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Abstract

This study aims to determine how Information Technology (IT) impacts financial inclusion and strengthens the profit of commercial banks and MDIs in Cambodia using two-stage value chain DEA technique. The model also provides the efficiency score and approached factors within financial inclusion and profitability mechanism. The finding suggests that financial inclusion is backed up by strong significant technology while profitability is anchored at 76.5 percent of total banks' profits. Furthermore, through the usage of IT-based transactions at 32 percent, banks and financial institution could enhance 28 percent of profit, and 78 percent of ATMs has been used to promote the access and financial usage. From these results, improving institutional IT adoption could increase financial inclusion and achieves the profit efficiency.

Keywords: Financial inclusion, Profitability, Technology, two-stage Value Chain DEA

1. Introduction

Over the last decade, Cambodia has maintained an economic growth rate of 7 percent, supported by garment, construction and real estate, tourism, and agriculture sector, while foreign direct investments (FDIs) have contributed towards the economic growth in the country. The Cambodia inflation has been manageable with an average of about 2.9 percent since decades.

Furthermore, the financial system in Cambodia is currently dominated by bank system which are commercial banks, specialized banks and microfinances. In 2016, banking sector expanded its assets around 27.8 billion US dollars, while credit and deposit increased to 17.6 billion US dollars and 15.4 billion US dollars, respectively. The liquidity ratio (LR) and its Solvency Ratio (SR) have remained substantial levels at 128 percent and 22.4 percent respectively,

while the non-performing loan (NPL) ratio remains lower at 3.5 percent. In addition to that, there exist various types of Microfinance institutions (MFIs) including deposit-taking and non-deposit-taking microfinance institution so-called MDIs and MFIs, respectively. The liquidity and solvency ratio are at a respectively higher level of 152 percent and 21 percent, and NPL ratio of MFIs is the only 1 percent. These show that the banking system in Cambodia remains healthy and contributes to the sustainable and inclusive economic growth. In the highly competitive banking sector in Cambodia, Khek and Naenna (2015) show that the overall score of bank's performance performs fairly good at around 76 percent in the whole banking system. This can be said that the banking system employed its excess resources around 24 percent, indicating that the entire banking system in Cambodia faces high operating cost and cost of fund, while the bank hardly increases their domestic saving mobilization, and they have to charge high interest rates on its loan as well. With these challenges, the National Bank of Cambodia (NBC) puts much effort to promote and ensure equal and transparent competition by introducing new instruments, Liquidity Providing Collateralized Operation (LPCO), to bank and financial institution that needs source of fund at a low cost, particularly in Riel currency. However, resource utilization is still high cost, because Cambodia is current high dollarization economy. Khek and Naenna (2015) also mentioned that the bank should adopt customer satisfactions and new technology innovation to enhance financial infrastructure to all people, particularly to the poor in rural areas, to meet consumer's needs, to promote financial inclusion, to reduce operational cost and to improve the performance efficiency by ensuring financial stability and consumer protection. Hence, the NBC introduced FAST payment system to promote financial inclusion in order to increase efficiency and lower cost in line with Financial Sector Development Strategy 2011-2020 (FSDS) in 2016.

To accommodate the increasing demands from the public, Banks and MFIs have been expanding their branch offices nationwide. As of 2016, there were 812 commercial and specialized bank offices with 1,260 ATMs and 11,761 POS that provided financial services including withdrawal, deposits, transfer, and payment, and there existed 4,154 and 2,083 of MFIs and registered microfinance operator branches respectively operating in the whole country. In this regards, the banking system in Cambodia plays a crucial role in promoting the access to and usage of financial services to all people—both the rich and the poor in urban and rural areas through expanding their branches and adopting advanced technology such as ATM, POS and other financial technology (Fin-tech). These indicate that the presence of information technology (IT) in

the banking system has profound implications for financial inclusion as well as financial productivity and the provision of financial services to the underserved the poor. Moreover, IT has also vital roles to play in leveraging profitability and market share in economy, (Meepadung et al. 2009).

The great success of the banking sector in Cambodia depends on a sound performance of each bank and financial institutions, therefore, understanding it inclusiveness is crucial for policy formulation. A study examines financial inclusion[1] and profitability efficiency of the banking system in Cambodia, employing the data envelopment analysis (DEA) approach, which was first introduced by Charnes, Cooper, and Rhodes (1978).

DEA is a non-parametric approach for measuring the relative performance efficiency of decision-making units (DMUs) by converting complex multiple inputs to multiple outputs. DEA has a lot of advantages because it does not require or assume any functioning relationship and predetermined weighs between the inputs and outputs, and it offers efficiency rating score, reference set as the best-practices and target level of improvement for inefficient DMUs to become efficient (Charne et al., 1978; Chen & Zhu, 2004; Meepadung et al., 2009; Khek & Naenna, 2015).

There are substantial studies mostly applied DEA in assessing bank performance efficiency and other financial institution (Chen & Zhu, 2004; Meepadung et al., 2009; Piot-Lepetit & Nzongang, 2014; Khek & Naenna, 2015), and there exist a number of attempts used various statistic approaches to measure financial inclusion across the countries (Klein & Mayer, 2011; Demirguc-Kunt & Klapper 2012; Cámara &Tuesta, 2014; Amidžić et al. 2014; Sahay et al. 2015; Gadanecz & Tissot, 2017), while there is limited empirical research to assess financial inclusion linking to assess profitability among bank and financial institution. In addition, to measure financial inclusion index, most studies focus on access to and usage of financial service; however, there significant gaps exist; particularly, much information is missing on the usage and quality of financial services and financial infrastructure and inadequate on access to finance likes the number of bank account or mobile bank account (BIS report 2015; Amidžić et al. 2014). To fulfill the

[1] Financial inclusion is treated as the capacity of the financial system which offers financial products and services to all citizens which refers to operation efficiency (Microfinance Centre—Policy paper for the Europe 2020 strategic objectives)

literature of the previous studies, this paper covers the missing dimensions of financial access and usage of financial services as well as the quality of financial services.

The objectives of this study aim to employ a two-stage value chain DEA application to measure the financial inclusion and profitability efficiency score and to determine how IT can impact financial inclusion and strengthen profit among commercial banks and MDIs in Cambodia.

The remaining of this paper is structured as follows: Section 2 discusses literature review and the research framework, Section 3 summarizes the main empirical result and discussion, Section 4 draws a conclusion by suggesting possible future extension and policy implication.

2. Literature Review

2.2. Financial Inclusion

Simply defined, financial inclusion is the access to and use of formal financial services by everyone particularly, households and firms. It is seen by policymakers as a way to improve people's livelihoods, reduce poverty, and advance economic development (Demirguc-Kunt & Klapper, 2012; Cámara &Tuesta, 2014; Amidžić et al., 2014; Sahay et al., 2015; Gadanecz & Tissot, 2017). Financial inclusion may also be interpreted as having access to and using the type of financial services that meet the user's needs (BIS, 2015).

There are several previous studies proposing different approaches to measure financial inclusion index using different composite indicators. Likewise, Gupte et al. (2012) proposed Human Development Index (HDI), UNDP approach, to measure financial inclusion for India using the impact of multi-dimensional variables such as access to, usage, ease of transactions and cost of a transaction. Later, Amidžić et al. (2014) extended the HDI and a weighted geometric average for computing the new composite index which focused on access and usage. The use of weighted average offered an elasticity of substitution between each variable. Cámara &Tuesta (2014) applied different tool which was called principal component analysis (PCA) to evaluate the financial inclusion index by using three dimensions—usage, barriers and access that a set of these correlated variables that were deemed to be latent and estimated the weights of financial literacy index. Sarma (2011)'s approach used banking penetration and availability of banking services and usage of financial service indicators to calculate an index of financial inclusion (IFI). The indicators are equally regarded as important for an inclusive financial system and they should have

equal weights. All in all, most previous studies focus on demand side rather than supply-side perspective that accesses to finance focused on conventional product and technology.

Technological advances are generating new competitive pressure on the financial system in Cambodia. IT leads to having a noticeable effect on the financial institution's ability to sell their retail products and services. IT also can provide competitive force, by creating economies of scale through the automation of routine transactions, (Meepadung et al. 2009). Chakrabarty (2011) also mentions that technology adoption can promote a greater financial inclusion and consumer protection, and can provide a lower cost to financial institutions. Moreover, the level of financial inclusion is the probably to increase while the income level of poor people is rising, new financial technologies reduce transaction costs and increase outreach; and financial inclusion has become a policy priority for the most country, (Lapukeni, 2015). Lapukeni (2015) further adds that information technology, particularly electricity consumption and mobile phone diffusion, has the positive impact on financial access, and also is a primary driver of communication and network technology to enhance a great financial inclusion and financial service sector. The innovative use of IT has organized a large number of small transactions easier and delivered financial service to the remote areas cheaper. This has shown that technology development innovation such as telecommunication infrastructure and more advanced payment system facilitates several obstacles that impact on the supply of and demand for financial service (Lapukeni, 2015).

In other studies, researchers attempted to measure the impact of technology on bank performance, particularly on operational and profitability efficiency using a non-parametric DEA application (Meepadung et al. 2009). The variable uses in the operation stage in their study were similar to other studies in measuring financial inclusion—the number of branches, number of ATMs, number of full time equivalent (FTEs) or number of employees, interest and operating expenses to provide financial service to the customer while the demand condition was used to assess the customer satisfaction in the stage as in the initial inputs to offer basic usages of financial product and services like savings, loans, bank accounts and the number of IT-based transactions.

In this study, two main initial variables are used for financial inclusion stage such as financial infrastructure and access and demand condition.

2.3. Profitability

Profitability, known as the profit efficiency model, is assessed by the output to input according to the subjective constraints. This model reflects a unique bank's business model acted as intermediaries for providing the access to and the use of financial products and services to all people. The objective of this approach aims to maximize the bank's profit which is interest and non-interest income (Meepadung et al., 2009).

In this study, four outputs from the financial inclusion stage are recognized as the inputs for profitability efficiency stage. Therefore, the inputs in this stage are loans, deposits, number of bank accounts and the IT-based transaction, as shown in Table 1. Bank's interest and non-interest income, assessed as the bank's outcomes, are listed in Table 1. Non-interest income is accommodated in this analysis as for it has been played crucial roles in term of competitive pressure on bank profit since the bank generates more income through fees, commission, investment and other business income (Wang et al., 2014; & Meepadung et al., 2009). Ta-Ho & Song-Zhu (2004) provides the correlation coefficients between loans and deposits and non-interest income which are 81 percent and 78 percent, respectively. The interest income comes from the interest from the loan (Wang et al., 2014), and from government and corporate bonds, interest and dividend income on securities (Kao & Liu, 2004). Interest income has a strong correlation with loans and deposits at 84 percent and 99 percent, respectively (Ta-Ho & Song-Zhu, 2004).

2.1. Two-stage value chain DEA

The mechanism model is approached from Chen & Zhu (2004) to determine the impact of IT on financial inclusion and profitability efficiency performance as well as to calculate financial inclusion and profitability score in Cambodia. As a non-parametric approach, a two-stage value chain DEA is able to address the relative efficiency score of various DMUs in both financial inclusion and profitability stage by converting the homogeneous inputs into outputs. Therefore, the mathematical programming technique is simultaneously able to calculate financial inclusion and profitability efficiency score under input-oriented and output-oriented respectively, while the usage of financial services (intermediate output) produced by the supply side (financial infrastructure or access to and quality of financial services or demand condition) in financial inclusion stage continues to produce profit in the profitability stage. The overall efficiency score is obtained unless both financial inclusion score and profitability score is efficient. In addition, the

model provides the reference set as the best-practices and target level of improvement for inefficient DMUs to become efficient.

Therefore, the single linear programming is following:

$$\text{Min } w_1\theta^1 - w_2\theta^2 \qquad (1)$$

Subject to

(1^{st} stage: Financial Inclusion Efficiency)

$$\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta^1 x_{i0}, \qquad \forall i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j x_{ij} - \theta^1 x_{i0} \le 0, \qquad \forall i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j z_{dj} \ge \tilde{z}_{d0}, \qquad \forall d = 1, \dots, D$$

$$\sum_{j}^{n} \lambda_j = 1, \qquad \forall j = 1, \dots, n$$

$$\lambda_j \ge 0, \qquad \forall j = 1, \dots, n$$

(2^{nd} stage: Profitability Efficiency) (2)

$$\sum_{j=1}^{n} \mu_j z_{dj} \le \tilde{z}_{d0}, \qquad \forall d = 1, \dots, D$$

$$\sum_{j=1}^{n} \mu_j y_{rj} \ge \theta^2 y_{r0}, \qquad \forall r = 1, \dots, s$$

$$\sum_{j}^{n} \mu_j = 1, \qquad \forall j = 1, \dots, n$$

$$\mu_j \ge 0, \qquad \forall j = 1, \dots, n$$

Where x_{ij}, $z_{dj}, and\ y_{rj}$ is denoted as input, intermediation and the final output level of DMUj respectively. The symbol " $\sim$ " is unknown decision variables, so the value of $\tilde{z}_{d0}$ is the unknown variable, which is computed in the optimum point of the intermediate variable. w_1 and w_2 are the weights reflecting the total reference over both financial inclusion and profitability. The value of $w_1 = w_2 = 1$ in first stage and second stage are equally essential so that if $\theta^{*1} = \theta^{*2} = 1$, $\lambda_{j0}^* = \mu_{j0}^* = 1, \text{and } \tilde{z}_{d0}^* = z_{dj}$ are the infeasible solution and it illustrates that both stages are efficient; therefore, the DMUs gain overall efficiency rating score.

2.4.1. Conceptual Model

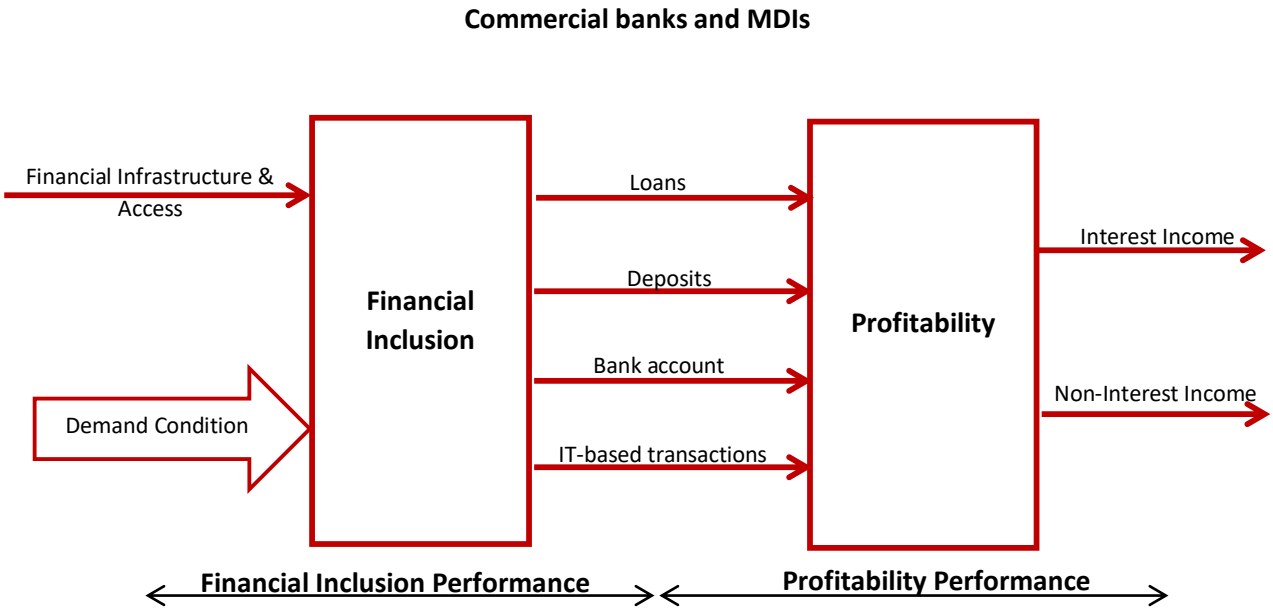

Figure 1: Two-stage value chain model

2.4.2. Descriptive Variables and Data

To calculate the financial inclusion and profitability efficiency score, and to examine IT's impact on financial inclusion and profit enhancement of financial institution in Cambodia, the study attempts to monitor some relevant variables. The data was from 36 commercial banks and 7 MDIs; however, given that a two-stage value chain DEA could not address negative sign variables, the research study proposes to analyze 35 commercial banks and 6 MDIs within 2016. Furthermore, MDIs are selected to analyze in this study, because they provide homogeneous financial products and services to their customers as well as commercial banks. The secondary data is collected from Annual Report 2016 published by General Directorate of Banking Supervision of National Bank of Cambodia.

Demand conditions variable refers to a composite index averages scores for the quality of financial products and services and the perceptions and attitudes of consumers toward the financial market. This variable is collected through a survey questionnaire based upon 5 points Likert-scale (the index score ranges from 1 (worst) to 5 (best). The sample size for demand factors is in line with Yamane (Israel, 2013) which mentions that the number of population is more than 100,000 and the common use confidence level is 95 or 90 percent and the sampling error is 5 or 10 percent, respectively; therefore, the sample size is 400 and 100, respectively. The questionnaires (Appendix

1) are divided into two parts which are the demographics of the respondents and the hybrid service quality or ESQUAL (Ganguli & Roy, 2010). The hybrid services cover on technology and conventional service quality

The Data description for financial inclusion score and profitability score calculation is stressed in Table 1.

Table 1: Input and Output variables

Variables	Descriptions	Unit
Financial Inclusion Inputs (x_{dj})		
- Financial Infrastructure and Access		
x_1: # of branches	Total number of branch offices	Number
x_2: # of ATMs	Total number of ATMs	Number
x_3: # of employees	Labor or Full-Time Equivalents (FTEs)	Persons
x_4: Interest expenses	Total interest expenses	Riels
x_5: Operating expenses	Total non-interest expenses	Riels
- Demand Side		
z_5: Demand conditions	Customer's perception on the quality of financial service	Scale
Financial Inclusion Outputs (z_{dj})		
- Usage of financial services		
z_1: Total loans	Loans and advance to customer	Riel
z_2: Total Deposits	Current, saving, checking, time	Riel
z_3: Total Bank accounts	Total bank accounts	number
z_4: Total IT-based transaction	Total number of IT-based transactions	number
Profitability Outputs (y_{dj})		
y_1: Interest income	Total interest income	Riel
y_2: Non-interest income	Total non-interest income	Riel

Source: Author's calculation

3. Result Discussion

3.1. Descriptive Statistics

The study executes two steps in data collection for DEA and for hybrid service quality. First, data collection for DEA is mainly from the National Bank of Cambodia website and from relevant department such as off-site banking supervision, licensing and payment department.

Second, the questionnaires are conducted through the online survey for the service quality of financial institutions. A sample size of 261 respondents has completed the questionnaires.

Table 2 indicates the demographic profile of the respondents. First, males comprised 46 percent of the sample. Second, about 77.8 percent are age 16-30 years, 18 percent are 31-45 years and 4.2 percent are over 46 years. Third, about 77.4 percent of the respondents are graduated from university and 18.8 percent are postgraduate while the rest of 3.8 percent completed high school. Fourth, only 10.3 percent are students while the government and private officials are 18.8 and 70.9 percent, respectively. Fifth, 64.4 percent of the respondents are in Phnom Penh, where 35.6 percent are in different provinces. Last, the length of service usage is varied with 8 percent using bank services from 1-6 month; 4.6 percent using from 6 to 12 months; 58.6 percent using from 1 to 5 years; 23.8 percent using from 5 to 10 years and 5 percent using bank services more than 10 years.

Table 2: Respondent's demographic profile

Description	Observations	Percentages
1. Gender		
Male	120	46.0
Female	141	54.0
2. Age		
16-30 years	203	77.8
31-45 years	47	18.0
Greater than 46 years	11	4.2
3. Education		
High school	10	3.8
Graduate	22	77.4
Postgraduate	49	18.8
4. Occupation		
Student	27	10.3
Private Official	185	70.9
Government Official	49	18.8
5. Location		
Phnom Penh	168	64.4
Provinces	93	35.6
6. Length of Service Usage		
1-6 months	21	8.0

6-12 months	12	4.6
1-5 years	153	58.6
5-10 years	62	23.8
More than 10 years	13	5.0

Source: Author's Calculation

3.2. Data Analysis

3.2.1. Financial Inclusion, Profitability, and Overall Efficiency Score

In this study, the bank and financial institution are selected according to the products and services, and business purposes. The overall efficiency score is illustrated in Table 3, which is 43 DMUs performed on average accounted for 87.8 percent, while the financial inclusion and profitability activity accounted for 99.1 percent and 76.5 percent, respectively. The results indicate that bank and financial institution have strengthened its financial infrastructures and services quality to value customer very well even though the use of financial products and services are still limited. The financial services widely provided almost everywhere; particularly in urban areas in Cambodia; however, most people choose to be self-excluded from financial services or in other words, people choose not to use financial products and services due to their knowledge, culture and trust. Therefore, the bank and financial institutions need to put much effort to promote the use of financial products and services through new product development in order to push up more profitability.

3.2.2. IT impact on financial inclusion and profitability

The study, it is assumed that IT and ATMs are adopted at each branch to serve business activities such as loan, deposit, payment services and others related activities. Table 2 shows that 83.7 percent of bank and financial institution efficiently perform in financial inclusion stage, while 16.7 percent are accessed to be efficiency in performance measurement in profitability; therefore, it implies that the bank and financial institution efficiently use financial infrastructure and provide good financial services to the client. In particular, according to Table 4, about 85 percent of the number of branches and 78 percent of ATMs are used to leverage the access to and use of financial products and services accounted for 20 percent in average (increasing 32 percent in IT-based transactions, 29 percent in total deposit and 14 percent in total loan). Along with the improvement

in financial inclusion activities, the bank and financial institution could reduce expenses on financial infrastructure accounted for 9 percent in average, which is 14 percent for the number of branches, 22 percent for ATMs and other operational expenses.

Table 3: DMUs' Score

DMUs	Financial Inclusion	Profitability	Overall
1	1	1	1
2	1	1	1
6	1	1	1
8	1	1	1
10	1	1	1
11	1	1	1
12	1	1	1
14	1	1	1
15	1	1	1
16	1	1	1
19	1	1	1
21	1	1	1
22	1	1	1
25	1	1	1
28	1	1	1
30	1	1	1
34	1	1	1
39	1	1	1
5	1	0.999	0.999
4	1	0.874	0.937
26	0.921	0.942	0.932
17	1	0.850	0.925
41	1	0.833	0.916
37	1	0.812	0.906
9	0.963	0.836	0.899

32	0.911	0.810	0.860
31	1	0.679	0.839
7	1	0.647	0.824
20	1	0.627	0.814
42	0.992	0.621	0.807
3	1	0.604	0.802
13	0.960	0.594	0.777
33	1	0.549	0.774
36	0.997	0.490	0.743
29	1	0.477	0.738
23	1	0.409	0.704
18	1	0.378	0.689
43	1	0.375	0.688
24	0.853	0.466	0.660
40	1	0.301	0.651
38	1	0.256	0.628
27	1	0.255	0.627
35	1	0.210	0.605
Mean	0.991	0.765	0.878

Table 4: Average of Inputs, Intermediations, and Outputs

KPIs	**Actual**	**Optimum**	**Percentage Gap**
Inputs			
Number of branches	48.05	41.19	-14.28 percent
Number of ATMs	36.44	28.28	-22.41 percent
Number of employees	1,105.95	1,041.69	-5.81 percent
Interest expenses	64.32	60.26	-6.31 percent
Operating expenses	62.40	59.65	-4.40 percent
Service quality	3.66	3.61	-1.41 percent
Mean			**-9.10 percent**

Intermediations			
Total loans	1,526.72	1,746.17	14.37 percent
Total deposits	1,658.67	2,135.86	28.77 percent
Number of bank accounts	154.69	163.44	5.65 percent
Number of IT-based Transactions	594.33	786.35	32.31 percent
Mean			**20.28 percent**
Outputs			
Interest income	1,825.20	2,236.40	22.53 percent
Non-interest income	195.75	261.82	33.75 percent
Mean			**28.14 percent**

Source: Author's calculation

To understand how IT impacts financial inclusion and profitability in the banking system, the relationship between financial inclusion and IT usage as well as profitability efficiency is analyzed, and the results are shown in Table 5. The number of ATMs has the positive correlation with the use of financial products and services and profitability, and the IT-based transactions have had the correlation with profit efficiency which indicated that bank and financial institution could increase profit efficiency through increased use of IT. According to Table 4, through the use of loans, deposit and IT-based transactions (32percent), banks and financial institutions can increase profit 28 percent in average. Therefore, IT adoption does not only impact on financial inclusion, but it also enhances financial products and service as well as profit through the cost-effectiveness.

In order to get more accurate results from the PCA regression and DEA, Table 5 is solved well with some correlations by proxies and controlling with some correlated variables in the regression. Hence, its results get better in order to interpret the objective research and apply with the real situations with financial sector in Cambodia.

Table 5: Pearson Correlations

KPIs	Branche	ATMs	Employe	Int Exp	Oper Exp	SQ	T. Loans	T. Depo	B. ACC	IT-TRN	Int Inc	Non-Int Inc
Branche	1	.518**	.813**	.668**	.777**	.164	.482**	.325*	.780**	.513**	.690**	.339*
ATMs		1	.783**	.823**	.828**	.625**	.826**	.799**	.783**	.692**	.846**	.842**
Employe			1	.899**	.983**	.494**	.803**	.674**	.975**	.669**	.946**	.716**
Int Exp				1	.904**	.585**	.944**	.860**	.851**	.589**	.977**	.788**
Oper Exp					1	.552**	.849**	.743**	.979**	.717**	.961**	.798**
SQ						1	.664**	.698**	.467**	.352*	.610**	.730**
T. Loans							1	.964**	.786**	.625**	.947**	.906**
T. Depo								1	.671**	.610**	.857**	.937**
B. ACC									1	.773**	.923**	.739**
IT-TRN										1	.665**	.697**
Int Inc											1	.845**
Non-Int Inc												1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Author's calculation from survey data

3.3. Customer Service Quality Analysis

Principal Component Analysis (PCA) of customer service quality is employed to determine the dimension of hybrid service quality in products and services by financial institutions in Cambodia. 56 variables of hybrid service quality are characterized by factor extraction with VARIMAX rotation method. The overall response rate of 9 factors extraction accounted for 66.79 percent of the total variance, and the Eigenvalue is greater than one which is shown to be meaningful and useful (Pett et al., 2003). A higher value of Cronbach's alpha, 0.951, is greater than 0.7 acknowledged to be acceptable and reliable for all factor (Hair et al., 2006). Four items are removed from the 56 items are Tech-never fail, Tech-low risk, Tech-recognized by name and Operation hours; the factor loading of 52 items properly loaded. The results of the customer service quality for each factor are presented in Table 6.

The hybrid service quality covers two dimensions which are technology enable the services and conventional service quality. First, the most customer feels that technology adopted by financial institutions give them feel more convenience accounted for 77 percent, while its user-friendly and security are limited at 61 percent so that the banks and financial institutions need to improve technology convenience to the customer through user-friendly and the security of technology. Second, the customer feels trust on bank staff about 80 percent, and they get access to the branch to receive the services was at 70 percent that this is compatible with the DEA model. Final, the customer provides low rate the ease of subscription to the financial service accounted for 50 percent; in particular, opening the new bank account is a more complicated process and requirements.

Table 6: Rotated factor matrix for service quality

Factors	Measurement Items	Factor Loading
Technology security and information quality (α = 0.777)	x6. I feel safe using my bank's technology	0.589
	x8. My personal information exchanged while using technology is not misused by my bank	0.546
	x9. My bank's technology is personalized	0.622
	x11. My bank's technology provides the precise information I need	0.739
	x12. My bank's technology provides sufficient information	0.764
	x13. My bank's technology provides the reports I need	0.649
Technology convenience (α = 0.891)	x14. My bank's technology is accessible beyond regular business hours	0.752
	x15. My bank's technology gives me more freedom of mobility	0.778
	x16. I find it more convenient to use technology than interacting with branch employees	0.810
	x17. My bank's technology allows me to complete transactions quickly	0.801
	x18. My bank's technology saves me a lot of time, especially when I am pressed for time	0.741
Technology usage easiness and reliability (α = 0.771)	x1. The technology provided by my bank is easy to use	0.580
	x2. The technology provided by my bank is user-friendly	0.591
	x3. The technology provided by my bank works accurately and is error-free	0.616
	x4. My bank's technology is reliable	0.632
	x41. My bank understands my specific needs	0.722

	x42. My bank pays personal attention to me	0.537
	x43. My bank offers its services promptly with very little waiting time	0.720
	x48. When I contact my bank's customer service, my requests are always anticipated properly	0.775
	x49. When I contact my bank's customer service, I am offered proper explanations	0.794
Customer services (α = 0.874)	x50. When I contact my bank's customer service, the representatives are supportive	0.758
	x51. When I contact my bank's customer service, the representatives offer personalized information	0.746
	x52. When I contact my bank's customer service, my calls are always answered promptly	0.629
	x53. When there are problems, my bank is sympathetic and reassuring	0.563
	x54. My bank employees are knowledgeable enough to resolve the problems	0.706
	x55. My bank resolves my complaints quickly	0.719
	x56. My bank offers a fair compensation for its mistakes	0.692
Staff competence (α = 0.861)	x34. My bank employees are trustworthy	0.764
	x35. My bank employees are competent	0.763
	x36. My bank employees are easily approachable	0.811
	x37. My bank employees are courteous, polite and respectful	0.795
	x38. My bank employees are willing to help customers	0.800
	x39. My bank employees are pleasant and friendly	0.783
	x40. My bank employees are caring	0.833
Image or reputation (α = 0.859)	x24. My bank has a good reputation	0.578
	x25. My bank's promotional campaigns are effective in building a positive reputation	0.592
	x29. My bank offers a wide range of services	0.632
	x30. Within each basic service, my bank provides a variety of options	0.710
	x31. My bank fulfills its promises	0.776
	x32. My bank performs all services right, the first time	0.729
	x33. My bank performs its services reliably, consistently and dependable	0.776
	x46. My bank's statements and other documents are accurate	0.599
	x47. My bank's statements and other documents are easy to understand	0.678

Price	x26. My bank clearly explains its service charges	0.606
(α = 0.826)	x27. The fees that my bank charges are acceptable and reasonable	0.787
	x28. My bank fees are competitive	0.750
Tangibles	x21. My bank employees are neat in appearance	0.720
(α = 0.625)	x22. My bank's physical facilities are visually appealing	0.760
	x23. My bank's printed materials (e.g. brochures) are visually appealing	0.564
	x44. My bank branches and ATMs are sufficiently available in many locations	0.655
Subscription	x19. It is easy to open a new bank account with my bank	0.458
ease		
(α = 0.617)	x20. It is convenient and hassle-free to open a new bank account with my bank	0.527

Note: Principle Component Analysis(PCA) Extraction and VARIMAX Rotation Method

The overall response rate of 9-factor extractions is 66.79 percent of the total variance with 0.951 of Cronbach's alpha

Source: Author's calculation

4. Conclusion

This study focuses on firm's level on the supply side that financial inclusion is treated as operation performance efficiency in order to convert financial infrastructure and demand condition to the use of financial products and services to gain the profit. The relative measurement of financial inclusion and profitability derive from a two-stage value chain DEA which are calculated based on homogenous outputs to inputs. It determines a process of improvement in the banking system by calculating the target value of inputs and outputs; particularly defining IT impacts on financial inclusion and profitability.

Furthermore, the bank branch and employee are the most key drivers to deliver financial products and service to customers even where it is adopted IT systems and equipped with ATMs to leverage products and services, cost efficiency, and profit. These also indicated that customers have limited knowledge of financial technologies (e-banking, mobile banking, mobile payment and other disruptive financial technologies). Consequently, to promote access and used of financial products and services and sustainability within micro-level links to macro-level, policy-makers should consider new financial technology adoption and to promote financial literacy program to all people at the same time, while some government policies are actively conducted such as the

national payment system, interest rate policies, consumer protection, and credit bureau. The micro data on demand side of this study focuses only on urban areas rather than remote areas; therefore, next study should use micro data to understand the usage of financial services in urban and remote areas in Cambodia.

References:

[1]. Amidžić G., Massara A., & Mialou A ., (2014). Assessing Countries' Financial Inclusion Standing—A New Composite Index. International Monetary Fund, WP/14/36.

[2]. BIS, (2015). Payment aspects of financial inclusion.

[3]. Cámara, Noelia and Tuesta, David, Measuring Financial Inclusion: A Muldimensional Index (September 22, 2014). BBVA Research Paper No. 14/26.

[4]. Chakrabarty K C., (2011). Convergence of mobile banking, financial inclusion and consumer protection. Reserve Bank of India.

[5]. Charnes A., Cooper W., & Rhodes E., (1978). Measuring the efficiency of decision-making units. European Journal of Operational Research, 2, 429-444.

[6]. Chen, Y. and J. Zhu (2004). Measuring Information Technology's Indirect Impact on Firm Performance. Information Technology and Management 5(1): 9-22.

[7]. Demirgüç-Kunt, Asli, and Klapper, Leora F., Measuring Financial Inclusion: The Global Findex Database (April 1, 2012). World Bank Policy Research Working Paper No. 6025.

[8]. Faith Lapukeni A., (2015). Financial Inclusion and the Impact of ICT: An Overview. American Journal of Economics, 5(5), 495-500.

[9]. Gupte R., Venkataramani B., & Gupta D., (2012). Computation of Financial Inclusion Index for India. Procedia-Social and Behavioral Sciences, 37, 133-149.

[10]. Hair Jr., Black J F., Babin W C., Anderson B. J., & Tatham L R., (2006). Multivariant Data Analysis. New Jersey: Pearson International Edition.

[11]. Israel G., (2013). Determining sample size. Program Evaluation and Organizational Development, IFAS, University of Florida, PEOD-6.

[12]. Kao C., & Liu S., (2004). Predicting bank performance with financial forecasts: A case of Taiwan commercial banks. Journal of Banking & Finance, 28, 2353-2368.

[13]. Klein, Michael U. and Mayer, Colin, Mobile Banking and Financial Inclusion: The Regulatory Lessons (May 1, 2011). World Bank Policy Research Working Paper No. 5664.

[14]. Meepadung N., Tang J., & Khang D., (2009). IT-based banking services: evaluating operating and profit efficiency at bank branches. Journal of High Technology Management Research, 20, 145-152.

[15]. Pett M A., Lackey N R., & Sullivan J J., (2003). Making Sense of Factor Analysis: The Use of Factor Analysis for Instrument Development in Health Care Research. SAGE Publications, Thousand Oaks.

[16]. Piot-Lepetit, I. and J. Nzongang (2014). Financial sustainability and poverty outreach within a network of village banks in Cameroon: A multi-DEA approach. European Journal of Operational Research 234(1): 319-330.

[17]. Sahay R., Čihák M., N'Diaye P., Barajas A., Mitra S., Kyobe A., Nian Mooi Y., & Reza Yousefi S., (2015). Financial Inclusion: Can It Meet Multiple Macroeconomic Goals? International Monetary Fund, SDN/15/17.

[18]. Sarma M., & Pais J., (2011). Financial Inclusion and Development. Journal of International Development, 23.10.1002/jid 1698.

[19]. Seyha Khek, Thanakorn Naenna, (2015). A Two-Stage Value Chain DEA Application To Assess Performance Measurement Of Commercial Banks In Cambodia. International Journal of Mechanical and Production Engineering (IJMPE), Vol. 3, Issue:11, pp. 64-70.

[20]. Shirshendu Ganguli, Sanjit Kumar Roy, (2010). Service quality dimensions of hybrid services. Managing Service Quality: An International Journal, Vol. 20 Issue: 5, pp.404-424.

[21]. Ta-Ho C., & Song-Zhu D., (2004). Performance measurement of Taiwan's commercial banks. International Journal of Productivity and Performance Management, 5, 425-434.

[22]. Tissot B., & Gadanecz B., (2017). Measures of financial inclusion— a central bank perspective. Bank for International Settlements, July 2017.

[23]. Wang K., Huang W., Wu J., & Liu Y., (2014). Efficiency measures of the Chinese commercial banking system using an addictive two-stage DEA. Omega, 44, 5-20.

Appendix: Service Quality Items

1. Technology

Factor 1: Technology security and information quality (TechInfoSecure)

x5. My bank's technology never fails

x6. I feel safe using my bank's technology

x7. I feel the risk associated with my bank's technology is low

x8. My personal information exchanged while using technology is not misused by my bank

x9. My bank's technology is personalized

x11. My bank's technology provides the precise information I need

x12. My bank's technology provides sufficient information

x13. My bank's technology provides the reports I need

Factor 2: Technology convenience (TechConven)

x10. My bank's technology recognizes me by name

x14. My bank's technology is accessible beyond regular business hours

x15. My bank's technology gives me more freedom of mobility

x16. I find it more convenient to use technology than interacting with branch employees

x17. My bank's technology allows me to complete transactions quickly

x18. My bank's technology saves me a lot of time, especially when I am pressed for time

Factor 3: Technology usage easiness and reliability (TechEaseRel)

x1. The technology provided by my bank is easy to use

x2. The technology provided by my bank is user-friendly

x3. The technology provided by my bank works accurately and is error-free

x4. My bank's technology is reliable

x44. My bank branches and ATMs are sufficiently available in many locations

2. Service quality items—Traditional

Factor 4: Customer services

x45. My bank's operating hours are convenient for me

x41. My bank understands my specific needs

x42. My bank pays personal attention to me

x43. My bank offers its services promptly with very little waiting time

x48. When I contact my bank's customer service (call centre), my requests are always anticipated properly

x49. When I contact my bank's customer service (call centre), I am offered proper explanations

x50. When I contact my bank's customer service (call centre), the representatives are supportive

x51. When I contact my bank's customer service (call centre), the representatives offer personalized information

x52. When I contact my bank's customer service (call centre), my calls are always answered promptly

x53. When there are problems, my bank is sympathetic and reassuring

x54. My bank employees are knowledgeable enough to resolve the problems

x55. My bank resolves my complaints quickly

x56. My bank offers a fair compensation for its mistakes

Factor 5: Staff competence (Staff Compt)

x34. My bank employees are trustworthy

x35. My bank employees are competent

x36. My bank employees are easily approachable

x37. My bank employees are courteous, polite and respectful

x38. My bank employees are willing to help customers

x39. My bank employees are pleasant and friendly

x40. My bank employees are caring

Factor 6: Image or reputation (Reputation)

x24. My bank has a good reputation

x25. My bank's promotional campaigns are effective in building a positive reputation

x29. My bank offers a wide range of services

x30. Within each basic service, my bank provides a variety of options

x31. My bank fulfills its promises

x32. My bank performs all services right, the first time

x33. My bank performs its services reliably, consistently and dependably

x46. My bank's statements and other documents are accurate

x47. My bank’s statements and other documents are easy to understand

Factor 7: Price

x26. My bank clearly explains its service charges

x27. The fees that my bank charges are acceptable and reasonable

x28. My bank fees are competitive

Factor 8: Tangibles

x21. My bank employees are neat in appearance

x22. My bank’s physical facilities are visually appealing

x23. My bank’s printed materials (e.g. brochures) are visually appealing

Factor 9: Subscription ease (Esubscription)

x19. It is easy to open a new bank account with my bank

x20. It is convenient and hassle-free to open a new bank account with my bank

Acknowledgements

The authors would like to express their deepest gratitude and thanks to H.E. Dr. Chea Chanto, Governor and H.E. Dr. Sum Sannisit, Deputy Governor of National Bank of Cambodia, parents and other colleagues who have usually supported me in any circumstances in this research.