sector reforms in Thailand since its inception in the late 1990s. Its primary goals were to create awareness and to assist other public organisations in achieving excellent results or high performance. Accountability and performance agreements (between agency heads or provincial governors and their corresponding permanent secretary) were the key components for this achievement. The Good Governance Act of 2003 (GG) was developed to ensure this goal. Its main contents included the need for all public agencies to be responsive to changes and citisens needs, to encourage public participation into their affairs, to become transparent, to improve a management system, to constantly monitor/evaluate/improve the performance levels, to become a learning entity, etc.

Due to the urgency and ongoing public-sector reforms, the awareness and skill development needed to ensure successful GG implementation and sustainability were tentatively set with a 5-year timeframe for all public agencies. In other words, to act upon and comply with the GG, the speedy upgrade of the skill among RTG staff became critical. This was due to the nature of public agencies that relied heavily on the staff to carry out the tasks. Simply put, the skill development for staff represented a critical success factor of KM and eventually performance excellence (Hung et al., 2005). The OPDC regarded KM as crucial to the GG sustainability and success. As a result, KM reflected an important effort for public-sector reform initiatives to ensure sustainable and continuous performance improvement (Wong and Aspinwall, 2004).

According to Wild, Griggs and Downing (2002), the integration of e-learning with KM had become more practical and more apparent. E-learning helped make the creation and sharing of knowledge within an organisation faster, less expensive and more flexible. Based on Shooley (2004), e-learning offered many benefits such as: consistency of presentation – instructions are identical to all learners; global learning; self-pace learning; on-demand learning – learners can take classes when they want, where they want; and cost saving. Due to these advantages and the goal of having 1.1 millions RTG staff undergoing skill development in order to meet the GG requirements within the 5-year timeframe, the use of e-learning was suggested and subsequently needed to be studied prior to its deployment.

2 Objectives and project scope

The overall objectives of the project were to examine and analyse the costs of applying e-learning for skill development of RTG staff. The scope of this study was primarily on common skills. These common skills represented the skill areas, subjects and topics in which governmental staff, regardless of the ministries and departments, would have the possession. The common skills for this study were mainly for complying with the GG. The OPDC worked closely together with the Kasetsart University Research Team for project completion. In this paper, the e-learning system indicates the combined structure of the LMS, multimedia and content development and skill-development subjects. The e-learning programme implies the 5-year duration for the e-learning system's implementation. The cost analysis covered both investment and operational stages of the e-learning programme. In addition, the study had to take into consideration the maintenance and upkeep costs. Although the study included the examination on the benefits of e-learning, most materials in the paper to be presented are on the cost analysis and comparisons.

3 Methodology

This project embraced several conceptual thoughts embedded in systems engineering (Blanchard and Fabrycky, 2005) and mind mapping (Buzan, 2001). The focus was divided into three areas that made up the e-learning system: course identification and design, content development and the LMS. The primary activities within the first area included the identification of skill development topics that were required by the GG, availability/capability/readiness of existing infrastructure (e.g. speed) and perception of e-learning by RTG staff. The essential tasks within the second area were the study into the media-delivery format, the determination into the delivery means to ensure compatibility across different operating system platforms (e.g. a standard for e-learning contents and delivery formats), etc. The critical tasks within the third area included the determination of the LMS functions, roles and responsibilities during implementation, etc.

The surveys and interviews were conducted, with strong support and cooperation from the OPDC, for data gathering and collection on the expected costs and benefits of e-learning. Both the central agencies (located in Bangkok) and the provincial administrations were included. The staff, who were residing in Bangkok and upcountry,

have been asked to participate in the surveys. A total of six ministries (e.g. Ministry of Agriculture and Cooperatives, Ministry of Interior) with more than 1,200 staff participated in the study. The interviews were also conducted with the organisations that had experience in e-learning and with the experts in order to identify its likely practical benefits.

4   Results

The results, derived from the three areas discussed earlier, primarily included:

1   the list of skill-development subjects with their priority and organisation – to highlight the need to seriously consider the use of e-learning for the requirement of a 5-year duration for skill development and upgrade

2   current computer and network capability – to provide the rationale for the selection of a suitable content for the RTG

3   multimedia and content development cost

4   investment and operation/maintenance or upkeep costs for LMS.

These results were the inputs for the cost analysis and comparisons, and later for developing the e-learning's cost-approximation functions. They are as follows

1   A comprehensive examination was made into key legislations from the USA and other countries that were compatible with and were relevant to the RTG's GG in order to identify common skills required. Such key legislations included Government Performance and Results Act (1993), Government Management Reform Act (1994) and Information Technology Management Reform Act (1996). To help verify these proposed course designs, many comparisons were made with those offered by other governments that had already undergone through vigorous public-sector reforms, such as British, Australian, Singaporean and US governments. In alignment with the GG, there were 176 common-skill subjects proposed, which could be further classified into 37 key areas and 10 competency programmes. Furthermore, it would be possible for the OPDC to add more contemporary topics, e.g. market management, contract management. This was due to continuous changes in governmental approaches in addressing public problems and concerns such as deploying the government by network concept (Goldsmith and Eggers, 2004) and creating high-impact middle management (Haneberg, 2005) concepts (see Appendix for the details).

These 176 subjects, in accordance with the discussion with the OPDC, were classified into three levels, namely basic, intermediate and advance. Most of the 176 subjects would involve at least 100,000 staff from the junior and middle levels. It was clear at this point that there was strong possibility that the OPDC would not be able to handle all of the proposed subjects within a 5-year period. This helped underline the need to seriously consider e-learning as an alternative for skill development (Table 1).

2 The questionnaires were sent to help determine whether public agencies were generally ready to apply e-learning. Simply put, the objective was to assess the capability of computers and internet connections and staff's attitudes towards e-learning. The findings showed their widespread openness to the use of e-learning. With regard to the existing internet infrastructure, public agencies in Bangkok had faster internet connection than those in the rural areas, which were still mainly connected via low-speed modems. According to the responses, approximately 58% of Bangkok-based departments from the surveyed ministries had internet speed between 1–10 Mb while more than 63% of province-based administrations still had less than 256 Kb internet speed. Because the connection speeds varied, the e-learning content had to be able to accommodate both ends by having at least two versions available, one for low speed and the other for high speed.

3 Additional related data for the cost analysis and comparisons were collected from the multimedia developers. Several forms that had been adapted for e-learning in Thailand were studied, e.g. low graphic (text mode), low graphic (two-dimension animation), high graphic (two-dimension animation with video clips) and high-interactive contents. Given the in-depth discussions with the popular content developers in Thailand such as Global Wireless, TeamMer & Partners, Virtual Link Solutions and A.R. Information & Publication, coupled with the previous results on basic infrastructure, it was agreed that the form of low graphics (with simple two-dimension animation with some video clips) would be the most suitable (see Table 2 for the cost relating to a low-graphic presentation).

4 With respect to other relevant costs, the study focused on investment, operation and upkeep activities that related to the LMS. Five of the world leaders in LMS market according to Gartner research report (Lundy and Walidr, 2004) participated and collaborated in an interview with research team to obtain the estimated cost data. The proposed functions for the RTG's LMS included registration and performance report, list of current/future subjects and curriculums, record update and keeping, tests and examinations, verification on subject sequences and pre-requisites during enrolment, payment and security and privacy protection. The LMS's cost data were estimated in terms of the number of learners participating in e-learning (Table 3).

Table 1 Classifications of the skill-development subjects to achieve the GG

Level of subject	Number of subjects	Target groups
Basic	85	Starting from junior staff
Intermediate	80	Starting from middle administrators
Advance	11	For senior administrators

Table 2 Cost data on content development in one skill-development subject (in Thai Baht)

Content development cost (per 60 min)	Instructor or 'Subject matter expert' (including joint material development, Q&A, progress monitoring and evaluation) in 1 year	Assistants to the instructor (one to two persons in 1 year)	Overall cost for content development
100,000–200,000	300,000–500,000	100,000–150,000	500,000–1,000,000

Table 3   Cost data on the LMS (in Thai Baht)

No. of learners	Total estimated cost (including software, hardware and implementation)	Cost per user	Total cost ranges	Maintenance cost per year
1,000	5,000,000	5,000	5–6 millions	300,000
10,000	28,900,000	2,890	25–30 millions	2,000,000
100,000	100,200,000	1,002	80–120 millions	10,000,000

5   Analysis of results

One of the study's requirements was to quantitatively compare between the use of e-learning and the traditional classroom approach. In this study, the cost comparisons were based on two circumstances as agreed with the OPDC: investment and operating costs with respect to the number of learners; and investment and operating costs with respect to both the number of skill-development subjects and the number of learners. In general, the cost of the e-learning programme could be described by the following equations:

$$\text{ACEL} = \text{SC} + \text{CC} \tag{1}$$

where ACEL: an annual cost of e-learning; SC: an annual e-learning system cost; CC: an annual cost of e-learning contents.

$$\text{SC} = \text{SW} + \text{HW} + \text{IM} + \text{MA} \tag{2}$$

where SW: an annual software related cost; HW: an annual hardware related cost; IM: an annual implementation cost, e.g. consulting fees for system implementation (such as technical assistance to help operate the LMS), programmer wages.

MA: an annual maintenance/ upkeep cost

$$\text{CC} = \sum_{i=1}^{n} (\text{DEV}_i + \text{INS}_i + \text{ADMIN}_i) \tag{3}$$

where i: an index of the skill development or training subjects; n: a total number of skill-development subjects; DEV_i: an annual media development cost of the ith subject; INS_i: an annual instructor cost of the ith subject; ADMIN_i: an annual administration-related cost of the ith subject.

The cost of traditional trainings (classrooms) could be described in the following equation:

$$\text{ATTC} = \sum_{i=1}^{n} \left[\sum_{j=1}^{N} \left(\text{INS}_{ij} + \text{ADMIN}_{ij} + \text{LC}_{ij} + \sum_{k=1}^{m} \text{TRV}_{ijk} \right) \right] \tag{4}$$

where ATTC: an annual cost of traditional training or skill development – classrooms; i: an index of the training subjects; j: an index of the repeated training classes; k: an index of the learners who need to travel to attend the session; n: a total number of skill development subjects; N: a total number of required classes for each subject; M: a total number of the learners who must travel to attend the session; INS_{ij}: an instructor cost of

the *j*th repeated classes for the *i*th subject; $ADMIN_{ij}$: an administration related cost of the *j*th repeated classes for the *i*th subject, e.g. meeting room fee, overhead cost,; LC_{ij}: a learner-related cost of the *j*th repeated classes of the *i*th subject, e.g. food and beverage, training document, folder; TRV_{ijk}: a travelling-related cost, such as hotel and transportation, for *k*th learner who travelled to attend the *j*th repeated classes for the *i*th subject.

The development and structure of these cost equations [from Equation (1) to Equation (4)] was based on the interviews with the companies mentioned earlier. At the same time, these equations were one of the key discussion points for review and feedback with a group of experts from the Continuous Learning Centre at Chulalongkorn University (Bangkok, Thailand) and the Department of Computer Engineering at Kasetsart University (Bangkok, Thailand). It was agreed that the four equations appeared to contain relevant cost components. In addition, there were four key assumptions embedded in this cost comparison work:

1   The cost models were computed based on 50 required skill-development subjects over a period of 1 year. This number was deemed practical by the OPDC.

2   Each traditional skill-development class could accommodate 300 participants (learners).

3   About 30% of all participants for each class had to travel to the session.

4   The 6-hour traditional training was equivalent to 4 hours when using online media.

For the first circumstance, the cost of e-learning was higher when the number of learners was below approximately 1,200 persons. The reason was that e-learning required a huge initial investment on hardware, software and content development (Figure 2). Interestingly, after the breakeven point had been identified, the cost of the traditional classroom approach was exponentially higher. This was clearly illustrated when there were more than 2,000 learners. This could be attributed to the repeated training sessions. On the contrary, the number of learners hardly had any impact on the cost when using e-learning. Therefore, the number of learners appeared to have much stronger impact on the cost of classroom trainings. The reason was that most of the costs of classroom trainings [from Equation (4)] would increase proportionally with the number of learners (Figure 3).

To further assist the OPDC's planning on the future implementation of e-learning, the idea of creating a cost-approximation function was suggested. This cost-approximation function represented a mathematical equation that would be derived from, and would be proven to fit with, the graphical results such as those shown earlier in Figures 2 and 3. The results from Table 4 showed that there were two suitable cost-approximation functions for either e-learning or classroom trainings due to the breakeven point previously stated. For this study, a suitable equation or function needed to be above the level of 0.80, characterised as an acceptable value of R^2. This was to ensure the degree of confidence in the equation's predictability. This function could be used to assist the OPDC in design and planning, including the level of budget to be requested and so on. In other words, the proposed cost-approximation function could be served as a baseline or a starting point for the OPDC planning tasks on budget preparation and formulation, and sensitivity analyses by varying number of learners to be participated and/or of subjects to be offered (in case of changes in priority and urgency), etc.

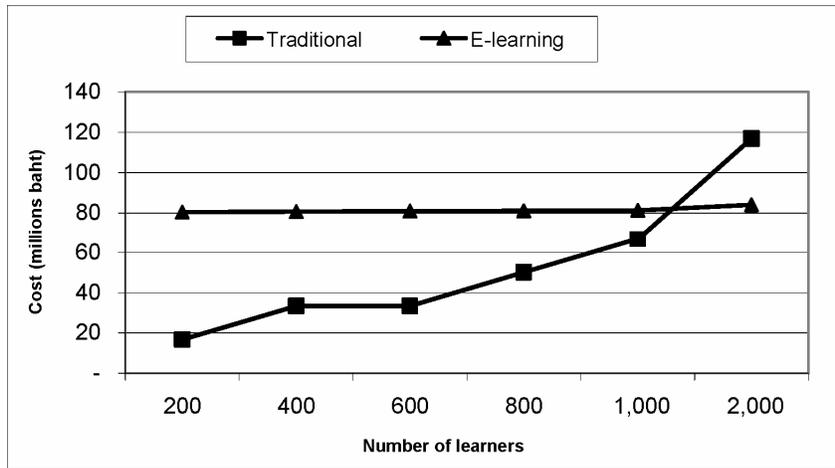**Figure 2**   Initial cost comparison for the breakeven point identification

Figure 3   Continuous cost comparison for the RTG
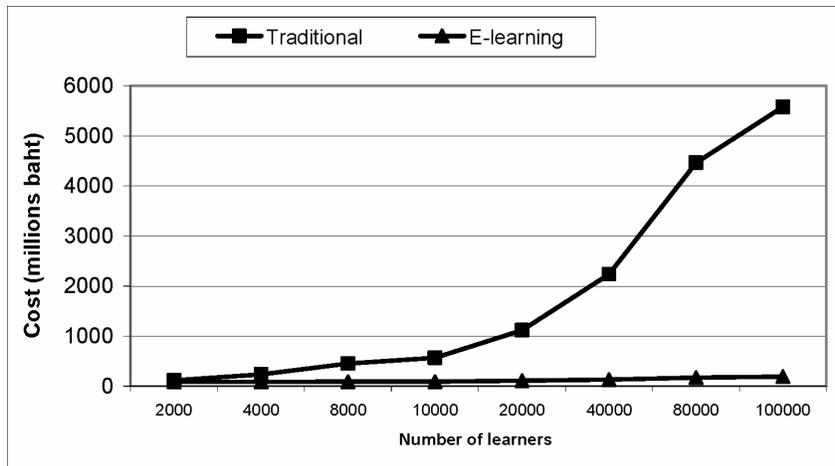
Table 4   Cost- approximation functions for the first circumstance

Approximation function, f(x)	R^2	Variable	Conditions
e-learning f(x) = 11.69x + 5.01	0.942	x: number of learners	$100 \leq x \leq 1,000$
Traditional approach f(x) = 0.2x + 80.3	0.999		
e-learning f(x) = $64.466e^{0.1246x}$	0.884		$1,000 < x \leq 100,000$
Traditional approach f(x) = $71.59e^{0.5629x}$	0.990		

An additional analysis was conducted for the second circumstance – simultaneous consideration into both the number of skill-development subjects and the number of learners. Based on Figure 4, the number of skill-development subjects had strong impacts on the cost of traditional classroom approach regardless of the size (whether it was for the 1,000, 10,000 or 100,000 learners condition). At the same time, the number of skill-development subjects seemed to only have strong impact on the cost of e-learning only when there were less than 1,000 learners. For the range of 10,000 and 100,000 learner scenarios, the number of subjects had very minimal effect on the cost of e-learning. This supported the notion that the cost per learner decreased as the number of learners increased for e-learning. This is due to the fact that the additional cost to accommodate more learners was not needed. On the contrary, administrative-related cost (such as lecture documents) for the traditional classroom approach increased as the number of learners increased. Each of the three conditions, for either e-learning or traditional classroom approach, required its own cost function. The similar level of R^2 was used to ensure the cost-approximation function's predictability (Table 5).
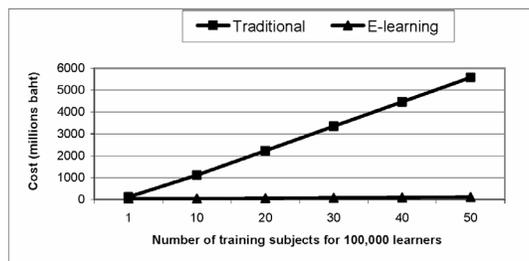
Figure 4 Impacts from the number of skill-development subjects for a given number of learners on the total cost
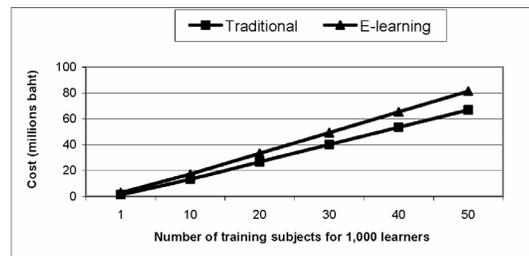
(a)
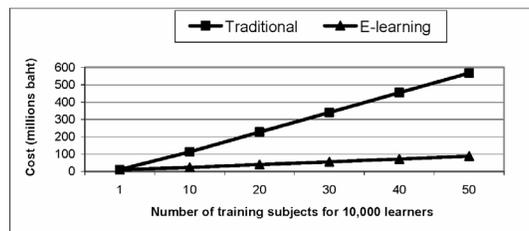
(b)

(c)

Table 5   Cost-approximation functions for the second circumstance

Approximation function, f(x,y) *Unit: million bahts*	*R²*	*Variable*	*Conditions*
e-learning f(x,y) = 15.771x − 13.633	0.9997	x: number of skill development subjects	1 ≤ x ≤ 50 y = 1,000
Traditional approach f(x,y) = 13.169x − 12.469	0.9997	y: number of learners	
e-learning f(x,y) = 15.771x − 7.1533	0.9997		1 ≤ x ≤ 50 y = 10,000
Traditional approach f(x,y) = 111.94x − 105.99	0.9997		
e-learning f(x,y) = 15.771x + 15.107	0.9997		1 ≤ x ≤ 50 y = 100,000
Traditional approach f(x,y) = 1099.6x − 1041.2	0.9997		

Given data from Tables 4 and 5, it was possible to formulate the general or overall cost-approximation function of e-learning for the RTG. This function could be demonstrated as follows.

The cost-approximation function for e-learning for the RTG (in million Baht)
$$= (1.6)X_1 + (0.000431)X_2 + 2.9045 \qquad (5)$$

where X_1: number of skill-development subjects offered via e-learning; X_2: number of learners.

6   Discussion

The cost comparisons provided clear evidence that supported the initiative on the use of e-learning. The use of e-learning became much more attractive as the number of learners was bigger, given at least 50 skill-development subjects to be offered each year. The rate of increase in the total cost for the traditional classroom approach was proportional to the increase in the number of learners. On the contrary, it was not the case for e-learning [see Table 6 for the results from Equation (5)].

Table 6   Annual e-learning cost and traditional training cost

Number of learners	*Number of training subjects*	*Annual e-learning cost (million baht)*	*Annual traditional approach cost* (million baht)*
100	50	18.5	6.0
1,000	50	81.3	66.8
10,000	50	87.8	567.8
100,000	50	110.0	5,577.8

To support the findings from the cost comparisons, the examination into the use of e-learning was also made on its potential practical benefits. Thanks to the interviews with the system administrators, the users and the so-called experts in e-learning from various

organisations (e.g. the Siam Cement Group, Seagate Technology, Thai Airways International), practical benefits from e-learning were identified as follows:

1   *Flexible schedule*. The e-learning approach would allow participating staff to choose their convenient schedule and the length of time to learn. The e-learning system was presumably available almost 24 hours a day for 365 days. There would be no ceiling on the number of participants in one subject. In contrast, for the traditional classroom approach, its quality heavily depended on the number of participants in each training session. Based on the interviews, the RTG training session was usually organised around 100–200 participants, especially for junior staff where the quality and consistency of learning had been the issues of concern. In addition, many participants had experienced schedule conflicts and sometimes could not attend the entire session due to work-related assignments (Gunasekaran, McNeil, and Shaul, 2002).

2   *Self-pace learning*. Unlike learning in an educational institute, the participants from the RTG in each session were likely to have different backgrounds, e.g. ages, educations, personal interest. The e-learning approach allowed individuals to manage the speed of learning by themselves. On the contrary, in the classroom-setting environment, especially with the large size, the participants who could not catch up with the instructor often felt isolated and embarrassed to ask an instructor to repeat or to re-visit the context. With e-learning, it allowed the participants to repeat or replay the context as often as needed. In addition, the participant could discuss with the instructor in more private situation via many communication tools, such as e-mail, chat room, web board (Liebowitz, 2003).

3   *Progress monitoring*. If the OPDC decided to move ahead with the e-learning programme, it would need to more effectively utilise the functions embedded in the LMS. The LMS would potentially act as a central portal for all the parties, such as instructor, learner, administrator and learner supervisor for monitoring and evaluation. The LMS would allow the OPDC or even a human-resource development unit within each ministry or department to track the individual progress and to assist in the competency analysis and report (Cegarra-Navarro and Sabater-Sanchez, 2005). Furthermore, a staff could register any additional subjects that he/she was interested in via LMS access even though that subject might not be required. As a result, the LMS would create a community of learning without the departmental or ministerial boundary. This community of learning would be a key element in driving the organisation to have better learning and subsequently knowledge-based characteristic (Lin and Tseng, 2005).

4   *Rapid training*. Another advantage of the e-learning approach for KM was that the OPDC could rapidly provide a mass skill development over a short period of time (de Gooijer, 2000). For the traditional classroom approach, the train-the-trainer approach – where many trainers were trained and then sent to train the others – has been commonly used in order to achieve a mass training within a short timeframe. However, it was difficult to control the consistency of the presentations of the trainers to all learners. In contrast, the presentations of the materials via e-learning approach were identical to all learners – positive impacts on knowledge management (Hong and Kuo, 1999).

Finally, for the e-learning system's structure to be recommended for the OPDC, the most inexpensive way would be for the OPDC to purchase the LMS that allowed the governmental staff to access the e-learning system. This was due to the fact that most of the LMS vendors set their price (fees) according to the registered learners. As the number of learners was higher, the cheaper the license fees per learner would become. Therefore, the centralised LMS was definitely less expensive than for each ministry or department to develop its own LMS. For the content development (unlike traditional training where the cost depends on the number of training sessions), once developed, it could be shared/reused/accessed by unlimited number of learners. As the number of learners became bigger, the cheaper the media development cost per learner would be. Thus, the OPDC would be primarily responsible for determining/updating skill-development subjects and for managing content development while the LMS would be under the supervision of another central agency, possibly the Ministry of Information and Communication Technology.

To ensure the continuation of the use of e-learning, the OPDC was recommended the followings. The monitoring and evaluation of the impacts from e-learning needed to relate with organisational performance such as effectiveness, efficiency and service quality delivered to people. Continuous feedback on the attitude of RTG staff on e-learning would be critical. The possibility of the internet-account purchase by the OPDC so that RTG staff could use e-learning at home was also mentioned. Some administrative issues would have to be addressed in the near future such as whether e-learning usage hours would be counted as the regular working hours, etc. Finally, the update/continuous revision on the cost-approximation functions was strongly urged (once the actual cost data began to emerge).

Given the issues of flexibility, short timeline and diverse backgrounds from participants, the use of e-learning appeared to be more feasible. According to the study, e-learning had many benefits and cost advantages; its shortcomings needed to be recognised. For some RTG staff, there were concerned about the financial implications, implying no travelling and meal allowances. Some doubted whether there would be available time and energy to learn new subjects after such long working hours (due to family consideration and work fatigue). Some expressed concern over a lack of individual interactions and of forming personal networking. They believed that the personal contacts and connection were extremely important. As a result, the traditional classroom approach could not be altogether abandoned.

7 Conclusion

This paper presents the initial analysis of e-learning for the RTG with respect to its cost and benefits. This project was part of the KM effort to help prepare the RTG staff for effectively complying with the GG requirements. The extensive cost comparisons between e-learning and the traditional classroom approach were illustrated. Several cost models relating to e-learning were demonstrated, including the general cost-approximation function. The benefits of e-learning were also presented. Finally, the shortcomings and issues of concern when using e-learning were discussed.

References

Blanchard, B.S. and Fabrycky, W.J. (2005) *Systems Engineering and Analysis* (4th ed.). Englewood Cliffs, NJ: Prentice-Hall.

Buzan, T. (2001) *The Mind At Work – Tony Buzan And Mind Mapping*. E-book and available at: www.amazon.com

Cegarra-Navarro, J.C. and Sabater-Sanchez, R. (2005) 'E-learning: organizational requirements for successful feedback learning', *Journal of Workspace Learning*, Vol. 17, pp.276–290.

De Gooijer, F. (2000) 'Designing a knowledge management performance framework', *Journal of Knowledge Management*, Vol. 4, pp.144–161.

Goldsmith, G. and Eggers, W.D. (2004) *Governing by Network: The New Shape of the Public Sector*. Washington, DC: Brookings Institution Press.

Gunasekaran, A., McNeil, R.D. and Shaul, D. (2002) 'E-learning: research and applications', *Industrial and Commercial Training*, Vol. 34, pp.44–53.

Haneberg, L. (2005) *High Impact Middle Management: Solutions for Today's Busy Managers*. MA: Adams Media.

Hong, J.C. and Kuo, C.L. (1999) 'Knowledge management in the learning organization', *Leadership & Organization Development Journal*, Vol. 20, pp.207–215.

Huang, Y.C., Huang, S.M., Lin, Q.P. and Tsai, M.L. (2005) 'Critical factors in adopting a knowledge management system for the pharmaceutical industry', *Industrial Management & Data Systems*, Vol. 105, pp.164–183.

Leacock, T. (2005) 'Building a sustainable e-Learning development culture', *The Learning Organization*, Vol. 12, pp.355–367.

Liebowitz, J. (2003) 'Keynote paper: measuring the value of online communities, leading to innovation learning', *Int. J. Innovation and Learning*, Vol. 1, pp.1–8.

Lin, C. and Tseng, S.M. (2005) 'The implementation gaps for the knowledge management system', *Industrial Management & Data Systems*, Vol.105, pp.208–222.

Lundy, J. and Walidr, A. (2004) 'Magic quadrant for e-learning suites 2004', *Research report*, Gartner Inc.

Schooley, C. (2004) *Justifying Technology for Training. Research Report*. Forrester Inc. Downloadable from http://www.forrester.com/Research/Document/Excerpt/0,7211,34699,00.html

Wiig, K.M. (1999) 'Knowledge management: an introduction and perspective', *Journal of Knowledge Management*, Vol. 1, pp.6–14.

Wild, R.H., Griggs, K.A. and Downing, T. (2002) 'A framework for e-learning as a tool for knowledge management', *Industrial Management & Data Systems*, Vol. 102, pp.371–380.

Wong, K.Y. and Aspinwall, E. (2004) 'Characterizing knowledge management in the small business environment', *Journal of Knowledge Management*, Vol. 8, pp.44–61.

Appendix: Summary of skill-development programmes, areas and subjects for RTG

Competency/skill-development programmes	Key areas	Subjects/topics
Governance introduction	Structure	Structure of Royal Thai Government
		Current national economic and social development plan
	Requirements	Essential aspects of the constitution for citizens
		Regulations for administering public organisations
		Accountability for the public sector
		Regulation writing
	Public relations	Writing press release
		Media management: newspapers, talk, radios, TV or public forum
		Public speech
		Understanding neighbours: Asians, China, India, Japan, South Korea
Planning	Public-sector economics	Risk analysis in the policy area
		Understanding business and markets
		Public goods
		Social economics
	Policy-making	Policy development
		Evidence-based policy-making
		Policy and laws
		Public Consultation Workshop
		International agreements in public administration (impacts on roles and responsibilities)
		International businesses
		Politics for policy making
		Policy research and evaluation
	Strategy formulation	Competitive environment for public and private sectors
		Data and intelligence gathering
		Value-chain management
		Technology forecasting
		Strategy development
		Strategy deployment
		Annual performance plan development

Appendix: Summary of skill-development programmes, areas and subjects for RTG (continued)

Competency/skill-development programmes	*Key areas*	*Subjects/topics*
Public finance/accounting	Budgeting	Overview/introduction of budgeting process (making budgets work)
		Practical budgeting for managers
		Time-value of money
		Cash flow analysis
	Public accounting	Managerial accounting
		Inventory costing and depreciation
		Public expenditures
		Financial statements
		Activity-based costing and management
		Public finance
		Practical approach for accounting and internal audit
		GFMIS basics: Government Fiscal Management Information System
	Acquisition: procurement for asset management	Acquisition logistics
		Outsourcing with performance-based contract for suppliers/vendors
		Life cycle/ownership cost
		Green procurement and purchasing
Programme/project management	Design and purposes	Cost-benefit ANALYSIS
		Cost estimation
		Revenue-requirement analysis
		Risk assessment and analysis
	Management process	Project Management Techniques (PERT/CPM)
		Probabilistic analysis
		Project quality assurance
		Reporting
	Contractor and contract management	Contract negotiations
		Contractor and supplier selection
		Contract and warranty management
		Working effectively with partners (contractors/suppliers)
		Contractor or supplier audit for effective acquisition

Appendix: Summary of skill-development programmes, areas and subjects for RTG (continued)

Competency/skill-development programmes	Key areas	Subjects/topics
Performance-based management	Performance measurement	Measurement concepts: Sink's, Balanced Scorecard, EVA and value-added
		Management systems model
		Ratio development for key performance indicators
		Developing and administering surveys
		Conducting and administering interviews
		Measuring organisational performance
		Measuring supplier performance
		Measuring customer satisfaction
		Measuring staff satisfaction
		Target-setting
	Performance analysis	Trend analysis with STATISTICS
		Root-cause analysis
		Benchmarking
		Applications of quality tools for analysis
		Reading and analysing an annual performance report
	Management reporting	Multi-database and multi-network reporting
		Report writing and executive summary
	Performance agreement	Provisions in performance-based contract for administrators/managers
		Contracting and contract amendment process
Knowledge management	Keeping skills in the workplace	Functional job and workload analysis
		Structure interviews and placement
		Managing training and development
		Evaluating training effectiveness
		MAKING TRAINING FUN
		Coaching
		Mentoring
		Succession planning
		Exit interviews

Appendix: Summary of skill-development programmes, areas and subjects for RTG (continued)

Competency/skill-development programmes	*Key areas*	*Subjects/topics*
	Knowledge and innovation building	Organisational learning (developing/deploying/transferring a knowledge management system)
		Knowledge as capital
		Human capital
		Organisational culture
		Organisational capital
		Communities of Practices (CoP)
		Public franchises
Office/workplace management	Management through people	Fostering staff motivation
		Applied rewards and recognitions
		Empowerment
		Supervisory
		Managing through diverse workforce
		Workplace psychology
		Stress management
		Working with 'difficult' workers
		Administering brainstorming sessions
		Emotional intelligence
		Administering nominal group technique sessions
		Generating creative and innovative ideas
		Managing white-collar/knowledge workers
		Disciplining staff
	Organisation development	360° feedback
		Fundamentals of critical thinking skills
		Development with situation-based approach
		Problem-solving
		Managing participation
		Mind and visual mapping
		Becoming effective facilitators
		Data gathering during public forum and meetings
		Team building
		Promoting team creativity
		Career development
		Performance-based appraisal
		Correcting performance problems
		Human resource scorecard

Appendix: Summary of skill-development programmes, areas and subjects for RTG (continued)

Competency/skill-development programmes	*Key areas*	*Subjects/topics*
	Administration	Office and business writing
		Effective briefing
		Effective presentations
		Effective meetings
		Dealing with conflicts in the workplace
		Assertive communications
		Mastering interpersonal communications
		Cross-cultural communications
		Sexual harassment
		Listening
		Negotiation
		Handling workplace stress
		Managing the experts and consultants
		Minute taking
	Change management	Organisational culture for the public sector
		Organisational psychology
		Organisational development
	Office asset management	Basics on maintenance and upkeep
		Lease vs. buy analysis
		Replacement analysis
Customer services	Product and service standard setting	Identifying needs/want and maintaining communication
		Establishing product and service, standards and standardisation of work processes
		Branding
	Customer relationship management	Making customer satisfaction a daily pleasure
		Call centre
		Telephone
		Working with upset customers
		Obtaining customer feedback, e.g. observation or data collection through surveys/interviews
	Products/service/ process audit	Checklist development
		Audit interviews
		Audit reports

Appendix: Summary of skill-development programmes, areas and subjects for RTG (continued)

Competency/skill-development programmes	*Key areas*	*Subjects/topics*
	Process improvement	Re-engineering
		Six Sigma
		Total quality management
		Understanding quality awards: Thailand Quality/ Malcolm Balridge Awards and EFQM Model
		ISO 9001: 2000 Basics
Basics on computer applications	Internet and network technologies	Internet and intranet applications
		Information server
		Networking and telecommunications fundamentals, wireless communication
		E-mail in the workplace
		Lotus notes for office communication
	Office programmes	Basics on office software, e.g. Microsoft Excel, Words or PowerPoint
		Support applications: connectivity or security
		Applications for programme and project management: Microsoft projects
		Web-based applications: web-based design – writing/editing
		Cyber laws
		Network communication
	Special programmes	SAP, Oracle, Basic Database, etc.
	Software development	C programming, Cobol, Java, software programming fundamentals
	Operating system	Linux, UNIX, Window
Language basics	English	Writing, speaking, listening and reading
	Chinese	Writing, speaking, listening and reading
	Japanese	Writing, speaking, listening and reading
	Hindi	Writing, speaking, listening and reading
	Arabic	Writing, speaking, listening and reading
Other topics	Capability and Maturity Model (CMM)	Capability and Maturity Model (CMM)
		Classification
	Intergovernmental relations	Integrated provincial management
		Authority distribution
	Governmental Financial Management Information Systems (GFMIS)	GFMIS (data entry)
		Financial transaction
		Verification and reporting
	Marketing	Quality function deployment
		American National Standard Institute