

Exploring and Bridging the Increasing Digital Divide for Cambodian Educational System

Bob Nanthakorn, Thammasat Business School, Thailand
Meirambek Zhaparov, Paragon International University, Cambodia
Peter Ractham, Thammasat Business School, Thailand

The European Conference on Education 2023
Official Conference Proceeding

Abstract

The usage of information technology (IT) has changed the process of learning and teaching in the last few years significantly. This trend has been boosted by the COVID-19 pandemic. Students not having the needed IT equipment, IT skills or online connections are facing issues in this process: A digital divide in education. This research aims to explore this digital divide for high school students in Cambodia and to highlight ways to bridge the gap. Therefore, it generated primary data using a case study approach. Surveys exploring different perspectives of the research area (IT availability, IT proficiency levels, online connection quality, learning efficacy, and well-being during online learning phases) are created and performed online or onsite with Cambodian high school students in different regions. The findings show, that Cambodia is facing a major digital divide in education. A majority of high school students have no access to computers, which are crucial for an effective online learning process. Smartphones are widely available but cannot offer the same quality within an online learning process. This situation is worse at government schools compared to private schools and more severe in rural areas compared to the municipality. Other findings: IT skills are in the mid-range. Online quality is varying, and results are indifferent. Many students report feeling unwell during phases of online learning.

Keywords: Digital Divide, Education, Cambodia

iafor

The International Academic Forum
www.iafor.org

Introduction

Covid-19 pandemic caused many stoppages and slowdowns in educational institutions worldwide. Most institutions were forced to close down and switched to online education from late 2019 to early 2022. This phenomenon has caused many hardships for all stakeholders involved including teachers, students and administrative staff members (Gupta and Goplani, 2020). One of the hardest countries that was affected by Covid-19 pandemic in education is Cambodia. Cambodia is one of the less developed countries in Asia and once the pandemic emerged in late 2019 and prolonged until early 2022, the whole educational systems were completely forced to transform into relying on digital infrastructure. To explore today's situation for Cambodian high school students, this research generated primary data from onsite and online surveys. The aim of this exploration is especially to contribute to academia by answering the following research questions: Do Cambodian high school students have the required hardware, internet access, and IT skills? Do they see online learning as efficient as onsite teaching? How do they feel in phases of online learning? To perform this exploration, in an initial step, the relevant existing literature on this matter is reviewed and presented. Based hereupon, the process of designing, testing and using the surveys is described. In the third step, the survey outcomes are analyzed. Following this, these findings are used to answer the research questions. In the final step, recommendations are given based on the findings.

Literature Review

Covid-19 Effects in Education

The Covid-19 pandemic has greatly affected different industries worldwide from late 2019 until 2022 (Pain, 2020). Most physical locations such as restaurants, schools and other businesses were forced to shut down and all people involved were forced to practice social distancing due to the danger of being infected with Covid-19 virus (Aday and Aday, 2020). This has been a major obstacle for most organizations that need interactions between all involved parties. One of the industries that was heavily affected by Covid-19 pandemic was the education industry. Most schools and universities worldwide were forced to close down and all of the teaching and learning activities were abruptly switched to an online mode. Initially, a large number of educational institutions were not prepared to transform all of the activities to online modes (Dhawan, 2020). Many factors such as lack of IT infrastructures, low digital literacy, and lack of reliable internet services in many areas have caused tremendous drawbacks for the shift to online learning for a number of schools and universities worldwide (Dhawan, 2020). Cambodia's educational system is one of the countries that was drastically affected by Covid-19 pandemic. According to Sothy (2020), more than 113,000 Cambodian educational stakeholders including school personnel, students and staff members were affected. More than 3 million Cambodian students and close to 100,000 teachers from 13,482 schools were affected and forced to switch to online learning due to Covid-19 pandemic. This swift change from face-to-face schooling to online learning has caused major confusion and hardship for most involved stakeholders and especially resulted in the widening of the Digital Divide gap in Cambodia where IT infrastructure was already faced with the discrepancy between different types of school settings such as rural vs urban schools.

Digital Divide and the Importance of IT Usage in Education

Digital Divide is defined as “inequalities in access to computers and the Internet between groups of people based on one or more dimensions of social or cultural identity” (Gorski, 2005). By January 2022, there were close to 14,000,000 internet users in Cambodia which is approximately 79% internet penetration for the total Cambodian population (Datareportal, 2022) However, according to Mr. Chea Vandeth, Minister of Posts and Telecommunication, only 30% of the Cambodian have a basic level of digital literacy. This is a result of poor IT infrastructure as well as the level of digital divide that has been widespread in some of the less developed ASEAN countries such as Cambodia and Myanmar. Since the beginning of Covid-19 pandemic, the number of relevant stakeholders who were affected by the pandemic has risen greatly. Especially in the field of education where many students were forced to study from home, and many lacked the necessary IT equipment and reliable high-speed internet to fully utilize online education while they were studying from home. Thus, this research aims to gain the latest and precise data to explore the actual situation of Cambodian high school students, primary data is generated using a case study approach.

Methods

This exploration employed a mixed methods approach combining the quantitative and qualitative data collection for this research. As described in the previous sections, the availability of IT hardware, sufficient IT skills, and adequate online connections are crucial to perform efficient online learning. The lack of them is leading to a digital divide in education, as demonstrated in the literature review. Nevertheless, the actual status of such a digital divide is a matter of major national and regional differences. Moreover, differences between different groups within society occur, which in education often can be localized in differences between students attending government schools to students from private schools. Additionally, differences in the genders may occur. In any case, the timeliness leads to changing requirements and new or different issues. Following this, this new, broad and very detailed research shall contribute to this need for research.

To gain the basis for this research, this research generated primary data from a large, representative group of Khmer high school students. Following Yin (2011) the case study approach is used, as it covers “a broad variety of subjects, such as community studies, education, public health, businesses and industry, public policy and public administration and social and societal problems and controversies.”

Survey Design, Testing and Performance

The primary data needed was generated in surveys with Khmer high school students. The survey was either provided online by posting links on a wide range of relevant websites (e.g. local high schools, Khmer educational websites, and social media groups focusing on Khmer education) or was promoted onsite by visits of researchers in selected Khmer high schools. In this approach, the researchers visited several schools in one urban province (here: Phnom Penh) and one rural province (here: Battambang). With prior approval by the schools, the research has been presented to the students. They were invited to voluntarily fill out the survey files. In any case, the participation was fully voluntary, and consent was given by the participants and/or their legal guardians. As minors were involved, the ethics of this research has been checked and approved by the ethics committee of the Paragon International University in Phnom Penh.

For the online and the onsite approach, the peer group of participants has been defined as follows:

- High school students (lower and upper secondary education students)
- Any nationality and any ethnic group living and being enrolled at a Cambodian high school
- Any form of high school (government, public, other)
- Any gender

The survey which has been used in the onsite and online approach has been designed to cover all perspectives of the previously described research questions in order to provide sufficient primary data to answer them. The different perspectives (e.g., IT availability, online access, IT skills, well-being) have been grouped. Additionally, statistical information has been gathered to filter and evaluate the results for different groups (e.g. urban students vs. rural students, government school students vs. private school students, and male vs. female students). In any case, all surveys were fully anonymous. No names or addresses were collected. Every answer could be skipped by choosing an option “cannot or do not want to answer.” As not all researchers were native Khmer speakers, all questions have initially been designed in English language. The final version has been translated into Khmer language by native Khmer speakers experienced in research. Using this translation, a questionnaire has been built up using a professional survey tool. Before starting the field research phase, the survey has been tested by 20 defined persons of the peer group. Their feedback on functionality, language and understandability has been taken into account and was leading to minor adaptations of the final survey.

Field Phase and Received, Valid Survey Answers

A total of 1,797 survey answers were received. One-third (= 614 / 34%) of these surveys were from people outside the defined peer group. Especially the number of university students filling out the forms was unexpectedly high. These surveys have been taken out of the evaluation process.

The remaining number of 1,183 valid surveys has been the basis of the findings in this research. From these valid surveys, 330 surveys (= 28%) came from students in the urban area of the municipal Phnom Penh. 849 surveys (= 72%) came from rural areas. A local focus within the rural provinces was Battambang. From this province, 564 surveys (= 48%) were received. The background for the high number of answers from this rural province is, that it has been defined as one area in which the field research was performed onsite. As also done in parallel in the province of Phnom Penh, researchers visited different schools in the province of Battambang. Here they presented the research project and invited the students to join the survey. Details of this procedure are described in the previous section. Surveys from 18 different provinces of the total number of 25 Khmer provinces were received. 757 surveys (= 64%) came from students visiting government schools. 426 surveys (= 36%) came from private school students. 694 male students (= 59%) and 464 females (= 40%) took part in the survey. The high quantity of answers and the broad spreading over the different Khmer regions, school types and genders provides a solid basis for this research and allows strong generalizability and validity of the findings described in the following section.

	Quantity	%
Received Surveys	1,797	100%
Surveys outside the peer group	614	34%
Valid received surveys	1,183	66%

Break-down for valid surveys:

Regions	Quantity	%
Urban (Phnom Penh)	330	28%
Rural	849	72%
thereof: Rural (Battambang)	564	48%
thereof: Rural (Other)	285	24%

School Types	Quantity	%
Government School	757	64%
Private School	426	36%

Genders	Quantity	%
Female	474	40%
Male	694	59%
Other	6	1%

Table 1: Received surveys broken down on regions, school types and genders
(Source: own table based on this research)

Results

In order to describe results from empirical studies, it is necessary to determine “an appropriate sample size is vital to draw valid conclusions from research findings” (Memon et al., 2022). Defining this necessary sample size shall enable to generalize based on basis of a sample and prevent as far as possible sampling errors and biases. Generally speaking, a larger sampling size decreases such risks in empirical studies (Taherdoost, 2017). The basis for the calculation of the necessary sample size for this research is the formula from Taro Yamane (Uakarn et al., 2021). It leads to the result, that a minimum of 400 samples is needed to enable to generalize from the sample size. As this exploration has more than 1,100 valid survey answers, as demonstrated in the previous section, it can be stated that the necessary sample size is exceeded by far and therefore grants a solid basis for generalizability.

Based on the received valid survey answers, the following results highlighted in this chapter can be summarized. To explore the high quantity of received primary data, more than 200 different queries exploring different perspectives of the research have been executed. Examples of such queries were the exploration of the availability of hardware in urban areas compared to rural areas. Or government schools versus private schools. Or female students versus male students. Each of these more than 200 queries received a query number which is highlighted after the relevant finding. The results are grouped reflecting the different perspectives of the research questions.

IT Hardware Availability for Khmer High School Students

Being asked if they had access to desktop computers (or alternatively notebooks or laptops), only 34% of Khmer high school students replied positively. More than half had no access to computers at all. 14% remarked they had access at least sometimes. (query report # S001). In rural areas, this trend is even slightly stronger (query report # S036, # S063). Significant differences can be found when comparing students from government schools with students at private schools: At government schools on average, only 26% of the students had access to computers, compared to a significantly higher share of 49% at private schools (query report # S090, # S117). Unexpected is a higher availability among girls (=38%) compared to boys (=31%), (query # S144, # S171).

Making a cross-country analysis with data on the availability of computers for high school students from neighbouring countries based on Nanthakorn et al. (2022 & 2023), leads to these results: The share of students having access to computers in Myanmar (= 59%) and Thailand (= 62%) is significantly higher compared to Cambodia (= 34%; query report # S001).

Analyzing the availability of smartphones (including tablets) leads to very different results: Nearly 80% of Khmer high school students have access to smartphones. No major differences between rural and municipal students can be found (query report # S002, # S037, # S064). Again, the availability in government schools is as expected lower (= 73%) compared to private schools (= 88%), (query report # S001 # S091, # S118). No major difference between the genders could be found (query report # S145, S172).

Performing the cross-country analysis for the availability of smartphones for students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the differences are less significant compared to the availability of computers. In Myanmar (= 79%) and in Thailand (= 82%) about the same share of high school students have access to smartphones as in Cambodia (= 79%; # S002).

More than half of Khmer students needed to invest in new IT equipment: 50% in computers and 61% in smartphones (query report # S004, S005). Financial support was received mainly from the family (= 76%) and in very few cases from the school (= 3%) (query report S007). 73% of the students needed to pay for their internet access (e.g. mobile internet) themselves (query report #S006).

Internet Access for Khmer High School Students

When being asked about the internet quality at their homes, about half (= 53%) of the Cambodian students state that it is 'good'. Nearly the complete second half (= 44%) defines the internet quality as 'weak' (query report # S008). The internet in urban areas has been evaluated better (= 61%) compared to rural areas (=50%), (query report # S042, S069).

Significant is also the difference between the different school types: At government schools, 45% of the students report good internet, whereas 66% of public school students came to the same conclusion (query report # S096, S123).

Performing the cross-country analysis on the internet quality at the student's homes in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the differences are

significant, especially in Thailand. In Myanmar 60% of students evaluate the internet quality at their home as being 'good', which is comparable to the result in Cambodia (= 53%). Nevertheless, Thai high school students seem to have superior access to the internet at home (= 83%).

The evaluation of the internet quality in schools was leading to even weaker evaluations: Only 28% of the students saw the quality here as 'good' and a majority of 57% as 'weak' (query report # S009). This conclusion was made both for government schools (= 29%) and public schools (=28%) without major differences (query report # S097, S124).

In a cross-country analysis, the corresponding information is found in the neighboring countries. Nevertheless, also here the results are more positive. 52% of the high school students in Myanmar and 40% of the students in Thailand are rating the internet quality in their schools as being 'good' (Nanthakorn et al., 2022 & 2023). In Cambodia, only 28% of the students come to the same conclusion (query report # S009).

IT Skills of Khmer High School Students

The Cambodian high school students were asked to self-estimate their IT skills. A Likert scale from 1 (= very low IT skills) to 5 (= very good IT skills) was provided. In two separate steps the students were initially asked about their skill levels in the usage of computers (including notebooks and laptops) and secondly asked about their skill levels in the usage of smartphones (including tablets).

For IT skills in the usage of computers, Cambodian high school students self-estimate themselves in a mid-field of 2,68 on a Likert scale (query report # S198). Skills in urban areas (= 2,99) are higher compared to rural areas (= 2,56), (query report # S199, S201). Results from government schools (= 2,47) are lower compared to public schools (= 3,05) (query report # S203, S205). Male students (= 2,89) self-estimate their skills higher compared to female students (= 2,52), (query report # S207, S209).

Being asked about their skills in the usage of smartphones and mobile devices the results are strongly differing: The overall skill level is evaluated as being much higher (= 3,56 on a Likert scale) (query report # S211). This is corresponding with the previously described higher access to smartphones compared to the availability of computers. The general trends are nevertheless comparable to the skill levels in the usage of computers: Skills are higher in the city (= 3,79) than in rural areas (= 3,48). Also, private schools (= 3,95) are superior to government schools (= 3,33) and boys (= 3,72) are evaluating their skills higher than in comparison girls (= 3,45), (query report # S200, S202, S204, S206, S208, S210).

Performing the cross-country analysis on the IT skills of high school students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the results are slightly better compared to Cambodia (= 2,68 on the Likert scale): High school students in Myanmar rate their skills with 3,3 on a Likert scale and Thai students even with 3,5 using the same scale.

When being asked, where the students received support when facing IT issues, the most important source of assistance was their family. 47% were able to receive support from their families if needed. 44% found support on the internet and 33% were able to receive assistance from their teacher (query report # S012, S013, S014). Taking these numbers into

account, it has to be assumed that a major group of students (> 50%) did not find any form of support when facing IT issues.

Online Learning Efficacy of Khmer High School Students

When being asked, if they have learned better before the COVID-19 pandemic, 46% of the students confirmed. Nevertheless, nearly the same amount of students (= 47%) disagreed (query report # S018). The share of students supporting this statement was significantly higher in Phnom Penh (= 52%) compared to students from rural provinces (= 43%) (query report # S050, S077). More public-school students (= 53%) agreed compared to government school students (= 41%). More boys (= 49%) confirmed than girls (= 44%), (query reports # S104, S131, S158, S185).

Performing the cross-country analysis on the online learning efficacy of high school students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the results are similar. Less Thai students (= 41%) and slightly more students from Myanmar (= 55%) come to the conclusion to have learned better before the COVID-19 pandemic compared to Khmer students (= 46%).

At the same time, most students were rather critical of the advantages of learning onsite. When being asked if they think they learned better being physically in the classroom, only 35% confirmed and 58% disagreed (query report # S019).

In an exploration, teachers stated, that the participation of students in class decreased significantly in online classes compared to onsite classes. Often students were described as 'fully passive' and 'unreachable' during online classes (Nanthakorn et al., 2022 & 2023). When asked about this, the Khmer high school students came to a very indifferent evaluation: 43% of the students stated that they participated more in onsite classes. Nearly the same quantity of students (= 49%) disagree with this statement (query # S020).

Well-Being of Khmer High School Students When Performing Online Learning

Besides exploring technical perspectives of online learning, this research also aimed to explore the well-being of Cambodian students when learning online.

About one-third (= 35%) of Cambodian high school students stated, that they felt depressed during the time they needed to learn online due to the COVID-19 pandemic (query report # S021). This feeling of being depressed was more reported in rural areas (= 38% compared to 30% in the city). No significant difference could be found when comparing government school students (= 36%) with private school students (= 34%) and when comparing boys (= 34%) with girls (= 36%), (query reports # SS053, S080, S107, S134, S161, S188).

Moreover, many students reported feeling lonely (= 43%), under pressure (= 40%), or helpless (= 30%). 11% of Cambodian high school students stated that they needed to consult a doctor in this phase due to not feeling well (query report # S022, S023, S024, S025).

Performing the cross-country analysis on the well-being of high school students in neighbouring countries based on Nanthakorn et al. (2022 & 2023), the data comes to similar results: Thai students (= 29%) tended to report less to be depressed in phases of online learning during the COVID-19 pandemic compared to Cambodian students (= 35%). The

numbers in Myanmar (= 40%) are significantly higher, but other external circumstances (e.g. the civil war at the same time) might have led to this result.

In open questions, Khmer high school students received the opportunity to express their thoughts about online teaching. Many students reported issues in connection with this new form of learning and about financial problems in their families.

“There were many challenges during the Covid-19 pandemic. For example, students couldn’t keep up with their learning: The schools were closed down. Moreover, we were facing financial issues within the family. We lost the income from tourism and did not have enough income to support our family.”

(Female high school student, unknown age, Siem Reap, survey number #63204945)

“The worst thing about Covid-19 was that the schools all over the country were closed. Everyone had to move to online learning, which was really difficult for some students.”

(Female high school student, unknown age, Phnom Penh, survey number #63243746)

Nevertheless, many students also reported that their relationships with their relatives and siblings in this phase of difficulties got closer and more intense.

“It had a bad impact on the distance between me and my friends, but it had a good impact on my family. We spend more time together at home.”

(Female high school student, 16 years old, Battambang, survey number #62656769)

When being asked, where they received support when they were not feeling well, most Cambodian high school students mentioned their family including siblings (= 56%), their friends (= 54%), their teachers (= 51%) and the internet including social media groups (= 32%) (query reports # S026, S027, S028, S029).

Discussion

Using the findings described in the previous sections, the research questions can be answered in the following way:

Research Question	Conclusion
<p><u>RQ 1:</u> Do Cambodian high school students have the required hardware, internet access, and IT skills?</p>	<p><u>Hardware availability</u> In a majority of cases, Cambodian high school students do not have the required ideal hardware for online learning. Two third did not have access to computers. At the same time, a high number of Cambodian students have access to smartphones. Nevertheless, smartphones are inferior in the online learning process due to their small screens, limitations in the usage of certain software and the emission of blue light. This situation is worse at government schools and in rural areas.</p> <p><u>Internet access</u> The findings are indifferent. Half of the students had sufficient internet access. The other half did not. Also here, government school students and students in rural areas are facing more issues.</p> <p><u>IT Skills</u> IT skills in using computers are only in the mid-range for Cambodian students. Smartphone skills are superior. Nevertheless, as stated before, in the process of online learning the usage of computers is preferable. Moreover, in many cases, there seems to be a lack of sufficient sources of technical support for Cambodian high school students in situations facing IT issues.</p>
<p><u>RQ 2:</u> Do Cambodian high school students see online learning as efficient as onsite teaching?</p>	<p>The findings are indifferent. Half of the students state that they learned better before the COVID-19 pandemic. The second half disagreed. Half of the students remarked that they participate stronger in onsite classes. The second half disagrees.</p>
<p><u>RQ 3:</u> How did Cambodian high school students feel in phases of online learning?</p>	<p>Many students felt unwell during the phase of online learning. A high number of Cambodian high school students mentioned emotional issues. One-third reported feeling depressed. An even higher share of students felt lonely or under pressure. About every 10th student mentioned that he/she needed professional medical support due to not feeling well in this phase.</p>

Concluding it can be said that the performed survey delivered sufficient primary data to answer the research questions, as stated above. In cases in which findings were indifferent, more detailed research may be needed to be performed in the future. Based on these findings, the recommendations described in the following section can be made.

Recommendations and Outlook

Based on the findings and conclusion described in the previous sections, the following recommendations are provided:

Recommendation 1:

The Cambodian government, local schools, NGOs and private initiatives should raise programs to increase access to computers. This can be done with financial support programs, scholarships, sharing strategies and re-using initiatives.

Recommendation 2:

Governmental and private initiatives should be raised to improve the internet access, especially in rural areas. Moreover, internet access in all school forms should be a matter of improvement programs.

Recommendation 3:

IT skills should be increased, especially in the usage of computers. The subject 'Information Technology' could be a part of the school's curriculum at an early stage.

Recommendation 4:

The emotions of students should be analyzed and monitored closely. Schooling for students and teaching staff should be performed to realize mental issues at an early point and to react in an appropriate way.

For access to the internet and for learning efficacy the survey data was leading to indifferent results. Here, additional research is needed to provide additional data. Moreover, the topic is a matter of ongoing changes within IT and within the performed teaching forms and requirements. Therefore, regular repetition of gaining new primary data is suggested.

Conclusion

This research aimed to explore the digital divide in the Cambodian educational system. To answer the research questions, primary data from Cambodian students has been collected in a widespread field research approach. Based hereupon, major issues resulting specifically from a lack of adequate IT hardware were identified. Recommendations to bridge the digital divide in the Cambodian educational system were provided and the need for additional research was defined.

References

- Aday, S., & Aday, M. S. (2020). Impact of COVID-19 on the food supply chain. *Food Quality and Safety*, 4(4), 167-180.
- Datareportal. (2022). Digital 2022: Cambodia. <https://datareportal.com/reports/digital-2022-cambodia>.
- Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of educational technology systems*, 49(1), 5-22.
- Gorski, P. (2005). Education equity and the digital divide. *AACE Review (Formerly AACE Journal)*, 13(1), 3-45.
- Gupta, A., & Goplani, M. (2020). Impact of COVID-19 on educational institution in India. *Purakala Journal U (CARE Listed)*, 31(21).
- Memon, M., Ting, H., Hwa, C., Ramayah, T., Chuah, F., & Cham, T.-H. (2020). Sample Size for Survey Research: Review and Recommendations. *Journal of Applied Structural Equation Modeling*: 4(2), i-xx, June 2020, eISSN: 2590-4221, 10.47263/JASEM.4(2)01.
- Nanthakorn, B., Ractham, P., & Suwannakart, P. (2022). Digital Inequalities at High Schools in Thailand: A Survey-Based Exploration Leading to Expert-Backed Bridging Strategies. in: Li, E.Y. et al. (Eds.) *Proceedings of The International Conference on Electronic Business*, Volume 22, (pp. 76-84) ICEB'22, Bangkok, Thailand, October 13-17, 2022.
- Nanthakorn, B., Ractham, P., & Kaewkitipong, L. (2023). Double Burden: Exploring the Digital Divide in the Burmese Educational System Following the 2021 Coup d' Etat and the COVID-19 Pandemic. *Computers in Human Behavior Reports*, Volume 11, 2023, 100310, ISSN 2451-9588, <https://doi.org/10.1016/j.chbr.2023.100310>
- Pain, N. (2020). The impact of the COVID-19 pandemic on sectoral output. OECD Economics Department. <https://oecdecoscope.blog/2020/12/12/the-impact-of-the-covid-19-pandemic-on-sectoral-output/>
- Sothy, C. (2020). The impact of the COVID-19 pandemic on education in Cambodia. *British Journal of Education*, 9(1), 13-19.
- Taherdoost, H. (2017). Determining Sample Size, How to Calculate Survey Sample Size. *International Journal of Economics and Management Systems*, Article February 2017, https://www.researchgate.net/publication/322887480_Determining_Sample_Size_How_to_Calculate_Survey_Sample_Size.
- Uakarn, C., Chaokromthong, K., & Sintao, N. (2021). Sample Size Estimation using Yamane and Cochran and Krejcie and Morgan and Green Formulas and Cohen Statistical Power Analysis by G*Power and Comparisons", *Apheit Vol. 10 No. 2 (2021): International Journal*, <https://so04.tci-thaijo.org/index.php/ATI/article/view/254253>

Yin, R.K. (2011). Applications of Case Study Research. Publisher SAGE, Edition 3, ISBN 1452235783.

Contact email: bob.nanthakorn@gmail.com