



O.R. Applications

# A simulation study of IT outsourcing in the credit card business

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Received 8 June 2004; accepted 17 June 2005

Available online 31 August 2005

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## Abstract

The use of Monte Carlo simulation for evaluation of financial risk of an information technology project selection decision is described. A major Thai bank considered the opportunity to expand credit card operations through information technology (IT). Alternatives considered were in-house development and outsourcing. There were many strategic reasons for the initiative. However, there were also many risks associated with the proposal. A Monte Carlo simulation spreadsheet model was used to model risk parameters, and to analyze key performance variables of financial performance. Key output variables were the number of cardholders expected, project net present value, net profit, and expected return on investment. The spreadsheet model made entry of model elements transparent, and Monte Carlo simulation provided clear visual display of the financial output variables. The bank used this information in its decision to outsource its credit card operations.

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*Keywords:* Investment analysis; Risk management; Simulation; Banking

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## 1. Introduction

Information technology (IT) outsourcing means that the physical and/or human resources related to

an organization's information technologies (ITs) are supplied and/or administered by an external specialized provider. IT outsourcing is often more efficient than developing systems internally because production costs are lower with outsourcing. The provider obtains scale economies from mass-producing its services and distributing its fixed costs among a great number of end-user clients [16]. Outsourcing IT can include data centers, wide area networks, applications development and maintenance

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functions, end-user computing and business processing [13].

The decision to adopt any information systems project is complex. Ideally, investing organizations might like to conduct detailed cost benefit analyses in net present value terms of all cash flows. However, the precise impact of information systems projects in terms of detailed cash flow is problematic. Benefits are difficult to describe with accurate quantitative measures, and costs involve high levels of risk. While intangible factors are important, they are usually incorporated through managerial judgment, which is informed of expected financial impact. This financial impact involves high levels of risk, a modeling environment that is well supported by Monte Carlo simulation.

IT outsourcing is a fairly recent option for banks and financial institutes in Thailand. In the early years of the 21st Century only three banks were outsourcing credit card operations. The first to use outsourcing began in 2003, outsourcing to IBM. The subject bank in this study (PPP-Bank) is small bank and could not outsource all of its IT functions. The high level of competition in the banking industry in Thailand made its credit card business an important means of generating revenue. PPP-Bank needed to enter the credit card business in order to retain competitive advantage. PPP-Bank had applied simulation to strategic decisions such as financial planning, capital budgeting and so forth.

This paper reports a Monte Carlo simulation study used to evaluate a proposal to expand credit card operations by PPP-Bank. If risk was moderate, the bank would want to obtain greater control over information technology by developing the supporting system in-house. However, if risk was high, outsourcing was viewed as a safer approach. The analysis found that credit card expansion involved high levels of financial risk. However, the bank felt that entry into this business was necessary strategically, and was interested in the probability of short-term loss. Long-run gains were expected, and were considered worth a moderate level of loss in the initial five years of operation. Based upon the simulation's estimation of risk, PPP-Bank made the decision to outsource its credit card operations rather than to develop the system in-house.

Section 2 of the paper discusses the use of simulation in support of strategic decision making. Section 3 reviews factors of IT outsourcing. The simulation model is presented in Section 4, with results in Section 5. Section 6 is the conclusions section.

## 2. Simulation to strategic decision making

Strategic decisions are those that involve a commitment of large amounts of organizational resources for the fulfillment of organizational goals and purposes through appropriate means [36]. Top management usually plays a central role in making these decisions through its involvement in corporate long-range planning [30,33]. Strategic decisions impact many aspects and functions of the organization, and influence its direction, administration and structure [14]. These decisions involve environmental forces which create uncertainty about strategic issues [12]. Strategic decision making arises from this process occurring over time among multiple organizational actors within complex organization contexts [24]. Lorance and Wendling [38] proposed that strategic decision making generally have multiple objectives and alternatives, long-term effects, multiple constituencies within the company, involve multiple disciplines and multiple decision makers, and always involve various degrees of risk and uncertainty. There is a need to assess alternatives and make significant strategic decisions with limited information, which leads to strategic decision making based on qualitative processes.

Simulation is a powerful means for the design of mathematical–logical models of the real-world system with alternative scenarios under the dynamic environments. Simulation can take into account both analytical and organizational complexities that cover strategy initiatives, market conditions, consumer behavior, and competitors' actions to realistically simulate the rapid changes and complexities of competitive dynamics. Simulation benefits strategic decision making through more realistic assessments in terms of functionality, and required total investment cost can be more accurately forecasted [21]. Moreover, simulation modeling allows evaluation of a broad range of system conditions to monitor the consequences

of altering processes and measuring the impacts, including performance and sensitivity related to the project. Simulations are often perceived as a tool for analytic modeling. Simulation modeling is a standard element of any strategic decision making activity [43]. Simulation results facilitate greater efficiency and effectiveness in decision making and provide a performance advantage on organizational systems because successful strategies require efficiency decisions. Examples of simulation in practice included computer simulation of crisis management in organizations [17]; use of a marketing strategy game to study strategic responses to success and failure [37]; and use of a dynamic simulation modeling system (DSMS) as a tool for proactive and optimal decision making in the project life cycle [21].

Monte Carlo simulation (using random sampling) is a well-established method for evaluation of risk [38]. The essential element of Monte Carlo simulation is to replace constant estimated values within mathematical models with probability distributions, and replicate studies many times drawing instances of outcomes from these distributions for each replication. The results of a Monte Carlo simulation will be variable, reflecting the variety of data distributions. Monte Carlo simulation has been applied to financial analysis [29], and has been evaluated for strengths and weaknesses [19]. Monte Carlo simulation has been applied to e-business options [11,27].

The Crystal Ball simulation model, an application of Monte Carlo simulation, is a spreadsheet of inputs and formulas. Crystal Ball enhances the spreadsheet by creating assumption cells for entering distributions for the simulation, and forecast cells for key outputs described by formulas. In addition to making entry of probabilistic data much easier, Crystal Ball simulation makes it easy to replicate simulations many times, and to apply controlled random numbers for improved control of the simulation.

### 3. Information technology outsourcing

Outsourcing information technology (IT) is a major contemporary strategic decision [40]. Out-

sourcing has been defined as passing IT functions previously performed in-house to out-side contractors [28,46]. The definition should be extended to IT functions not previously performed in-house. IT outsourcing can be comprehensive or partial. The service provider may be an independent entity or a wholly owned subsidiary. The outsourcing decision can be simple or complex. A simple example might be a small organization choosing to outsource a payroll application primarily to reduce costs.

Outsourcing decisions can be complex because IT applications tend to be integrated with each other and permeate the organization, touching most activities performed; it may be difficult outsource a single application. The criteria use to evaluate outsourcing decisions may be multidimensional and intangible. Besides cost savings the organization must consider possible effects on customer service and its own staff, and whether it might become overly dependent on the service provider [7]. IT outsourcing is a strategic move. Most companies aggressively outsource some functions in order to enhance their competitiveness by focusing on their core competencies, achieving a higher return on assets through less capital commitment and increased ability to quickly adjust to changing environments through lower commitment to in-house resources [31]. Consequently, outsourcing is motivated by growing pressures on management to remain competitive.

#### 3.1. Reasons for outsourcing

Many writers have proposed research frameworks [25], criteria [23], and schemes for analyzing or assessing outsourcing [6]. Expected advantages of outsourcing IT include:

- reduced operating costs,
- avoidance of some types of risk,
- allowing the organization to focus on core competencies, and
- reduction of skill diversity within organizations that could increase cultural conflict.

##### 3.1.1. Reduced IT costs

Outsourcing reputedly reduces IT costs; service providers claim to cut costs by 10–50% [34] but such

figures may represent short-term savings or budget manipulations such as taking activities off balance sheets [35]. The costs of developing, maintaining and running an application should be differentiated. By having expertise and up-to-date software and hardware, a service provider may be able to maintain and run an application more cheaply than can be done in-house [36,39]. Economies of scale can lower costs; a service provider can apply, run and update the software needed for a common application, classically payroll and share registries [9,18], and distribute costs amongst many clients.

### 3.1.2. Risk avoidance

By purchasing services at a fixed cost per transaction, a client can avoid financial uncertainty. An organization may prefer to contract out an activity at an agreed price instead of trying to ascertain in-house costs, cope with possible variations in in-house costs or possible disruptions such as of its own system malfunctioning. It buys insurance from the service provider. A corollary is that service provider incompetence may disrupt the client's business [10]. Reliance on service providers can also eliminate problems associated with technical obsolescence [28].

### 3.1.3. Concentration on core activities and competencies

Outsourcing supposedly allows managers to concentrate on their core business. A manager may feel unable to manage an IT function competently. It is rational for managers to concentrate on their organization's core activities and exploit competencies based on their experience and knowledge, contracting out activities in which they are less competent. Service providers' claim that they can supply expertise and state-of-the-art technology [10], and increase the flexibility and quality of IT services [2].

Service providers generally promise to manage the functions that cannot add value internally, allowing management to focus on strategic business issues [20].

### 3.1.4. Avoidance of cultural problems

An effective IT department may have a culture that differs from that of the rest of the organiza-

tion. Good systems analysts are willing to dispute managerial fiats and make suggestions that threaten jobs and hallowed assumptions. Jealousy may arise because predominantly young and articulate computer staff may enjoy anomalous working conditions and compensation, "Cultural differences can also often cause friction between IT and management [45]." Outsourcing may ameliorate these problems.

## 3.2. Disadvantages of outsourcing IT

The expected advantages just presented are offset to a degree by a number of negative aspects of outsourcing. These disadvantages include:

- risk of loss of certain organizational competencies,
- problems created by changing procedures,
- difficulties in accurately knowing cost impact,
- cultural problems, and
- other factors.

### 3.2.1. Loss of distinctive competencies

It may be bad strategy to outsource the intellectual or other skills underlying a distinctive competence [7]. Banks that outsource the development of software that drives its automatic telling machines (ATMs) may drive competitors to gain advantages or create new competitors because the skills and knowledge accumulated by the provider could be applied to the development of a competitor's application. Although confidentiality agreements prevent copying code written for one bank being applied directly to another bank's application, the experience gained will make developing the second bank's application much easier and quicker. If the service provider's employees disperse, it may be difficult for the first bank to enforce confidentiality.

The bank may become dependent on the service provider [22], it may be impractical to transfer knowledge and skill in-house, and the service provider may be able to use its monopoly power to demand a high price for changes [39]. It may be impossible to keep some commercial secrets from a service provider intimately involved in core

activities, and the service provider may be able to identify and recruit its client's best IT staff.

### 3.2.2. *Change problems*

Outsourcing may create problems because procedures are changed. If an in-house system is replaced by a service provider's system, there is some danger of disruption caused by a failure to properly transfer data. Employees may be irked because the new system requires that work be done differently. Outsourcing a function may entail dismissal or redeployment of employees, changes in the work they do, or their transfer to the service provider's employment with different conditions [27].

### 3.2.3. *Ascertaining relevant costs*

It may be difficult to ascertain or quantify all costs and benefits relevant to an outsourcing decision. It is notoriously difficult to allocate the costs of internal IT amongst individual applications or to quantify fixed and variable components. The cost of coordination with an out-side provider may be greater than co-coordinating internal departments' activities [32], and some relevant costs may be intangible. Clients may be ignorant of service providers' cost structures and thus may find it difficult to ascertain whether they are paying excessive fees.

### 3.2.4. *Cultural problems*

Cultural fit between parties can be important [1]. Clark [15] argued "...equally important, the delivery team must understand and adapt to your organization's culture." Useem and Harder [44] suggest that outsourcing and partnering require different skills in client managers. Instead of being directly responsible for operations, managers may become resource managers and have to develop skills in negotiation, deal making, partnership management and change management.

### 3.2.5. *Other factors*

There may be other, ostensibly irrational, influences. The current Australian government has an ideological commitment to outsourcing, based on the opinion that the private sector is intrinsically more efficient than the public sector [8]. Like

TQM and BPR, outsourcing might be a managerial fad for which enthusiasm may fade [42]. Outsourcing may be a cosmetic avoiding head count limitations or converting a capital expenditure into a continuing expense.

### 3.3. *IT selection practice*

While theoretically sound financial models exist, they are often not used, as investing organizations rely instead on managerial judgment to deal with the high levels of uncertainty, as well as many intangible factors, such as market share impact and developing experience with new technology. Studies in both Great Britain [4] and the US [3] have found that only about half of IT investment project adoption decisions are made based upon any type of traditional financial analysis, to include factors such as internal rate of return, net present value of expected cash flow, and related estimates. Organizations find it very difficult to evaluate IT/IS investments, they significantly underestimated costs, and benefits are often based on faith and notional figures [26]. Many IT project evaluation methods have been used, including methods capable of supporting consideration of intangible factors [41]. However, those methods that can include intangible factors require managerial judgment. IT outsourcing is a more attractive option when high levels of risk are identified in financial models.

## 4. **Simulation model development**

This paper reports the use of Monte Carlo simulation to support strategic decision making in a new practical application. The Board of Directors (BOD) sought to increase credit card business, but was concerned about the risks associated with this strategic move. While many opportunities were seen in the long run, huge operating expenses and the risk of initial operational losses in the first two years were of interest. In this highly competitive environment, bank survival almost required expansion of credit card operations. Outsourcing was proposed as a means to reduce the risk of entering the important new market.

#### 4.1. PPP-Bank Pcl.—An overview

The PPP-Bank Public Company Limited (*assumed name*) is a registered member of the Stock Exchange of Thailand. With a license from the Ministry of Finance, it is allowed to operate in certain finance-related activities, to include finance for consumption, development, commerce, housing, and funding. In addition, the company is allowed to perform other financial services, such as bond holder representative business, mutual fund trustee business, and selling agency. The company's major service lines provide individual and institutional clients with consumer finance and personal loans, working capital financing for institution clients, inventory financing, and deposit service for the general public via promissory notes.

At the end of 2003, the Bank of Thailand announced a financial master plan implementing regulations that created an opportunity for PPP-Bank to add another product to their portfolio. This business was intended to expand the bank's customer base through hire-purchase customers. A services group in the bank (PPP-Group) encompasses banking, securities, life-insurance, fund management and assets management. The credit card expansion would virtually complete the product line of financial services offered.

All operations pertaining to each affiliated company under the PPP-Group thoroughly comply with the Group's core strategies, which places the highest priority in creating quality service and financial innovations in order to meet customer needs and preferences through a comprehensive set of offered products and services. All affiliated companies in the Group work together to represent PPP's products to its customers through inter-group coordination and emphasize prompt service and convenience to customers.

There has been sharp growth in credit card business in Thailand. Credit card use increased from the equivalent of \$1.571 million in 2001 to over \$2.800 million in 2003. The number of credit cards in the financial system tripled from 2.5 million cards in 2001 to over 6.7 million cards in 2003. Some classes of expenses are required to be paid through credit cards. Credit cards are a major channel for financial institutions and for consumer

convenience. Most financial institutions use credit cards as a marketing channel and plan their use as access to further business, such as personal loans, asset financing, insurance, and hire purchase.

From the industry perspective, the proportion of personal expenses paid by credit card ranged from just over 3.5% to almost 7.5% from 2001 to 2003, respectively. The proportion of credit card loans to credit card expenses ranged from 3.16% to 17.71% from 2001 to 2003, respectively. These numbers show an opportunity for financial institutions in Thailand to enhance revenue from credit card business.

The approximate population of Thailand was 63.08 million in 2003. These data indicate that less than 11% of the Thai population had a credit card (even less, considering multiple card holders).

#### 4.2. Simulation for credit card operation outsourcing decision

To sustain competitive advantage and to take advantage of market opportunities, PPP-Bank company's shareholders and their Board of Directors (BOD) decided to enter the credit card business by emphasizing issuer-business. (Issuer-business is responsible for card issuing in cooperation with credit card brands such as VISA and Master Card. However, the business is not responsible to merchant-businesses, which involve setting up an electronic data center for each merchant.)

PPP-Bank planned to issue their owned credit card in 2005. At first, the BOD formed a team to study the feasibility of the project. The estimated cost of the IT investments approached \$40 million (฿800 million), which was considered too high. In addition to costs of installing the system, PPP-Bank would need to hire large operational IT staff, which in turn resulted in high IT maintenance cost. Because of the high cost of these investments, the BOD decided to explore possibilities of outsourcing credit card's operations and processing. The BOD's primary objective was to outsource all operations and processing relating to the credit card operation while firmly retaining control of all marketing related functions.

The team assigned to study this outsourcing began work in August 2003. Two steps were needed



to complete the study. The first step was to select a group of potential service providers, who were required to meet many strict criteria. These criteria included reputation, cultural fit, financial strength, market share, data centers' resources, employees' locations, and experience. In addition, capabilities such as reengineering, the ability to deal with company's organization and industry, experiences in implementing new systems, and relationships between potential service providers and their existing partners were considered to be important [5]. This first step took about two months. After several negotiations and discussions with many service providers, only one potential provider remained. That provider offered to undertake primary responsibilities of operation and processing credit card business as follows:

1. *Credit card issuing process*, which included application receipt, data capture, verification, and card issuing and welcome call.
2. *Credit card operation*, which consisted of settlement, and reporting.
3. *Debt collections*, which consisted of collection report, call, reminder letter, notice, legal action and close case.
4. *Credit card system*, which consisted of:
  - 4.1. Hardware equipment and systems support services.
  - 4.2. Application implementation.
  - 4.3. Application customization/interface.
  - 4.4. Application on-going support.
  - 4.5. Data center operations services.
  - 4.6. Network communication services.
  - 4.7. Network operations.

After PPP-Bank selected the service provider, the team obtained a set of assumed parameters for the current customer base, potential customers and outsourcing costs. The information of current customer-base parameters was obtained from PPP-Bank and that of potential customers and outsourcing costs were obtained from industry overview. A project feasibility study was developed based on those assumptions. After the study, the team faced many questions about the risks of project feasibility study from the BOD.

At this stage, the team decided to use simulation to study the project's feasibility and to answer BOD questions. Assumptions were obtained from company policy, credit card industry standards, and a survey of company customer-based demand. Those assumptions in the projection were:

1. Number of cardholders—PPP-Bank wanted to initially provide service to about 300,000 customers and expected the growth of the customer base to be 20% per year.
2. Credit usage—A survey was conducted to better understand potential card use. This survey indicated that about 46% of the initial 300,000 customers planned to use the PPP-Bank issued credit card. However, PPP-Bank only expected about 70% of that 46% would really be using their cards because most customers were from out-of-town.
3. Utilization volume—The industry's average utilization volume per card is about Bt7000 (about \$170) per month. PPP-Bank forecasted the volume to be about 70% of the average (Bt4900 or \$120 per month). The structure of forecasted volume is 80% from purchasing (Bt3920 or \$95) and 20% from cash advance (Bt980 or \$25).
4. Revolving volume—The credit card business is a revolving loan. Therefore, it is essential to include "revolving volume" in the set of assumptions. PPP-Bank estimated that customers would revolve their credit line about 70% of their purchasing volume.
5. Non-performing loan (NPL)—The proportion of NPL of non-asset backed loans (clean loans) in the financial industry is around 24% per year. PPP-Bank estimated the NPL recovery rate is 30% of the industry's average. This estimation was based on the average clean loan recovery during the Thailand's financial crisis in 1997.
6. Operating cost—There are four categories of operating cost.
  - (a) Funding cost—The average cost of funds at PPP-Bank was 2.80% in year 2003.
  - (b) Outsourcing cost—The following outsourcing cost structure is proposed by CCSP:
    - (i) Bt200 (\$4.80) per new issuing card;

- (ii) Bt10 (\$0.24) per card per month for statement printing and mailing;
  - (iii) Bt480 (\$11.55) per year for operational system;
  - (iv) Debt collection fee equal to 20% of recovery debt.
- (c) Marketing cost—The marketing cost was estimated to 25% of revenue in the first year and to decrease with the following schedule for the next four years: 20%, 15%, 15%, and 10% consecutively. The forecast period was stopped at four years.
- (d) MISC business cost—Business development and miscellaneous costs were estimated to 10% and 5% of revenue respectively.
- (e) Credit card cost—credit card company charges the issuer bank an initiation-fee of Bt8.6 million (\$207,000) and a membership-fee of \$1.00 per issued card. In addition, Bt1.0 (\$0.024) per transaction will be charged as transaction-fee.
7. Other assumptions—The company planned to charge customers Bt1000 (\$24) for a gold card and Bt600 (\$14.40) for a silver card. The revolving interest rate was 18% of the revolving amount per month for cash advances. The cash advance fee was equal to 3% of the amount advanced. The interchange fee from acquirer banks was 1.2% of purchasing volume. Finally, the merchant discount rate was 1.8% of sales draft.

Table 1 shows the variables and assumed parameter values for the spreadsheet (financial) simulation model. This is the analogue of a block diagram for an entity flow simulation.

After all assumptions were defined, the next phase was to run the simulation. A preliminary simulation model was developed prior to the use of Crystal Ball. We faced some limitations from our assumptions that have high levels of uncertainty and time limitations. Therefore, we decided to use all of the data as of June 30, 2003, and tried to use conservative forecasting for all financial items. The simulation was set to run for five years. A five year period was enough to correctly identify the survivability of the credit card business at PPP-Bank. Under these assumptions, we found that the com-

pany incurred a loss during the first two years, and began receiving profit in the third year. We calculated the project's net present value (NPV) with 6.25% discount rate. The 6.25% is a conservative rate, based on weighted average PPP-Bank's highest prime rate and industry's prime rate. The calculated NPV is Bt185.46 billion (equivalent to over \$4 billion) through out five years of operation. After we finished the first business model and presented results to the BOD, they concluded that the outsourcing option was better than investment in an internal system. However, the working team could not answer many questions that the board had. Prior to the Crystal Ball model, we could not prove some project feasibility results. The BOD had questions relative to the certainty levels of NPV (net present value), ROI (return on investment), net profit, and number of cardholders. Distributions and parameters for risk variables are shown in Table 2.

Four output variables were used as forecast variables: number of cardholders, net profit, ROI, and NPV of the project. The trials were set to 1000 trials per model. Confidence level is specified at 95%. The random number generator's initial seed value was initiated with a value of 1234.

## 5. Simulation model results

The Crystal Ball simulation provided results shown in Fig. 1.

### 5.1. Cardholders

From the graph in Fig. 1, there was a 0.494 probability that the number of PPP-Bank cardholders at the end of the 5th year would be over 441,600 cards. The model indicates a minimum number of cardholders equal to 251,000 cards. Statistics for this output variable are shown in Table 3.

### 5.2. Net profit

Simulation output for cumulative net profit over the first five years of operation is shown in Fig. 2.

Accumulated net profit averaged Bt96 million (roughly \$2 million). There was a 0.881 probability



Table 1  
Model assumptions

| <i>Assumptions</i>                  |           |  |
|-------------------------------------|-----------|--|
| Number of active card holders (%)   | 46%       | Of card holder (research)  |
| Credit limit/year (Bt)              | 7000      | Bt/month   |
| Credit usage/year (%)               | 70%       | Of no. of active card in 1st year, 80% in 2nd year and 100% from 3rd to 5th year                   |
| Purchasing volume/year (%)          | 80%       | Of credit usage  |
| Cash advance volume/year (%)        | 20%       | Of credit usage  |
| <i>Revenues</i>                     |           |  |
| Annual fee (gold card) (Bt)         | 1000      |  |
| Annual fee (silver card) (Bt)       | 600       |  |
| Revolving interest (%)              | 18%       | Of revolving/month   |
| Cash advance fee (%)                | 3%        | Of cash advance volume   |
| Interchange fee from acquirer (%)   | 1.2%      | Of purchasing volume   |
| Merchant discount rate (%)          | 1.8%      | Of sales draft/year  |
| Debt recovery rate (%)              | 30%       | Of NPL   |
| <i>PPP-Bank card operation cost</i> |           |  |
| Interchange fee for issuer (%)      | 1.2%      | Of sales draft of other's merchant   |
| Initiation-fee (Bt)                 | 8,600,000 | One time payment   |
| Member-fee (\$)                     | 1.0       | USD/card   |
| Transaction-fee (Bt)                | 1.0       | Bt per transaction   |
| Bad debt (%)                        | 2%        | 2% of NPL in 1st year, 3% in 2nd year, 5.0% in 3rd year, 7.5% in 4th year, and 10% in 5th year     |
| Funding cost (%)                    | 2.8%      | Average per year   |
| Marketing (%)                       | 25.0%     | 25% of revenue in 1st year, 20% in 2nd year, 15% in 3rd year, 15% in 4th year, and 10% in 5th year |
| <i>Outsourcing cost</i>             |           |  |
| Card issuing (new card) (Bt)        | 200       | Per card   |
| Statement printing and mailing (Bt) | 10        | Bt/card/month  |
| System (Bt)                         | 480       | Per year/card  |
| Debt collection fee (%)             | 20%       | Of recovered debt  |
| <i>Other expenses</i>               |           |  |
| Business development fee (%)        | 10%       | Of revenue   |
| Miscellaneous (%)                   | 5%        | Of revenue   |

*Note:* All information in this table is assumed.

of a positive net profit. Fig. 3 shows the probability that makes the company have a positive net profit is at a certainty 88.10%. Table 4 gives the results for this output variable.

### 5.3. Present value of the project

Fig. 3 shows the Crystal Ball histogram for project present value.

PPP-Bank policy is to capture a new market in credit card users, and use credit cards as a marketing tool to facilitate financial instruments sold to customers. Therefore the BOD did not require immediate profit, but wanted to know the proba-

bility of positive net present value (NPV) of the project (see Table 5). The NPV for the project was positive only 30% of the time (see Fig. 2). The simulation revealed the expected impact of the project in terms of what it would cost PPP-Bank to develop this product line.

### 5.4. Return on investment of the project (ROI)

Fig. 4 shows results for return on investment. There was a 0.305 probability that this measure would be positive.

Return on investment of the project is currently equal to 5.91%. From Crystal Ball simula-

Table 2  
Monte Carlo simulation risk distributions

| Items                         | Distribution types                                       | Parameters  |
|-------------------------------|--|---|
| No. of active cardholder      | Normal distribution                                      | Mean 46%, SD 5%   |
| Credit limit per year         | Normal distribution                                      | Mean 7000, SD 700   |
| % Credit usage                | Normal distribution in 1st year,<br>lognormal in 2nd–5th | Mean 70%, SD 7% in 1st year<br>Mean 80%, SD 8% in 2nd year<br>Mean 100%, SD 10% in 3rd year<br>Mean 100%, SD 10% in 4th year<br>Mean 100%, SD 10% in 5th year   |
| Revolving interest            | Normal distribution                                      | Mean 18%, SD 2%   |
| Cash advance fee              | Normal distribution                                      | Mean 3%, SD 0%  |
| Debt recovery rate            | Normal distribution                                      | Mean 30%, SD 3%   |
| Interchange fee from acquirer | Normal distribution                                      | Mean 1.2%, SD 0.1%  |
| Member fee                    | Normal distribution                                      | Mean 1, SD 0.1  |
| Bad debt                      | Triangular distribution                                  | Min. 2%, likeliest 5%, Max. 10%   |
| Funding cost                  | Normal distribution                                      | Mean 2.8%, SD 0.3%  |
| Marketing cost                | Normal distribution in 1st year,<br>lognormal in 2nd–5th | Mean 25%, SD 2.5% in 1st year<br>Mean 20%, SD 2% in 2nd year<br>Mean 15%, SD 1.5% in 3rd year<br>Mean 15%, SD 1.5% in 4th year<br>Mean 10%, SD 1.0% in 5th year |
| Card issue                    | Normal distribution                                      | Mean 200, SD 20%  |
| Statement and printing        | Normal distribution                                      | Mean 10, SD 1   |
| System                        | Normal distribution                                      | Mean 480, SD 48   |
| Debt collection fee           | Normal distribution                                      | Mean 20%, SD 2%   |
| Business development fee      | Normal distribution                                      | Mean 10, SD 1   |
| Miscellaneous                 | Normal distribution                                      | Mean 5, SD 1  |

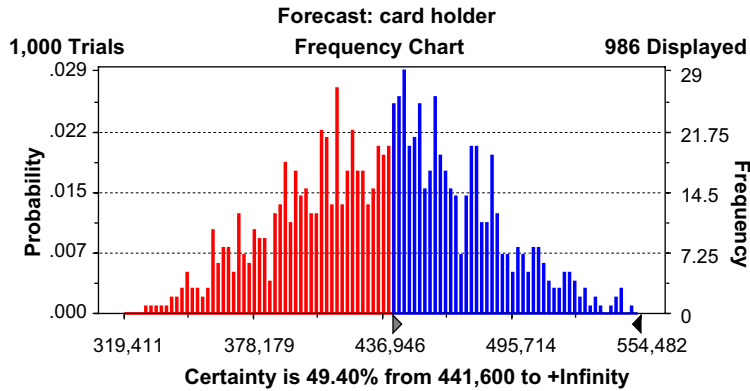


Fig. 1. Histogram of number of cardholders.

tion the probability that project return on investment will exceed 5.91% is only 5.60%. Table 6 shows a mean return on investment that is negative. Even though the forecast of return on investment for the project is low, PPP-Bank still

favoured the project because the project covers shareholder objectives of entering a market that was promising in the long run. The outsourcing option was viewed as a way to reduce risk.

Table 3  
Monte Carlo statistics for number of cardholders

| Statistics          | Value   |
|---------------------|---------|
| Mean                | 438,939 |
| Median              | 440,967 |
| Standard deviation  | 45,325  |
| Skewness            | 0.05    |
| Kurtosis            | 3.21    |
| Range minimum       | 251,585 |
| Range maximum       | 592,414 |
| Mean standard error | 1433    |

Table 4  
Monte Carlo statistics for net profit

| Statistics          | Value        |
|---------------------|--------------|
| Mean                | 96,404,959   |
| Median              | 92,085,649   |
| Standard deviation  | 84,313,277   |
| Skewness            | 0.50         |
| Kurtosis            | 3.51         |
| Range minimum       | -132,711,895 |
| Range maximum       | 112,885,091  |
| Mean standard error | 2,666,220    |

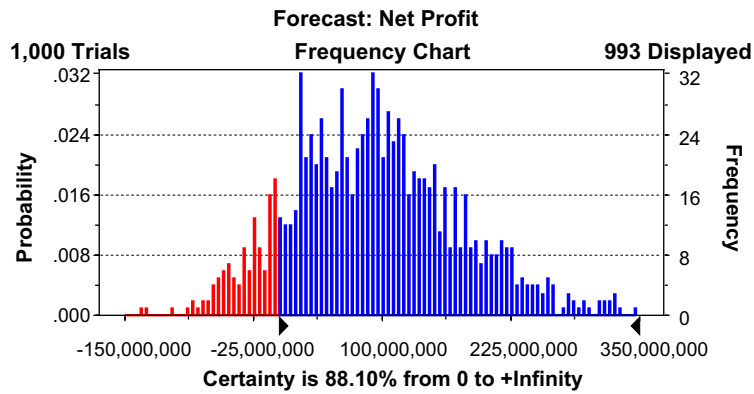


Fig. 2. Histogram of net profit in Bt.

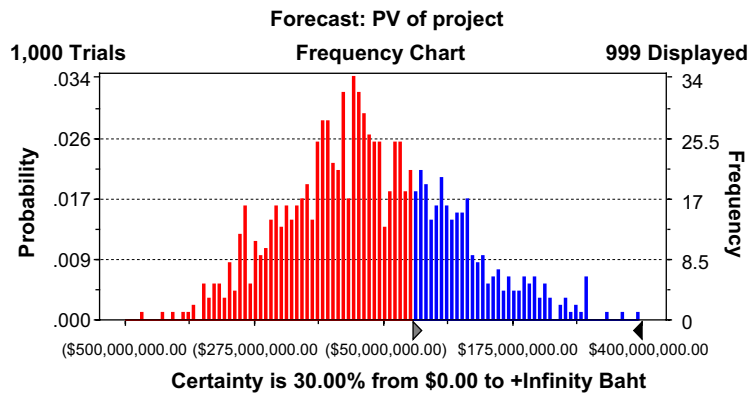


Fig. 3. Histogram of project net present value in Bt.

Table 5  
Monte Carlo statistics for project net present value

| Statistics          | Value        |
|---------------------|--------------|
| Mean                | -69,513,227  |
| Median              | -79,634,610  |
| Standard deviation  | 142,780,971  |
| Skewness            | 0.28         |
| Kurtosis            | 2.97         |
| Range minimum       | -466,351,039 |
| Range maximum       | 417,480,531  |
| Mean standard error | 4,515,131    |

Table 6  
Monte Carlo statistics for return on investment

| Statistics          | Value   |
|---------------------|---------|
| Mean                | -2.40%  |
| Median              | -2.77%  |
| Standard deviation  | 4.91%   |
| Skewness            | 0.26    |
| Kurtosis            | 3.02    |
| Range minimum       | -17.16% |
| Range maximum       | 14.84%  |
| Mean standard error | 0.160%  |

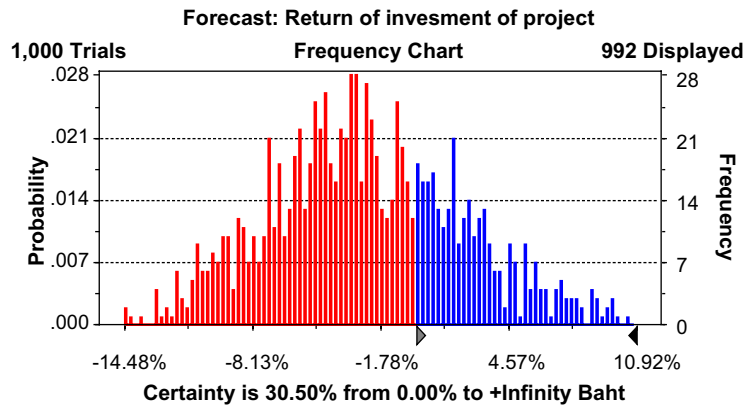


Fig. 4. Histogram of return on investment.

## 6. Conclusions

The decision in question involved means to enter the credit card business at manageable levels of risk. The BOD of PPP-Bank had experience with internal operations. Outsourcing, which they had little experience with, was viewed as a way to control risk. The simulation study commissioned had the purpose of evaluating various profit measures and market penetration of the outsourcing option. Crystal Ball provided the Board of Directors of PPP-Bank with a prediction of key forecast variables and their risk in terms of NPV (net present value), ROI (return on investment), net profit, and number of cardholders. From the result of the simulation, results indicated ranges of a certainty that 5.10%, 3.90%, 5.60%, and 49.40%,

respectively. The Board was thus more confident in the certainty level of the project success under the conservative assumptions.

The Board decided to enter into the credit card business by outsourcing from the following reasons:

- First: Simulation answered all of the certainty level of the key forecast variables so that the Board was confident that the project would attain their strategic objectives, despite the likelihood of short-term negative profit.
- Second: New customers would be accessed, with the model forecasting the number of these expected new customers.
- Third: Under Thailand's highly competitive financial market, the Board recognized the

value-added contribution from future credit card business. Some of the strategic opportunities include cross selling products, direct sale, marketing channel, payment, and risk management. These are intangible benefits from credit card business.

Crystal Ball was an important tool that here aided the Board to make a decision to outsource, based upon some added confidence in the risks. Without the Crystal Ball model, some of the Board's questions about the expected cost of their investment could not have been answered. This application demonstrates the following valuable features of the Monte Carlo analysis of IT investment options:

1. Those factors that involve risk can be described through distributions. In this case, Crystal Ball provided a rich palette of distributions reflecting expected performances.
2. Spreadsheet simulation makes it easy to clearly include whatever assumptions are desired.
3. The Crystal Ball output demonstrated in Figs. 1–4 clearly demonstrate the levels of output risk involved in the model.

With any simulation analysis, the key is to focus on critical questions. In this application, the key question was what range of performance was expected from a new method of obtaining needed IT. Simulation allows the ability to include the many assumptions involved in a relatively clear format.

The strategic intent of IT to support expansion in credit card operations tends to get lost in the hectic day-to-day business environment where focus is switched from problem to problem. IT implementation is often in the hands of semiautonomous teams that focus on measurable objectives, usually cost reduction [31]. The dominant success metric in consideration of outsourcing has often been lower cost, but that focus can lead to classic sub-optimization. Outsourcing can easily lead to dependencies that create unforeseen strategic vulnerabilities. In this study, the Board was assured that the volume of expected business would safely make the outsourcing option viable, and enable the

bank to avoid the risk of investing in in-house IT staff needed to develop required support internally.

4. Simulation also provides the ability to measure many different outcome variables.

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