CDRI
Cambodia Development Resource Institute

ASSESSING TECNOLOGY READINESS OF STUDENTS AND TEACHERS IN CAMBODIAN HIGHER EDUCATION DURING COVID-19

Saing Chan Hang, Chea Phal and Song Sopheak

Working Paper 144
October 2023

CDRI Working Paper Series No. 144

Assessing Technology Readiness of Students and Teachers in Cambodian Higher Education during COVID-19

Saing Chan Hang, Chea Phal and Song Sopheak

CDRI – Cambodia Development Resource Institute

Phnom Penh, October 2023

ISBN-13: 978-9924-500-47-6

Citation:

Saing Chan Hang, Chea Phal and Song Sopheak. 2023. *Assessing Technology Readiness of Students and Teachers in Cambodian Higher Education during COVID-19.* CDRI Working Paper Series No. 144. Phnom Penh: CDRI.

CDRI
☞ 56 Street 315, Tuol Kork
✉ PO Box 622, Phnom Penh, Cambodia
☎ +855 23 881 701/881 916/883 603
@ cdri@cdri.org.kh
www.cdri.org.kh

Layout: Oum Chantha
Cover designed: Chhay Monyka
Edited: Jessica Garber

Table of contents

List of figures and tables

Acknowledgements

The team benefitted greatly from comments and suggestions by Dr Vincent Guermond and Dr Lars Balzer on the earlier draft version. The team also gives special thanks to Dr Eng Netra for her support and guidance. We are also incredibly grateful to the students, faculty members and administrators who participated and facilitated this study's data collection. Finally, the team would like to sincerely thank the Australian Department of Foreign Affairs and Trade (DFAT) through The Asia Foundation's Ponlok Chomnes Program for their financial support. The views expressed in this study are the authors' own and are not necessarily those of the Australian government, The Asia Foundation, or CDRI.

Abbreviations

CDRI	Cambodia Development Resource Institute
CFA	Confirmatory Factor Analysis
HEIs	Higher Education Institutes
ICT	Information and Communication Technology
LMS	Learning Management System
MLVT	Ministry of Labour and Vocational Training
MoEYS	Ministry of Education, Youth and Sports
MOOC	Massive Open Online Course
ODL	Open and Distance Learning
OLS	Ordinary Least Squares
PCA	Principle Component Analysis
RUPP	Royal University of Phnom Penh
TR	Technology Readiness
TRI	Technology Readiness Index
TVET	Technical and Vocational Education and Training
UNESCO	The United Nations Educational, Scientific and Cultural Organization

Executive summary

The global COVID-19 pandemic brought unprecedented disruptions to the higher education landscape worldwide. Widespread school closures, driven by the imperative of social distancing to combat the virus's spread forced a rapid and dramatic shift from traditional face-to-face instruction to online learning and teaching environments in numerous countries. Recent research has highlighted the formidable challenges lower- and middle-income countries face, particularly those with weaker ICT infrastructures and less technology-ready teachers and students, when adapting to these new tech-enhanced teaching and learning modalities. As a lower-middle-income country, Cambodia encountered its own challenges, most notably technology readiness, as it embarked on the journey of adopting online learning and teaching. Cambodian efforts to integrate ICT in education began in 2004, culminating in promulgating the 2010 Master Plan for ICT in education for 2009-2013.

This study aimed to contribute to the growing body of literature on technology readiness among educators and students amidst the forced transition to online learning during the COVID-19 pandemic. Its overarching goals were to provide insights into technology readiness levels, its determinants, and regional disparities. To assess these aspects comprehensively, two independent surveys were conducted between June and July 2020 gathering responses from 370 teachers across 18 HEIs and 1,338 students from 22 HEIs in Cambodia.

Findings from this study illuminated how educators and students adopted online learning and teaching at a slow pace in the pre-pandemic era. This sluggish adoption was attributed to a combination of factors, including a lack of motivation, inadequate support, and limited funding for HEIs to transition to e-learning environments. Nevertheless, when the pandemic necessitated a rapid shift, nearly all teachers and students embraced online learning and teaching irrespective of their levels of technology readiness. Concerns emerged as a significant portion of students reported dedicating only one to two hours daily to online classes, potentially resulting in learning loss. Furthermore, less than one-third of students expressed satisfaction with online learning and a minority favouring it over traditional approaches. Strategies such as ensuring access to necessary ICT tools, providing conducive study environments, and offering personalised support for e-learning modes become paramount to mitigate learning loss.

This study utilised the technology readiness measure developed by Parasuraman and Colby (2015) to understand how teachers exhibited greater technology readiness than students. Teachers displayed higher levels of optimism and motivation, with a larger proportion falling into the explorer and pioneer categories with a smaller percentage identified as sceptics. These findings underscored the pivotal role of teachers' accumulated ICT experience and positive attitudes toward technology in enhancing their technology readiness. Strategies aimed at bolstering students' ICT skills and reshaping their perceptions, particularly among those identified as sceptics, are recommended to address these disparities.

Furthermore, regional disparities in technology readiness were evident among both teachers and students. Urban educators were more inclined to be pioneers and less prone to hesitancy compared to their non-urban counterparts. Similarly, urban students were more likely to exhibit explorer and pioneer characteristics and less likely to be sceptics when contrasted with their rural peers. This regional variance highlights the importance of tailoring technology integration strategies to attract both teachers and students in different geographical contexts. Gender differences in technology readiness were also evident. Male teachers and students displayed higher readiness levels than their female counterparts. Specific interventions targeting female students and educators alongside mentoring and support programs should be implemented to address these gender disparities.

Lastly, the study delved into a quantitative analysis of technology readiness determinants among teachers and students during the COVID-19 pandemic. Factors influencing technology readiness among teachers encompassed birthplace region, tablet ownership at home, the percentage of teaching time involving ICT tools, perceived benefits of ICT usage in teaching, general ICT competency, ICT-related training experience, and perceptions of school ICT infrastructure and policies. In contrast, student technology readiness was influenced by variables such as gender, English language proficiency, home assets, tablet ownership, prior online class experience, satisfaction with online learning during the pandemic, and the average daily hours spent online.

In navigating the ever-evolving landscape of education in the digital age, this study underscores the importance of comprehensively addressing technology readiness across several areas. Based on the research findings, a set of recommendations is proposed to enhance technology readiness and better facilitate the transition to online learning within Cambodia's HEIs. Firstly, these initiatives should prioritise student preparedness and support by offering incoming students with pre-requisite ICT skills training, orientation sessions, and dedicated support services. Second, efforts to enhance English language programs within HEIs can significantly improve language proficiency and technology readiness among students. Third, it is also important to ensure equitable access to technology, mainly by providing tailored assistance to students from lower socio-economic backgrounds and guaranteeing widespread internet access, especially in rural areas. Fourth, advocating for the integration of ICT tools into the curriculum and promoting digital teaching methods that align with student preferences should be prioritized. Fifth, it will be crucial to develop comprehensive training programs for teachers encompassing a wide range of ICT skills and emphasising practical applications within their teaching practices. Sixth, addressing gender and regional disparities in technology readiness requires specialised interventions and mentorship programs. Lastly, promoting research and innovation initiatives will facilitate the identification of emerging trends and innovative approaches tailored to Cambodia's unique educational context.

1. Introduction

The COVID-19 pandemic has put global public health preparedness to an unprecedented test and disrupted the global education system on an immense scale. Massive educational disruption through school closures due to social distancing measures started to prevail around the second quarter of 2020 when several countries worldwide experienced exponential surges in the number of new infection cases. At the pandemic's peak, over 1.6 billion learners in more than 190 countries were out of school, and more than a million teachers and school personnel were affected by school closures (UNESCO 2021a). In 2020, the crisis affected around 220 million tertiary-level students around the globe (UNESCO 2021b). The primary concern of school closure was the immediate learning loss at both "*intensive*" (how much students learned during school closure) and *"extensive"* (how many students continued to learn during school closure) margins and the long-term impact on students' outcomes (OECD 2020). A study among primary school students in the Netherlands, the world's highest rate of broadband access, showed that students made little or no progress while studying from home. This suggests more significant learning loss in countries with weaker infrastructures, especially information and communication technology (ICT) (Engzell, Frey, and Verhagen 2021).

A survey of 57 countries by the UNESCO National Commission between December 2020 and February 2021 showed that all countries reported an increase in online teaching and learning among higher education institutions (HEIs) during the pandemic. However, universities in high-income countries, such as those in Europe and North America, were better able to cope with the school disruptions than those in lower- to middle-income countries (UNESCO 2021c). The ability to cope with the school closures partially reflects the level of the online teaching and learning readiness among teachers and students. Parasuraman and Colby (2015) posited that technology readiness of individuals could be measured by individuals' propensity to embrace and use cutting-edge technology, which captures both an individual's mental motivators and inhibitors to use new technology. Existing studies suggest that e-learning adoption at HEIs increases with the level of technological readiness of both teachers and students (Obi 2018; Alfy et al. 2016; Oketch 2013; Eslaminejad 2010; Roper 2006). Therefore, getting teachers and students to be technology ready is crucial for online learning and teaching adoption.

For Cambodia, school closure was announced on March 16, 2020, by the Ministry of Education, Youth and Sports (MoEYS) following the social distancing measure passed by the government (Chet and Sok 2020). HEIs were compelled to move their traditional face-to-face classroom to online learning and teaching environment. The pandemic allowed the universities to experiment with their ability to adopt online learning and teaching environments. While school ICT infrastructures are critical for e-learning adoption, technology readiness among teachers and students is another essential factor. Given the differences in ICT infrastructures and technology readiness among teachers and students, schools have adopted different strategies to adapt to new tech-enhanced online learning and teaching. For instance, the Royal University of Phnom Penh offered an additional credited course on Digital Distance Learning and Teaching to students in two programs identified as individuals with substantially inadequate ICT skills to properly apply distance learning (Chet and Sok 2020). Institutions with insufficient resources for teachers and students to adapt to new technologies faced drops in student enrolment (UNESCO 2021c). Some HEIs resorted to providing cash (US$50 per student) to enable students from low socioeconomic status backgrounds to secure and maintain stable internet connectivity (Chea et al. 2020).

Efforts to integrate ICT into education started as early as 2004 as shown in the "Policy and Strategies on Information and Communication Technology in Education in Cambodia" (MoEYS 2004). The 2004 Policy was followed by a Master Plan for ICT in Education 2009-2013 in 2010 (MoEYS 2010). The Master Plan explicitly addressed how to provide ICT skills to all faculty and support staff and ICT-based professional skills to all university students and to offer open and distance learning (ODL) in at least 5% of universities. Both of these plans formed a pathway toward the development of the National Open University of Cambodia.

Given the rapid growth of ICT in the last decade, we hypothesized that there has been progress in ICT-based learning and teaching at HEIs around Cambodia. However, given the funding and existing ICT infrastructures, not all universities shared similar visions as the Master Plan. This study is therefore intended to contribute to the literature on online learning and teaching during the COVID-19 pandemic and document the evidence of adoption of e-learning. The ultimate goal of this study would be to contribute to the development of future policies on ICT integration into HEIs and systems. It aims to answer three specific questions:

- To what extent are university teachers and students ready to shift to online teaching and learning?
- What are the determinants of technology readiness among teachers and students?
- Are there regional and gender gaps in technology readiness among teachers and students?

2. Context and background

Before delving into e-learning development and growth of HEIs in Cambodia, it is important to briefly explore the historical development of these institutions since their e-learning environments have been shaped by their history. The development of Cambodia's higher education system and institutions has a close relationship with historical colonial rule and civil war, as well as rapid demographic transition in past decades. In the decade after gaining independence from nearly a century of French colonial rule in 1953, there was a dramatic surge in the number of HEIs across Cambodia under King Norodom Sihanouk's leadership. However, these institutions were extremely low quality due to poor planning around their financing, staffing, and resource allocation not to mention the limited assistance they received under colonial rule (Ayres 2000; Pith and Ford 2004 cited in Williams, Kitamura, and Keng 2016). The higher education system was further disrupted between 1970 and 1975 as civil war grew. Higher education was later completely abolished during the 1975-1979 Khmer Rouge genocide period, which took the lives of around three-quarters of the university staff and the lives of the majority of the students (Chet 2005, cited in Williams, Kitamura, and Keng 2016). This tremendous loss of human capital has created a legacy of today's higher education system and institution development.

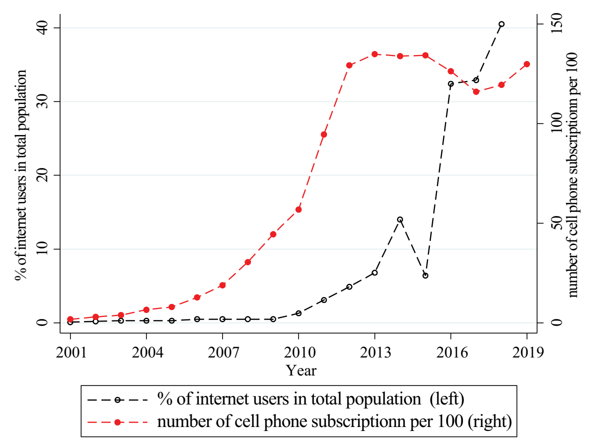
Scarred by a subsequent decade of civil war in the 1980s, the new government along with help from the Soviet Union re-established the higher education system (Williams, Kitamura, and Keng 2016). However, HEIs struggled financial support until 1997 when private funding was permitted resulting in the rapid expansion of HEIs and the foundation of private institutions (Chet 2009). This expansion was partly driven by the increase in demand for education services among the baby boomer generation (i.e., those born after the 1970s civil war). The use of ICT tools, such as desktop computers and access to the internet, at private HEIs located in the capital city of Phnom Penh started to grow following 1997. Another wave of rapid expansion of both public (fee-paying programs) and private institutions occurred again from early 2000s until the early 2010s and was followed by gradual expansion of HEIs in Cambodia through

2018 (Chet 2009; Un and Sok 2018). After having just eight HEIs in Cambodia prior to 1997, the number of HEIs in 2018 reached 125, including 77 private institutions (Un and Sok 2018; MoEYS 2019). Further underscoring the demand for higher education, the total number of university students enrolled annually between 1993 and 1997 was approximately 10,000. In 2018, the number of enrolled students jumped abruptly to 249,092 students (Un and Sok 2018; MoEYS 2019). The dramatic surge in HEIs over the past two decades raised concern over the quality of the services and potential mismatch between skills taught at universities and those required by employers (Chet 2009).

At the same time that HEIs were proliferating, there was also a rapid expansion of the ICT sector as measured by the percentage of individuals using the internet, the number of mobile cellular subscriptions per 100 people, and the index of ICT service export in current US dollar value (Figure 1). As of 2018, approximately 96% of the Cambodian population had access to a mobile phone, and 100% of the population lived within reach of mobile-cellular signal (ASEAN Secretariat 2020). This suggests the ICT industry's expansion played a crucial role in facilitating online or e-learning adoption among students and teachers at HEIs.

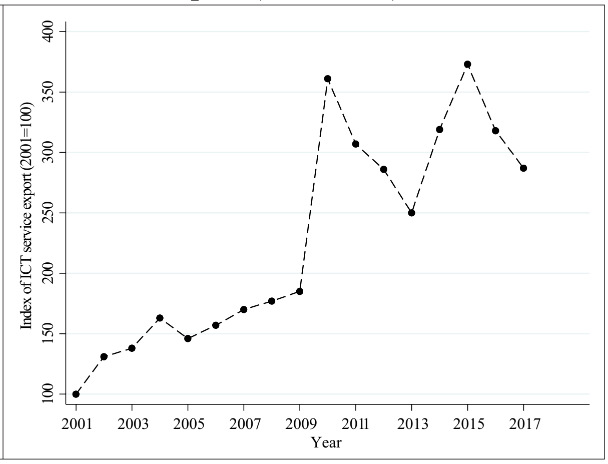
Figure 1: Evolution of selected ICT indicators in the last two decades

Panel A: Percentage of individuals using the internet and phone subscription per 100



Source: World Bank 2021

Panel B: Index of current US dollar value of ICT service export (2001=100)



Source: World Bank 2021

Cambodia's first plan to integrate ICT into education, particularly HEIs, was introduced in 2004. As elaborated in the "Policy and Strategies on Information and Communication Technology in Education in Cambodia" by MoEYS, the plan was set to achieve full implementation by 2015 (MoEYS 2004). In 2007, MoEYS enlisted assistance from UNESCO, the Open Institute, and the Asian Development Bank to allocate software and hardware resources to six regional Teacher Training Centres and the National Institute of Education (Elwood and MacLean 2009). In 2010, the Master Plan for ICT in Education 2009-2013 was disseminated. It called for the increased use of computers and access to information in tertiary education among most students by 2013 and for all tertiary-education students by 2015. It also called for increased acceptability and affordability of open and distance learning (ODL) among students who did not have access to face-to-face learning (MoEYS 2010). Additionally, the Master Plan aimed to provide ICT skills to all faculty and support staff and ICT-based professional skills to all students by the end of their academic year. Lastly, it intended to provide ODL from at least 5% of universities in order to form a pathway toward the goal of having a National Open University in Cambodia. Nonetheless, HEIs did not share the vision articulated in the Master

Plan because of its pragmatism and numerous challenges, and the resources of the institutions to move forward with the plan are also limited (Nguon 2015).

Despite several initiatives and substantive efforts to integrate ICT into HEIs, assessment of the extent of ICT penetration in HEIs is scarce. Some studies attempted to address ICT integration issues, including online learning, but they have been limited in scope and sample coverage. For instance, one study focused on distance learning program offered by a private university in Phnom Penh to 272 students in five provinces and found that more than two-thirds of the students completed the program with desirable results (Abdon, Ninomiya, and Raab 2007). Another study conducted a survey of 130 students at the National Institute of Education to understand their perception of ICT usage and showed that ICT was perceived to be useful for schoolwork, particularly in foreign language and science classes (Elwood and MacLean 2009). Students in this study reported being competent in word processing only and expressed no sign of anxiety in acquiring new technology, which indicates students' peaceful coexistence with technology, and they preferred technology and cell phones over other means to perform various tasks. The study focused on the distance learning program had limited scope and scale, but to some extent, provides promising evidence for developing MoEYS's goal of creating the National Open University in the 2009-2013 Master Plan. The second study requires an update and a larger sample size since students' perceptions may have changed over time.

Despite the lack of studies regarding the relationship between ICT industry growth and e-learning adoption at HEIs, our prior research suggests that most teachers and students possess the required technology tools, including computers, smartphones, and internet connectivity, that allow them to perform online learning and teaching. However, teacher and student technology readiness and the required ICT skills and training remain important factors alongside university ICT infrastructures and technical support staff for moving forward with online learning adoption.

The COVID-19 pandemic has put Cambodia's higher education system and institutions to the test as they have been forced to adopt of online learning when all education institutions nationwide were ordered to close on 16 March 2020 (Chet and Sok 2020). It provided HEIs an unprecedented opportunity to experiment with their existing ICT infrastructures and technology readiness among teachers and students. For policymakers, it was a rare chance to explore how a new Master Plan for ICT in education should look in the wake of the lessons learned from the forced implementation of e-learning. Indeed, after adopting online learning, the Royal University of Phnom Penh (RUPP), one of Cambodia's top universities, discovered that students in two programs showed substantially inadequate ICT skills to properly participate in distance learning (Chet and Sok 2020). The school addressed the problem by providing them with a credited course on Digital Distance Learning and Teaching via Google Suite, a free and open-source technology at the time of the study. This study provides a step towards understanding the challenges faced by teachers and students during the adoption of e-learning during the pandemic.

3. Literature review

According to Contreras and Hilles (2015), e-learning refers to the use of educational technology, electronic media, and information and communication technology (ICT), such as the internet, e-mail, computer and teleconferencing, in the education process. Existing studies suggest that e-learning adoption at HEIs increases with the level of technology readiness of both teachers and students (Obi 2018; Alfy et al. 2016; Oketch 2013; Eslaminejad 2010; Roper 2006), and technology itself is one of the core factors in adopting online learning and teaching (Phan and Dang 2017; Ünal et al. 2013; Gay 2016). Roper (2006) surveyed 178 teachers and 756 students at 648 public and private HEIs in the United States in the spring of 2006 to find that faculty technological readiness positively associated with the faculty use of technology for teaching. The same study also found that student technology readiness was associated with their expected use of technology for learning. Obi (2018) surveyed 284 medical students in Nigeria and showed that student technology readiness positively correlated with student e-learning readiness. A similar positive association between technology readiness and e-learning readiness was also found among university instructors in Egypt and the United Arab Emirates (El Alfy et al. 2016), among medical instructors in Iran (Eslaminejad 2010), and among university lecturers in Nairobi (Oketch 2013).

The forced adoption of e-learning at HEIs around the globe due to the COVID-19 pandemic has cast doubt over online or e-learning readiness, particularly technology readiness, among university teachers and students within this new tech-driven learning and teaching environment. Indeed, successful implementation of e-learning relies partly on whether students are keen to use the e-learning system (Clay et al. 2008; Al-Qirim et al. 2018). Since the pandemic began, there has been a growing body of work aiming to explain the level of e-learning readiness and technology readiness, in some instances, among teachers and students at HEIs. Our review of the literature reveals two lines of evidence. Some studies show that teachers and students at HEIs are not ready to adopt e-learning forcibly (Alsoud and Harasis 2021; Kabir 2020; Mahyoob 2020; Obeidat et al. 2020; Scherer et al. 2021; Paliwal and Singh 2020). Other studies reveal that teachers and students can and will adapt to the online learning environment (Alqabbani and Almuwais 2020; AISaqqaf and Ke 2021; Rafique et al. 2021; Chung, Subramaniam, and Dass 2020; Händel et al. 2020; Kabir 2020; Junus et al. 2021; Martha et al. 2021).

3.1. Students' readiness for e-learning environment

Evidence of e-learning readiness among university students during the forced adoption of e-learning is mixed. University students in some countries were ready to adapt to this new reality while students in other countries were not. For instance, Händel et al. (2020) surveyed 1,826 students at HEIs in Germany in the summer of 2020 and identified more than half of the students were highly ready for digital learning. These students were also less likely to be stressed and lonely due to the pandemic than those unprepared for online learning. Similarly, Chung, Subramaniam and Dass (2020) borrowed the Online Readiness Scale introduced by Hung et al. (2010) to assess e-learning readiness among 399 university students in Malaysia. They showed that students were generally ready for online learning, but that women were more prepared than men. Additionally, degree students were also considered more ready than diploma students. However, students expressed several challenges, including inconsistent internet connectivity, managing multiple online learning methods, difficulty focusing, and lacking some technical skills. Similar evidence of difficulties with e-learning readiness was also observed among a majority of the 482 students across in 22 universities in Indonesia in by Martha et al.'s (2021) study that utilized the e-learning competencies scale developed by Parkes, Reading and Stein (2013). Martha et al.'s (2021) study also showed differences in e-learning competencies by gender, region, academic year, and field of study. In addition, Rafique et al. (2021) surveyed 340 students from 9 public universities in Pakistan during the pandemic using Hung et al. (2010) comprehensive scale of online learning readiness. Their study showed that students were sufficiently prepared for online learning during the pandemic because they were motivated to study online but lacked control over their learning environment, which resulted in poor student performance.

While the above studies paint a more coherent picture of e-learning readiness among university students, other studies conducted in Jordan and Bangladesh show another picture. Alsoud and Harasis (2021) examined e-learning experience and readiness of 463 university students in Jordan during the pandemic and found that students were unprepared for the quick transition since most of them had never attended online classes before the pandemic. Almost half of the students surveyed spent less time studying for their online classes than before the pandemic. Meanwhile just under half of the students surveyed attended either half or fewer of their online class or just exams. Students from rural areas faced tremendous e-learning challenges, including technological accessibility, poor internet connectivity, and distracting learning environments. Issues, such as lack of viable internet connectivity and laptops, had also been documented in a 2020 survey of 399 students at Hashemite University in Jordan (Obeidat et al. 2020). The study also indicated that male students accepted e-learning more smoothly than their female counterparts. Kabir (2020) surveyed 302 university students in Bangladesh and found that students from public universities encountered several challenges because the public universities were scattered in rural areas with limited access to technology and internet connections. The study also revealed that only one out of every ten public university students attended virtual classes, suggesting a lack of readiness for both public universities and their students. Mahyoob (2020) surveyed 184 English language learners in Saudi Arabia during the pandemic to find that students experienced several challenges, including missing classes and tasks on Blackboard when transitioning to e-learning environment, technical issues (e.g. internet connectivity, course material download), and ineffective student-teacher interactions. These studies demonstrate that the transition to e-learning has been mixed, and, in many cases, difficult for students.

3.2. Teachers' readiness for e-learning environment

Like students at HEIs, teachers in some institutions were more ready to adapt to e-learning environments than teachers in other institutions. For example, Al-Saqqaf and Ke (2021) used Chapnick's (2000) model of e-learning readiness (i.e., technological skill readiness) and measurement scale developed by Aydin and Tasci (2005) to show that the majority of the 68 English language teachers in Malaysia were technologically ready to use e-learning in teaching. Alqabbani and Almuwais (2020) surveyed 401 instructors to investigate their readiness to shift to online teaching at the Princess Nourah bint Abdulrahman University in Saudi Arabia and found that almost all instructors exhibited moderate to high readiness. However, teachers did not comply with learning management systems, like Blackboard prior to the pandemic. Teachers' readiness can be directed related to Saudi Arabia's early development of learning management system platform in 2002 as well as the university's provision of quality and sufficient services (e.g. provision of personal laptops, free internet access on the whole campus, and very rapid and efficient information technology support) to faculty. In Bangladesh, Kabir (2020) showed that teachers at private universities were technologically ready and had adopted the appropriate mindset to adopt tech-based virtual learning. In Indonesia, Junus et al. (2021) conducted an online survey with 112 lecturers from most regions in Indonesia and learned that the lecturers possessed strong technical skills to use e-learning platforms for online courses and adapted quickly to using learning management systems.

Meanwhile, some teachers faced several challenges that made them unprepared for adopting e-learning during the pandemic. For instance, Paliwal and Sing (2020) assessed teachers' readiness in handling online teaching. They found that teachers had the technical competency to readily handle online education but were not adequately ready in terms of course design competencies, communication competencies, and time management competencies. In times of immediate disruption, such as the pandemic, teachers' perception of their readiness and support from HEIs for online teaching and learning is critical to their readiness. Scherer et al. (2021) used three dimensions of higher education teachers' readiness, namely technological and pedagogical content knowledge self-efficacy (perceived online teaching and learning competence), perceived online teaching presence, and perceived institutional support, to classify 739 surveyed teachers globally into low, inconsistent, and high readiness profiles. The findings suggested that while some teachers were ready to take on new e-learning challenges during the pandemic, others lagged behind. The three teacher profiles were found to be correlated with the teachers' gender and prior experience of online learning and teaching, the context of the shift of online learning, innovation potential in education, and their cultural orientation (Scherer et al. 2021).

3.3. Determinants of technology readiness

Studies on causes and correlates of technology readiness (TR) were suggested by Parasuraman and Colby (2015) as a potentially fruitful research avenue since such studies can help us understand why each correlate matters. Parasuraman and Colby (2015) suggested that researchers examine demographic correlates, including gender, age, education and occupation, and ownership of high-tech gadgets, among others. Education and occupation may likely cause changes in TR while TR may either decline at a certain age or vary by age cohorts due to differences in exposure to and experience of the technology.

4. Methodology

4.1. Conceptual framework

Our review of studies on e-learning readiness among teachers and students at HEIs reveals a wide range of enabling factors and challenges teachers and students face. Nevertheless, access to and understanding of how to use technology was shown to be the most common and critical requisite facilitating e-learning readiness. Therefore, we adopted the concept of technology readiness developed by Parasuraman and Colby (2015) to assess teachers' and students' technology readiness in adopting online learning and teaching during the pandemic. We did not test the association between technology readiness and e-learning adoption, nor did we test teacher and student attitudes toward e-learning technology since the associations were consistently positive in the literature (e.g., El Alfy, Gómez, and Ivanov 2016). All HEIs in our study, regardless of their level of technology readiness, had shifted to online learning and teaching at the time it was conducted. Examples of earlier works using the technology readiness measures and demonstrating that it was a factor influencing e-learning technology adoption include El Alfy, Gómez and Ivanov (2016), Badri et al. (2014), Summak, Bağlıbel, and Samancıoğlu (2012) for teachers and Borrero et al. (2014) and Tang et al. (2021) for students.

According to Parasuraman and Colby (2000, 2015), technology readiness (TR) measures individuals' propensity to embrace and use cutting-edge technology by capturing both mental motivators and inhibitors of and individual's predisposition to use new technology (see Table 1 below). The individuals can be either teachers or students. Technology readiness is a robust predictor of technological-related behavioural intentions and actual behaviour. Conceptually, teachers or students at HEIs who possess the personal traits of optimism and innovativeness toward new technology tend to be mentally motivated to embrace it. By contrast, those with the personal characteristics of discomfort and insecurity toward new technology tend to be mentally inhibited from adopting it. Each of the four personal traits are measured using four Likert scale questions (see Table A.1 in the Appendix). Using Parasuraman and Colby's (2015) scale and categories, individuals with high motivation and low inhibition are referred to as "*explorers*" or early adopter explorers, and those with low motivation and high inhibition are regarded as "*avoiders*" or late adopter laggards. Meanwhile, there are also individuals who possess complex combinations of motivation and inhibition, and they include *pioneers* (high motivation, high inhibition), *sceptics* (low motivation, low inhibition), and *hesitators* (moderate motivation, high inhibition).

Table 1: Four dimensions of technology readiness

TR dimensions	Definitions	Mental drive
Optimism	Positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives	Mental motivators
Innovativeness	A tendency to be a technology pioneer and thought leader	
Discomfort	A perceived lack of control over technology and feeling of being overwhelmed by it	
Insecurity	Distrust of technology stemming from scepticism about its ability to work properly and concerns about its potentially harmful consequences	Mental inhibitors

Source: Parasuraman and Colby (2015)

Intuitively, classifying teachers and students into the five categories mentioned above helps us understand the level of support that the individual teacher or student may need as they transition to new technology. For instance, teachers or students with high technology readiness, such as the *explorers* are interested in advanced functionality and capable of mastering new high-tech applications with minimal help, while those with low technology readiness, such as the *avoiders* and *hesitators*, are more satisfied with basic functionality and will need more support and reassurance in using the more advanced features (Parasuraman and Colby 2015, p.14). Furthermore, *sceptics* may need convincing messages as to why they have to adopt the new technology, while the *pioneers* may need little persuasion to adopt new technology but require more support to be satisfied.

4.2. Data

In 2020, students and teachers' surveys were conducted separately to assess the technology readiness among teachers and students at higher education and technical and vocational education and training (TVET) institutions in Cambodia. According to the 2020 Education Congress Report, there are 124 HEIs in Cambodia under 16 different ministries and agencies, of which 101 HEIs (81.45 percent) are under MoEYS and the Ministry of Labour and Vocational Training (MLVT). For logistical reasons, this study did not include the HEIs under the other 14 ministries in the sampling frame. HEIs with an enrolment of less than 500 were also excluded, leaving 75 HEIs as the primary sampling units for the first-stage sampling of HEIs. We employed systematic sampling with probability proportional to size, measured by the total student enrolment to select 22 HEIs. This process ensured that HEIs with large numbers of students were less likely to be excluded from the study.

4.2.1. Student survey

After selecting HEIs, the researchers requested lists of students enrolled in the 2019-2020 academic year from the sampled universities and technical training institutes. The numbers of sampled students by HEIs were calculated based on the enrolment size of each HEI. In total, 1,338 students were interviewed in person using a KoboToolbox survey between late July and early September 2020. The survey collected information regarding participants demography, education and training, internships and apprenticeships, access to and use of information communication technology (ICT) facilities and services, e-learning experience, technological readiness, and current enomic activities of students. Each participant was asked for consent before the interview and informed that their information would remain confidential.

4.2.2. Teacher survey

We used the student survey approach to construct our sampling frame to select teaching staff. Lists of part-time and full-time teaching staff were obtained from the selected HEIs. However, only 18 HEIs participated in the teacher survey. The teacher survey was conducted through in person interviews with 370 teachers using a KoboToolbox platform survey. The teacher survey was done after the student survey and ran from late September to early November. This survey collected teachers' demographic information, education and training, knowledge and use of ICT gadgets and services in teaching, technological readiness, and e-learning and online teaching experience during COVID-19.

4.3. Measurement of Technology Readiness Index (TRI)

The study uses the Technology Readiness Index (TRI 2.0) developed by Parasuraman and Colby in 2014 to measure the technology readiness of university students and teachers for e-learning adoption. The conceptual framework illustrates that TRI consists of four dimensions: optimism, innovativeness, discomfort, and insecurity. Each of the four dimensions has 4 Likert-style questions with response scales varying from 1 (strongly disagree) to 5 (strongly disagree). Each participant's TRI 2.0 is then constructed from the 16-item scale. Since they do not make their method available to the public, we relied on Parasuraman and Colby's expertise in constructing TRI from the data and requested they construct a TRI 2.0 for our data in order to classify students and teachers into the five categories of technological adopters.

4.4. Empirical estimation method

We applied three statistical methods to perform data analysis of the survey data. First, we examined differences in technological readiness and distribution of teachers and students across the five categories of e-learning adopters by utilizing both t-tests for continuous outcomes (i.e., TRI) and Chi-square tests for categorical outcomes (i.e., category of adopters). Second, we performed multivariate linear regression with school as fixed effects using Ordinary Least Square (OLS) estimation with clustered standard error at the school level. The OLS model allows us to examine the determinants of technology readiness among both teachers and students. We ran OLS estimation on the equations below for teacher (1) and student (2) samples:

$$TRI_{ij} = \beta_0 + \beta_1 IND_{ij} + \beta_2 TECH_{ij} + \beta_3 DEGREE_{ij} + \mu_j + \upsilon_{ij} \quad (1)$$

$$TRIS_{ij} = \alpha_0 + \alpha_1 IND_{ij} + \alpha_2 FAM_{ij} + \alpha_3 TECH_{ij} + \pi_j + \varepsilon_{ij} \quad (2)$$

In models (1) and (2), TRI_{ij} and $TRIS_{ij}$ represent outcomes (i.e., technology readiness index, or TRI) of teacher or student i, respectively, in school j. IND_{ij} in both models denotes characteristics of teacher or student i in school j, including the teacher's or student's gender, age, region of residence, marital status, academic stream in high school, foreign language proficiency, employment status, and/or teaching experience. In model (2), FAM_{ij} represents the family characteristics of students, including family size, number of living parents, and family assets (e.g., land, home durables, agricultural equipment, etc.). In models (1) and (2), $TECH_{ij}$ denotes teachers' and students' technology skills and training and whether they owned high-tech gadgets. Finally, model (1) also includes $DEGREE_{ij}$ which represents the highest level of education or degree (e.g., bachelor's, master's, or doctorate) that the teachers have attained.

The error term of the model was captured by ε_{ij} and υ_{ij}. We also included the school's fixed effects denoted by π_j for model (1) and π_j for model (2) to account for time-invariant unobserved school-level factors that might be correlated with one of the covariates since teachers and students were nested within schools. The OLS assumption is violated when an unobserved factor is correlated with the covariates (Wooldridge 2010, pp. 62). In our case, the unobserved school-level factors, like school quality as measured by highly-motivated school management team, for instance, are likely correlated with one of the covariates, like socio-economic status of students, leading to inconsistent estimation of coefficients (i.e., α or β). Such a correlation would simply prove that students with higher socioeconomic status likely end up in better-quality schools.

Another problem arising from this method is that the within-school error correlation can lead to misleading standard errors, narrow confidence intervals, large t-statistics, and low p-values for α and β (Cameron and Miller 2015, pp. 2). It is important to note that there must be some mechanism driving teachers and students to be at the same school. For instance, which school a student attends is often influenced by family background, place of residence, and parental choices that all reflect similarities between students within a particular school (Rabe-Hesketh and Skrondal 2012, pp. 2). This within-school error correlation can be overcome by clustering standard errors at the school level, which is what this study has done (Cameron and Miller 2015).

5. Results and discussion

5.1. Descriptive statistics of samples

Table 2 shows summary statistics for the teacher and student samples. While almost half of the surveyed students were male, only one in ten teachers was female. The low number of female teachers indicates a considerable gender gap in Cambodian HEIs. Students had an average age of 21.3 years, and the average age for teachers was approximately 40.8 years. Roughly 21% of students and 24% of teachers surveyed were born in urban areas. Almost all students (96%) were never married, while only 12% of the teachers were never married. Most students reported that their parents were alive and lived in a household with an average size of 5.4 members. Additionally, around two-thirds of students' households owned farmland. Close to two-thirds of students were in the social science academic track during high school and the other one-third were in science, which suggests the science track is only moderately popular in high school. The majority (86%) of surveyed students reported that their English language proficiency was either intermediate or fluent. Finally, for the teachers, the average number of teaching years was 11.4 years, and roughly one in five teachers earned a doctoral degree (92% had earned master's degrees).

Almost every student surveyed stated that they owned a smartphone, and more than two-thirds (75%) of them owned personal computer suggesting that most students at HEIs had some computer literacy. A substantial proportion of surveyed students had access to the internet at home and school either via LAN or Wi-Fi. Nevertheless, the small proportion who did not have access to the internet should receive support from schools to access the Internet. As for the teachers, nearly every teacher owned a personal computer and had access to the internet.

On top of that, 97% of teachers reported using ICT tools such as a computer, projector, email, and web-based learning environments. On average, 76.6% of their teaching activities involved ICT tools (see Table 2). Moreover, just under half (49.7%) of surveyed teachers had an above median score for the index of perceived benefit of using ICT when teaching. Half of all teachers had scores above the median for the index of general ICT competency while 47% of teachers scored above the median for the index of ICT-related training experience. The split in teachers' general ICT competency and ICT-related training experience index values suggests that more teachers need ICT-related training in order to successfully utilise online teaching strategies. Additionally, 46.5% of surveyed teachers had above mean value scores for the index of school ICT infrastructures and policies suggesting that school ICT policies and infrastructure need further improvement.[1] Because the majority of teachers and students reported owning the required tools, such as a computer, smartphone, and/or tablet, and having access to the internet, this indicates that they are, to some extent, subconsciously prepared to adapt to the new tech-enhanced online learning environment required by the COVID-19 pandemic.

Table 2: Summary statistics of teacher and student samples

Characteristics	Student sample			Teacher sample		
	Mean	S.D.	N	Mean	S.D.	N
Outcome variables						
Technology readiness index (TRI 2.0)	3.12	0.33	1338	3.36	0.35	370
E-learning adoption before COVID-19	0.06	0.24	1338	0.09	0.29	370
E-learning adoption during COVID-19	0.97	0.18	1323	0.94	0.25	370
Individual characteristics						
Gender (male)	0.49	0.50	1338	0.90	0.29	370
Age	21.3	2.70	1338	40.8	8.23	370
Birthplace regions						
Urban (capital city of Phnom Penh)	0.21	0.41	1338	0.24	0.43	370
Provincial town	0.16	0.37	1338	0.18	0.38	370
District	0.28	0.45	1338	0.38	0.48	370
Rural	0.35	0.47	1338	0.20	0.39	370
Marital status						
Never married	0.96	0.18	1338	0.12	0.33	370
Married	0.03	0.18	1338	0.87	0.33	370
Divorced/separated	0.01	0.03	1338	0.01	0.09	370
Number of years of teaching	-	-	-	11.37	6.77	370
Highest degree						
Doctoral degree	-	-	-	0.21	0.41	370
Master's degree	-	-	-	0.92	0.27	370
Bachelor's degree	-	-	-	0.99	0.11	370
Academic track (Science)	0.38	0.48	1302	-	-	-
Language proficiency						
Fluent	0.31	0.46	1338	-	-	-
Intermediate	0.55	0.49	1338	-	-	-
Basic	0.14	0.34	1338	-	-	-

1 We dichotomized the indexes of general ICT competency, ICT-related training experience, and school ICT infrastructures and policies by replacing the indexes with one for those with above-median value and zero for those with equal- and below-median value.

Hours spent surfing internet per day	7.0	3.5	1338	-	-	-
Surfing the internet for school work	0.98	0.11	1338	-	-	-
Access to computer freely at school	0.44	0.49	1338	-	-	-
Did any work in the past seven days	0.60	0.49	1338	-	-	-
Hours spent on online study per day	3.6	2.3	1338	-	-	-
Satisfied with e-learning during COVID-19	0.27	0.44	1280	-	-	-
Preferred e-learning over traditional class	0.03	0.17	1280	-	-	-
Family characteristics						
Father is alive	0.90	0.29	1338	-	-	-
Mother is alive	0.96	0.18	1338	-	-	-
Household size	5.4	1.8	1338	5.10	2.16	370
Number of children	-	-	-	1.78	1.17	370
Own farmland	0.67	0.47	1338	-	-	-
Home durable asset index (median)	-0.18	2.38	1338	-	-	-
Agricultural asset index (median)	-0.24	1.54	1338	-	-	-
Ownership of technology gadgets						
At home						
Smart phone	0.99	0.05	1338	-	-	-
Personal computer	0.75	0.43	1338	0.98	0.11	370
Tablet	0.11	0.32	1338	0.47	0.50	370
Internet access: LAN	0.13	0.34	1338	-	-	-
Internet access: Wi-Fi	0.63	0.48	1338	-	-	-
Internet access: LAN or Wi-Fi	-	-	-	0.95	0.21	370
At school						
Personal computer	0.83	0.37	1338	0.87	0.52	370
Internet access: LAN	0.58	0.37	1338	-	-	-
Internet access: Wi-Fi	0.91	0.29	1338	-	-	-
Internet access: LAN or Wi-Fi	-	-	-	0.98	0.17	370
ICT-related skills and training						
Ever taken online class before COVID-19	0.06	0.23	1338	0.19	0.39	370
Use ICT tools when teaching	-	-	-	0.97	0.15	370
Percentage of using ICT tools when teaching	-	-	-	76.6	26.2	370
Perceived benefit of ICT (median)	-	-	-	-0.33	0.91	370
General ICT competency (median)	-	-	-	0.16	0.94	370
ICT-related training experience (median)	-	-	-	0.13	0.85	370
School ICT infrastructures & policies						
Index of school ICT infrastructures & policies	-	-	-	0.18	0.95	370

Note: Principle component analysis (PCA) was used to derive home durable asset index and agricultural asset index, while indexes for perceived benefit and disadvantage of using ICT when teaching (e.g. improved ICT skills, add new teaching methods, easy monitoring of student learning progress, accessed to more quality learning resources, collaborate with other faculty, collaborate with faculty from other schools, better managed administrative tasks, increased workload, increased work pressure, and taught less effectively), general ICT competency (e.g. MS Word and Excel, Power Point Presentation, email, photo edit, electronic filing, SPSS/Stata), ICT-related training experience (e.g. introductory & advanced MS Office, multimedia, internet, ICT-integrated pedagogy) and school ICT infrastructures & policies (e.g. ICT use policy, ICT tools for teacher & student, technical support, and required ICT skill, knowledge and tools among students) were derived using confirmatory factor analysis (CFA).

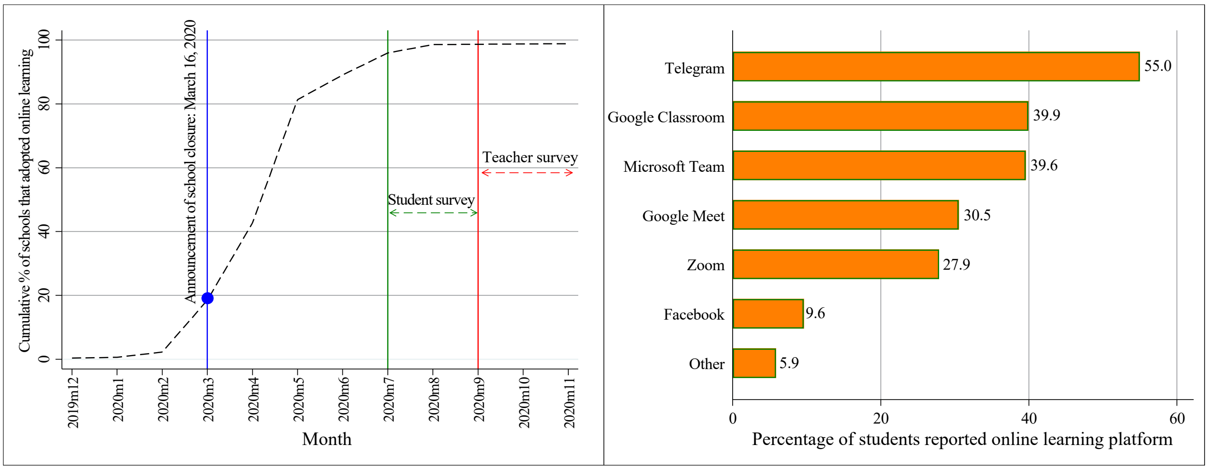
5.2. E-learning adoption before and during COVID-19

Our teacher and student surveys suggested that the pace of e-learning and teaching adoption among students and teachers prior to the pandemic had been slow. For instance, only 6% of the surveyed students reported that they had taken online classes before the pandemic while only 9% of teachers reported that they had taught online class before the pandemic (see Table 2). Nonetheless, the global pandemic has completely changed the picture of e-learning adoption by forcing teachers and students to shift their traditional face-to-face classroom to an online one. Almost every student (97%) and teacher (94%) have adopted online learning and teaching during the pandemic. Although majority of the teachers and students stated that they owned tech gadgets and had access to the internet, whether students and teachers were ready for the technology adoption relied on their mental motivators.

On March 16, 2020, all schools were ordered to close in order to contain the spread of the virus (Chet and Sok 2020). It took several months for all schools to shift to online learning completely. However, the shift was abrupt, and student learning outcomes might have been negatively affected since not every student had ample experience to adapt to the new online learning environment. Our surveys showed that only 23.7% of students reported spending one to two hours per day for online classes while the remaining 41.8% of students reported they spent three hours daily, suggesting that some learning losses may have arisen due to school closures. A recent survey of Cambodian university students focusing on their experience of the use of Massive Open Online Courses (MOOC) for learning showed that just under half (48.6%) of them had heard of MOOC, which indicates students have limited experience with online classes (Corrado, Pretorious and van der Westhuizen 2021). Panel A in Figure 2 shows the evolution of the proportion of schools that shifted to online learning as reported by their students between December 2019 and August 2020. Results from our student survey showed that less than one-third (27%) of students were satisfied with the online learning environment. Additionally, only 3% of students preferred online learning to traditional classroom environment, which suggests that majority of students were not able to effectively adapt to online learning. In addition, according to surveyed students, the most common platforms used for online learning included Telegram, Google Classroom, Microsoft Team, Google Meet, and Zoom (Panel B in Figure 2).

Figure 2: Schools adopting online classes and online platforms

Panel A: Proportion of schools going online   Panel B: Online platforms used by students

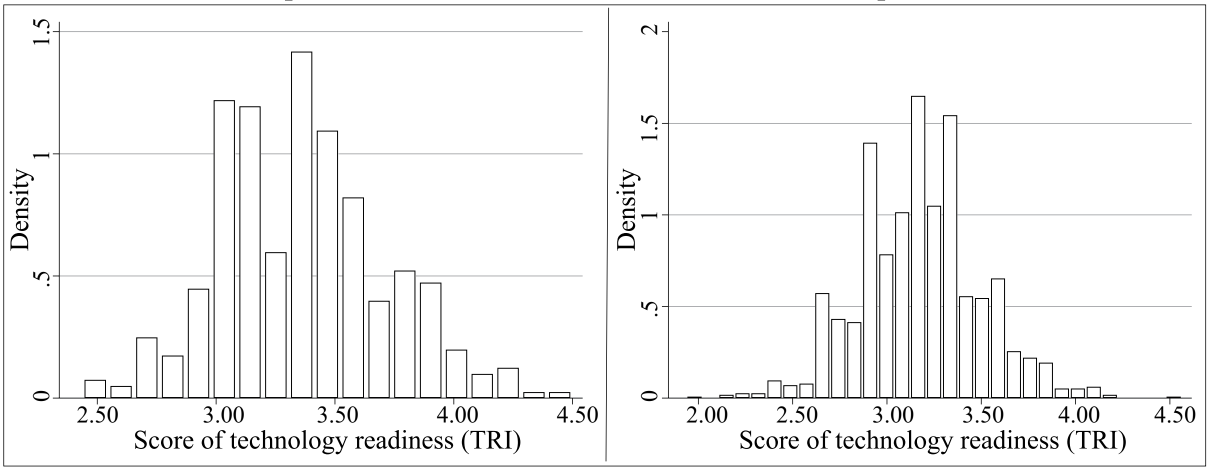


5.3. Descriptive analysis of technology readiness

Table 3 describes the level of TRI and levels of each of the four TRI components across five segmentations of surveyed teachers and students. Generally, the average TRI scores for teachers and students showed that they were optimistic about new technologies with teachers scoring 4.17 and students scoring 3.77. Teachers were more optimistic and technologically ready than the students since the overall TRI score for teachers was higher. This finding may suggest that teachers' accumulated experience of using ICT in their classroom as well as their positive perception (attitude) toward the usefulness and benefit of using ICT tools in class is beneficial. In fact, around 97% of teachers surveyed reported using ICT in their class and half of them perceived using ICT when teaching as a benefit. Overall, we found that teachers and students were moderately ready for new technology since their TRI scores were slightly above the 3.0 average score.

Figure 3: Distribution of TRI for teacher and student samples

Panel A: Teacher sample   Panel B: Student sample



Within the teacher sample, the majority of respondents fell into either the *explorer*, *pioneer*, or *sceptic* categories leaving less than 6% of respondents in the *hesitator* or *avoider* categories. Roughly one-third of teachers were rated as *explorers* who are both highly motivated to adopt new technology and least inhibited from accepting new technology, and this is reflected in their scores of each TRI component in Table 3. The *explorers* group does not require substantive assistance and persuasion to adopt new technology. Instead, they are usually the first to adopt it. This group can also be leveraged to convince their peers who fall into other categories to consider using new technology because they can serve as *evangelists* thereby lowering the cost of training others to use new technology (Parasuraman and Colby 2015). The *pioneers* are teachers who are also highly motivated but have a high level of discomfort and insecurity about new technology. *Pioneer* teachers make up 23.8% of the sample. This group will need support, encouragement, training, friendly design, and reassurance about using new technology to overcome their emotional discomfort and insecurity (Parasuraman and Colby 2015). Since our estimates indicate that approximately 60% of the pioneers had positive perceptions about benefit of using ICT in their class, it seems promising to persuade them to use new technology, including online learning tools.

The second largest of the five categories constituting about 38.9% of the teachers surveyed are the *sceptics*. Although *sceptic* teachers have a low level of discomfort and insecurity about using new technology in class, they also have low level of motivation to use new technology.

According to Parasuraman and Colby (2015), persuasive messages that provide teachers with concrete reasons to integrate new technology into their teaching and learning environment must be developed to attract this group of teachers. However, once they are persuaded, they are ready to adopt new technology due to their low levels of discomfort and insecurity.

The two smallest categories in our sample—the *hesitators* and *avoiders*—indicate that there are many ways HEIs can support teachers in implementing new technology in their classrooms without spending large amounts on training and support. The *hesitator* group, which is just 5.1% of the surveyed teachers, have moderate motivation but a high level of discomfort and insecurity about new technology. The least technology-ready group of teachers—*avoiders*—constitutes less than 1% of the sample. Such a small percentage of *avoiders* is an excellent sign of the technology readiness of Cambodian teachers at HEIs because they usually show low levels of motivation but high levels of discomfort and insecurity about new technology. Parasuraman and Colby (2015) suggest that both *hesitators* and *avoiders* tend to be satisfied with the basic functionality of new technology (e.g., tech-based educational resources) but need strong support and reassurance about using that technology. Since the last two groups constitute less than 10% of the sample, it is not of great concern to HEIs and policymakers to structure training and support for teachers that fall into these categories.

Table 3: Segmentation of teachers and students based on Technology Readiness Index (TRI)

		Mean (Ranks)				
Segments (n)	%	Optimism	Innovativeness	Discomfort	Insecurity	TRI
Teacher sample						
Full sample (370)	100	4.17	3.46	2.99	3.20	3.36
1. Explorers (117)	31.7	4.47 (1)	3.77 (2)	2.52 (5)	2.70 (5)	3.75 (1)
2. Pioneers (88)	23.8	4.27 (2)	3.84 (1)	3.65 (1)	3.77 (1)	3.17 (3)
3. Sceptics (144)	38.9	3.87 (4)	3.12 (3)	2.94 (4)	3.21 (4)	3.21 (2)
4. Hesitators (19)	5.1	4.25 (3)	2.47 (5)	3.25 (3)	3.47 (3)	3.00 (4)
5. Avoiders (2)	0.5	2.50 (5)	2.50 (4)	3.37 (2)	3.50 (2)	2.53 (5)
Adjusted R-square		37%	46%	43%	36%	62%
Student sample						
Full sample (1338)	100	3.77	3.11	2.89	3.31	3.17
1. Explorers (171)	12.8	4.31 (1)	3.68 (1)	2.50 (5)	2.74 (4)	3.69 (1)
2. Pioneers (146)	10.9	4.10 (2)	3.61 (2)	3.53 (1)	3.82 (2)	3.09 (3)
3. Sceptics (919)	68.7	3.64 (4)	3.02 (3)	2.83 (4)	3.31 (5)	3.13 (2)
4. Hesitators (64)	4.8	3.99 (3)	2.18 (5)	3.07 (3)	3.44 (3)	2.91 (4)
5. Avoiders (38)	2.8	2.86 (5)	2.22 (4)	3.30 (2)	3.87 (1)	2.47 (5)
Adjusted R-square		39%	42%	22%	21%	49%

Note: Adjusted R-squared were obtained from linear regression model in which TRI and each of its components were used as dependent variables and student and teacher segments were categorical independent variables. Adjusted R-squared presents percentage of each TR component and overall TR explained by the segmentation variable.

Within the student sample, more than two-thirds of the students fall into the *sceptics* category, and less than 25% fall into either *explorer* or *pioneer* categories. Additionally, less than 10% of students are among *hesitators* and *avoiders*, which is a similar percentage to that of teachers. However, the most-ready adopters of new technology, the *explorers*, constitute just 12.8% of the student sample. Since this group is highly motivated and least inhibited from using new educational technology and forms the smallest proportion of the sample, interventions to attract students to new technology are going to be more costly than those for teachers. More importantly, *pioneers* as the second most-ready adopters, who are highly motivated, but with high level of inhibition, make up a small proportion (10.9%) of the sample. This group needs strong support when using new technology, but little persuasion to adopt new technology.

The *sceptics* are similar to the *explorers* in terms of their technology readiness and constitute around 68.7% of the total sample, which is the largest group by far. This suggests that to attract a large pool of students to new technology, policymakers or higher education administrators will need to pay considerable attention to crafting persuasive messages that provide students with concrete reasons for using technology and pair that with material supports, like making tablets, laptops, and desktop computers available. According to Badri et al. (2014), despite being constrained by high level of discomfort and insecurity, once *sceptics* are convinced, they are ready to adopt the new technology. The smallest two categories—*hesitators* and *avoiders*—form such a small proportion of the sample that spending additional resources to attract them to use e-learning technology is not of great concern.

5.4. Regional and gender gaps in technology readiness

This section presents an analysis of regional and gender gaps by comparing the mean of overall TRI and percentages of each of the five categories of teachers and students by region and gender (see Tables 4 and 5). We did not find any differences based on gender in the mean of overall TRI in urban (Phnom Penh) and that in non-urban areas (province, district, and rural) for both teacher and student samples. We also performed tests of regional differences using the mean of optimism, innovativeness, discomfort, and insecurity from the teacher and student samples. We did not find any significant difference in the TRI components for the teacher sample but found significantly higher scores of three components—optimism, innovativeness, and insecurity—in urban areas for the student sample. However, the differences are extremely small and vary from 0.07 (optimism) to 0.15 (innovativeness) to 0.16 (insecurity).

Regarding possible regional gaps between the categories of the teacher sample, we found that the proportion of *pioneers* in urban areas (27.1%) was substantially and statistically significantly higher than that in non-urban areas (13.3%). By comparison, the proportion of *hesitators* in urban areas (3.9%) was statistically and significantly lower than that in non-urban areas (8.9%). For the student sample, we found that the percentages of both *explorers* (16% vs. 11.5%) and *pioneers* (15.5% vs. 9.1%) in urban areas were statistically and significantly higher than those in non-urban areas. However, the proportion of *sceptics* in urban areas (62.2%) was statistically and significantly lower than that in non-urban areas (71.3%).

Table 4: Urban and rural gaps in TRI scale and segments of teachers and students

Outcomes	Teacher sample			Student sample		
	Urban (Phnom Penh)	Province, district, rural	Difference	Urban (Phnom Penh)	Province, district, rural	Difference
TRI score	3.36	3.34	0.1	3.18	3.16	-0.02
1. Explorers	31.4	32.2	-0.8	16	11.5	4.5**
2. Pioneers	27.1	13.3	13.8***	15.5	9.1	6.4***
3. Sceptics	37.1	44.4	-7.3	62.2	71.3	-9.1***
4. Hesitators	3.9	8.9	-5.0*	3.7	5.2	-1.5
5. Avoiders	0.4	1.1	-0.8	2.6	2.9	-0.3

Note: TRI score is expressed as mean, while segments are expressed as percentage. A t-test of difference in mean is performed for TRI score, while Chi-square test of difference in proportion is performed for each segment of the teachers and students. Urban, province, district, and rural denote locations of HEIs.

*** significant at 1%; ** significant at 5%; * significant at 10%.

Results from our t-test of TRI showed that male teachers and students had a higher TRI mean than female teachers or students did (see Table 5). Notably, there was a larger TRI gender gap in the teacher sample than there was in the student sample. We also observed significant differences in the proportion of teachers and students who scored into certain categories. For instance, the teacher sample had a significantly higher proportion of male teachers who were *explorers* compared to the same category of female teachers. Additionally, the proportion of female teachers who were *sceptics* was significantly higher than that of male teachers. For the student sample, the proportion of male students who were *pioneers* was significantly higher than that of female students while the proportion of female students who were *sceptics* was significantly higher than their male counterparts. Our findings suggest that male teachers could help motivate their female peers to accept and adopt new technology since most of them are *pioneers* and *explorers* while the majority of female teachers are *sceptics*. However, both male and female students need considerable support and motivation to accept new technology.

Table 5: Gender gap in TRI scale and segments of teachers and students

Outcomes	Teacher sample			Student sample		
	Male	Female	Difference	Male	Female	Difference
TRI score	3.37	3.25	0.12**	3.19	3.15	0.04***
1. Explorers	33.13	17.14	16.0*	13.81	11.76	2.05
2. Pioneers	23.88	22.86	1.02	14.11	7.74	6.37***
3. Skeptics	37.01	57.1	-20.1**	65.62	71.73	-6.11**
4. Hesitators	5.37	2.86	2.51	4.8	4.76	0.04
5. Avoiders	0.60	0.00	0.60	1.65	4.02	-2.37***

Note: TRI score is expressed as mean, while segments are expressed as percentage. A t-test of difference in mean is performed for TRI score, while Chi-square test of difference in proportion is performed for each segment of the teachers and students. Urban, province, district, and rural denote locations of HEIs.

*** significant at 1%; ** significant at 5%; * significant at 10%.

5.5. Determinants of technology readiness

This section presents the analysis of the determinants of technology readiness (TR) among teachers and students during the COVID-19 pandemic using multivariate linear regression models with school as fixed effects and robust clustered standard errors. Results for the teacher and student samples are presented in Table 6 and Table 7, respectively.

For the teacher sample, we identified a number of factors that were statistically and significantly associated with level of TR, including birthplace region, ownership of tablet at home, percentage of teaching time using ICT tools, perceived benefit of using ICT when teaching, general ICT competency, ICT-related training experience, and perception about school ICT infrastructure and policy. We found that teachers who were born in urban (capital city of Phnom Penh) areas were more willing to adopt new technology than those born in the provinces. The recent expansion of HEIs to the provinces has provided province-born teachers with an unprecedented opportunity to contribute to their communities. However, it is important to note that, traditionally, teachers who are ready to take on new challenges and compete for higher pay prefer to work in Phnom Penh, and this trend continues today. Therefore, urban-born teachers are more likely to be *explorers*, but less likely to be *sceptics* due to self-selecting factors.

Table 6: Determinants of technology readiness among teachers

Dependent variable	Teacher TR score		
	Coefficient	S.E.	P-value
Sex (male)	0.113	0.074	0.145
Age 42 and above	-0.053	0.029	0.106
Married or live together (Ref: Single or divorced)	-0.008	0.082	0.920
Region (Ref: Phnom Penh)			
Provincial capital	-0.145**	0.056	0.019
District	-0.066	0.042	0.136
Rural	-0.074	0.054	0.191
Number of years of teaching experience	0.006	0.010	0.508
Square of years of teaching experience	-0.0001	0.0003	0.657
Number of children	-0.010	0.023	0.665
Own computer at home	-0.125	0.234	0.601
Own tablet at home	0.074**	0.031	0.028
Access to internet at home	-0.029	0.079	0.721
Computer at school	-0.006	0.041	0.884
Access to internet at school	-0.017	0.125	0.891
Hold a PhD degree (Reference: Master/bachelor)	0.007	0.044	0.867
Ever taught online before the COVID-19	0.032	0.061	0.597
Percentage of teaching using ICT tools	0.002***	0.001	0.009
Perceived benefit of using ICT when teaching	0.060**	0.024	0.023
General ICT competency	0.042**	0.020	0.052
ICT-related training experience	0.081**	0.031	0.018
School ICT infrastructure & policies	0.063***	0.020	0.005
Constant	3.317	0.296	0.000
School fixed effects	Yes		
Number of observations	370		
R-squared	0.31		

Note: Standard errors are clustered at school level. Indexes for perceived benefits and disadvantages of using ICT when teaching (e.g. improved ICT skills, add new teaching methods, easy monitoring of student learning progress, access to more quality learning resources, collaborating with other faculty, collaborating with faculty from other schools, better managed administrative tasks, increased workload, increased work pressure, and taught less effectively), general ICT competency (e.g. MS Word and Excel, PowerPoint Presentation, email, photo edit, electronic filing, SPSS/Stata), ICT-related training experience (e.g. introductory & advanced MS Office, multimedia, internet, ICT-integrated pedagogy) and school ICT infrastructures & policies (e.g. ICT use policy, ICT tools for teacher & student, technical support, and required ICT skill, knowledge and tools among students) were derived using confirmatory factor analysis (CFA).

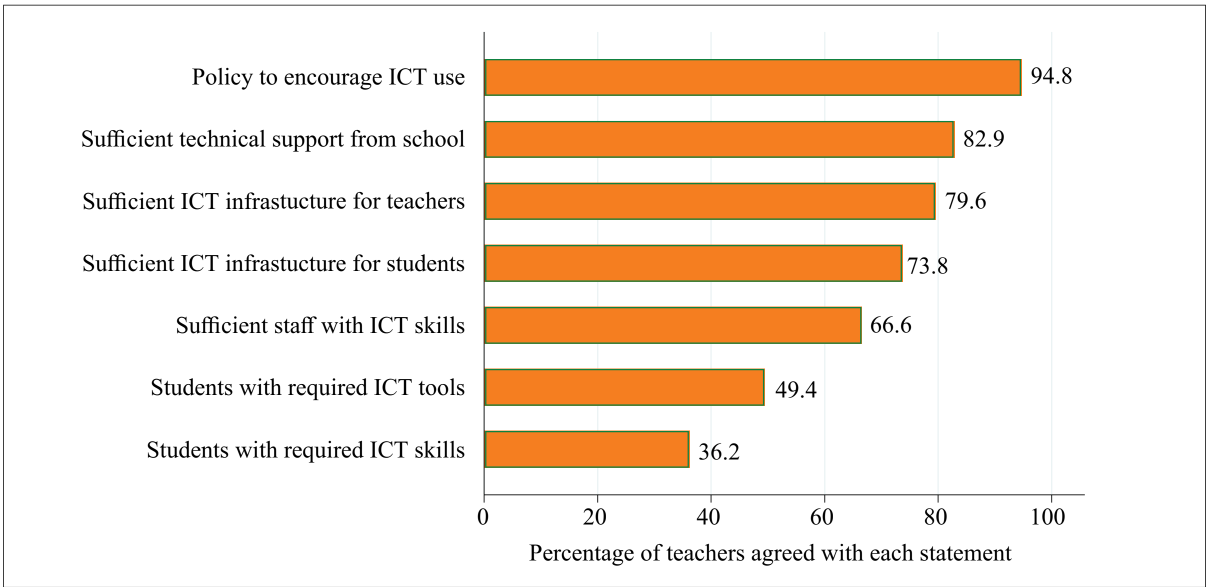
*** significant at 1%; ** significant at 5%; * significant at 10%.

Additionally, we found teachers who owned tablets at home had higher TR scores by approximately 0.07 points. Surprisingly, we did not find any significant association between computer ownership at home and a higher TR score because almost every teacher had a personal computer (98%). The percentage of teaching time using ICT tools was found to be associated with TR score, but the magnitude of the association was extremely small. The increase in hours of teaching using ICT tools is associated with higher TR scores. However, given the small magnitude of the association, our finding provided minimal economic importance for future mandates for increasing teaching time using ICT tools. Nonetheless, it is important to note that this variable may interact with other variables in the regression model, such as the perceived benefit of using ICT when teaching, general ICT competency, or ICT-related training experience. Generally, without good understanding of ICT tools and a positive perception of the benefits of ICT, teachers are not able to use ICT tools optimally.

Another factor, the perceived benefit of using ICT when teaching, was also found to be related to TR score. A one-unit (a standard deviation of 0.99) increase in the index of perceived benefit of ICT use was associated with a 0.06 increase in the TR score, which was equivalent to about 1.8% of the mean of the overall TR score. Our results showed a promising sign of the effects of integrating ICT into higher education. Having a sense of the perceived benefit or usefulness of ICT in addition to having a positive attitude toward ICT and technology, in particular, were found to be associated with behavioural intention to use technology in the literature (e.g., El Alfy, Gómez, and Ivanov 2016).

General ICT competency and ICT-related training experience were also shown to have a positive association with teachers' TR score. The magnitude of the association of the ICT-related training experience variable was twice as large as the size of the association of the general ICT competency. This suggests that while general ICT competency was crucial for improving TR score, ICT-related training experience was even more important. A one-unit increase in the index of general ICT competency and index of ICT-related training experience was associated with 0.04 and 0.08 increase in TR scores, respectively. Our findings, therefore, provide support for the government's integration of ICT skills training in higher education for lecturers as laid out in the Master Plan for ICT (MoEYS 2010).

Figure 4: Perception of teacher toward school and student ICT



Last, we identified teachers' perceptions regarding school ICT infrastructures and policy as factors influencing teachers' technology readiness. We found that a one-unit increase in the index of teachers' perception regarding school ICT infrastructures and policy was associated with 0.06 increase in the teachers' TR score. We further examined each component of the index by showing the proportion of teachers who somewhat or strongly agreed with each of the components in the graph below (see Figure 4). The majority of the teachers had a positive perception on all but two components of whether students had the required ICT tools (49.4%) and skills (36.2%). This clearly suggests that if teachers' assessment of students' ICT tools and skills were right, improving students' ICT tools and skills would enhance teachers' confidence or readiness in their use of ICT in their teaching. The objective of improving all first-year students' ICT-based professional skills as outlined in the 2009-2013 Master Plan for ICT in education should be fulfilled (MoEYS 2010).

For the student sample, we identified a number of factors that are statistically and significantly associated with levels of technology readiness, including gender, English language proficiency, home durable asset, ownership of a tablet at home, experience taking online classes, satisfaction with online learning during COVID-19, and average hours spent online every day. In our regression model, we demonstrated a gendered difference in students' level of technology readiness that was not found among teachers. We found that male students were more technology-ready than their female counterparts. On average, males had TR scores approximately 0.03 higher than female students.

Table 7: Determinants of technology readiness among students

Dependent variable	Student TR score		
	Coefficient	S.E.	P-value
Gender (male)	0.034*	0.019	0.091
Birthplace regions (Ref: Phnom Penh)			
Provincial capital	-0.009	0.026	0.729
District	0.044	0.035	0.218
Rural	0.053	0.035	0.149
Academic stream at high school			
(Science=1, Social science, otherwise)	-0.018	0.015	0.230
English language proficiency (Ref: Basic)			
Intermediate	0.026	0.023	0.261
Fluent	0.121***	0.021	0.000
Family size	-0.002	0.004	0.603
Father alive	-0.009	0.022	0.696
Mother alive	0.011	0.072	0.882
Own farmland	-0.037	0.025	0.158
Index of durable home asset	0.015**	0.006	0.030
Index of agricultural asset	0.009	0.007	0.237
Own computer at home	-0.021	0.028	0.453
Own tablet at home	0.056*	0.027	0.054
Internet (LAN) at home	0.054	0.038	0.171
Internet (Wi-Fi) at home	0.008	0.020	0.703
Computer at school	0.004	0.025	0.887
Internet (LAN) at school	0.025	0.017	0.162
Internet (Wi-Fi) at school	-0.008	0.024	0.162
Taken any online class before the COVID-19	0.092**	0.042	0.042
Satisfaction with online learning (Ref: Unsatisfied)			
Neutral	0.071***	0.013	0.000
Satisfied	0.103***	0.024	0.000
Log average hours spent online per day	0.031*	0.017	0.083
Access to computer freely at school	-0.017	0.019	0.372

Did any work in the past seven days	0.029	0.023	0.229
Log average hours spent on online study	0.002	0.025	0.927
Constant	2.988	0.118	0.000
School fixed effects	Yes		
Number of observations	1247		
R-squared	0.12		

Note: Standard errors are clustered at school level. Principle component analysis (PCA) was used to derive home durable asset index and agricultural asset index.

*** significant at 1%; ** significant at 5%; * significant at 10%.

High levels of English language proficiency were also found to be associated with high TR scores. Students who could speak English fluently were found to have approximately 0.12 TR score higher than those with basic speaking proficiency. This suggests that schools with a more rigorous English language program that operate in tandem with their degree program tend to better prepare their students to be ready for new technology. Our data also indicated that well-off students were more technology-ready than students from poor family backgrounds. When the index of household income durable assets was increased by one unit, the TR score of students increased by 0.015. In addition to home durable assets, we demonstrated that students who owned tablets at home had higher TR scores than students who did not. However, we found was no rise in TR scores among students who owned a computer, which suggests that students may value the portability and convenience of tablets compared to computers. However, it is essential to note that most of the surveyed students had personal computers (75%) at home, and 63% had Wi-Fi access. Similar to teachers' experiences with ICT tools, tablets were a practical and popular tool to get more students ready to adopt new technology and online learning. Therefore, providing subsidies for students from low socioeconomic backgrounds to get a tablet may help to enhance technology readiness among students.

Unlike teachers, students' level of online learning experience was found to be associated with their level of technology readiness. Students who had taken online classes before COVID-19 had TR scores about 0.09 higher than that of students who had never taken online classes before. In addition, logs of the average number of hours spent surfing the internet daily were found to be associated with a student's level of technology readiness. A 1% increase in average hours spent online was associated with a 0.03 increase in TR score. This finding suggests that students with more experience surfing the internet tended to be more technology-ready than those with less experience surfing the internet. Nonetheless, it is important to note that among those who surfed the internet 99.3% of students reported that they surfed the internet for studying, learning new skills, or reading. Meanwhile, most of these students also reported that they surfed the internet for entertainment (97.3%), work (56%), and communication with friends and family (80%).[2]

Lastly, we identified students' satisfaction with their online learning experience during COVID-19 as a determinant of their level of technology readiness. Students who reported being neutral or satisfied with online learning had between 0.07 and 0.10 increases in their TR scores. This finding suggests that students who were able to moderately (neutral) or strongly (satisfied) adapt to the new online learning environment tended to possess qualities of being technology-ready. It is therefore crucial to understand the characteristics of those who were

2 Responses were from multiple-response question meaning that students were allowed to select all options including surfing internet for study, surfing internet for entertainment, surfing internet for work, and surfing internet for communication with friends and family. Therefore, percentages for all response added up to more than 100%.

not satisfied with the e-learning environment so that strong, persuasive messages about using technology can be communicated to them along with necessary ICT training courses that are tailored to them. It is also crucial to develop an intervention to improve the perception of online learning among students who were neutral.

6. Conclusion and policy implications

6.1. Conclusion

In conclusion, this study sheds light on the landscape of online learning adoption and Cambodian teachers' and students' technology readiness in the context of the COVID-19 pandemic. Prior to the pandemic, the adoption of e-learning was limited revealing challenges stemming from insufficient motivation, support, and funding within HEIs. However, the pandemic compelled an overwhelming shift to online learning albeit with potential learning losses due to limited online engagement.

Teachers exhibited greater technology readiness compared to students, which was underpinned by their optimism, motivation, and accumulated experience with ICT tools. The segmentation analysis revealed that while teachers predominantly fell into the *explorer* and *pioneer* categories, students were more likely to fall into the *sceptic* group. The high level of student *sceptics* indicates the need for targeted strategies to enhance students' ICT skills and change perceptions about the benefits of using technology in learning. Urban teachers more likely to be *pioneers* and less likely to be *hesitators* while urban students are more likely to be *explorers* and *pioneers*. Such regional variation underscores the importance of providing a tailored approach to promoting technology adoption. Discrepancies in technology readiness also varied by gender with female teachers and students having lower TR scores and being more likely to fall into the sceptics category.

Through qualitative analysis using regression models, various determinants of technology readiness were identified for both teachers and students. For teachers, factors included birthplace region, home tablet ownership, ICT tool usage in teaching, perceived benefits of ICT use, ICT competency, training experience, and perceptions of school ICT infrastructure. Meanwhile, students' factors determining technology readiness included gender, level of English proficiency, household assets, tablet ownership, prior online class experience, satisfaction with online learning, and daily online hours.

In light of these findings, it is evident that comprehensive strategies are essential to promoting effective online learning and teaching. Addressing supply-side challenges—aligning institutional visions, resource allocation, and ICT infrastructure development—as well as addressing demand-side issues—student motivation and access to necessary tools—should be paramount. The use of a robust Learning Management System (LMS) platform, accompanied by proper training, motivation, and consultation, is a promising way to enhance ICT integration in higher education.

Since the COVID-19 pandemic has exposed vulnerabilities in educational systems worldwide, it is imperative to bolster technology readiness among educators and learners alike. By recognising the importance of teacher training, student support, and equitable access, Cambodia's HEIs can navigate current and future challenges posed by online learning, ensuring a resilient and effective educational environment in the future.

6.2. Policy implications

Based on the findings, the study proposes the following policy implications to create a more technologically inclusive and adaptive learning environment in order to enhance the overall quality of education and student experiences.

- **Student preparedness and support**: It is crucial to bolster technology readiness among students entering HEIs by initiating pre-entry ICT skills training in general education. These programs should equip incoming students with foundational digital skills and familiarise them with essential technology tools. Moreover, offering comprehensive orientation sessions and ongoing support services can help students navigate the transition to online learning environments. These sessions should address any discomfort or insecurity students may feel when adapting to digital platforms. Concurrently, HEIs should enhance students' English language proficiency because, as our study has shown, there is a positive correlation between English language skills and technology readiness underscoring the importance of strengthening English language education.
- **Equitable access to technology**: Ensuring equitable access to technology is paramount in cultivating a technologically inclusive learning environment. Institutions should establish programs aimed at bridging the technology gap for students from low socioeconomic backgrounds. Providing subsidies for laptops or tablets and reliable internet connectivity to all students can enable their effective participation in online learning regardless of students' backgrounds. Collaborations with telecommunication providers would facilitate internet access, particularly in rural and remote areas, thereby ensuring all students have equal opportunities to engage in online education.
- **Curriculum and pedagogical changes**: To foster greater comfort with technology, HEIs should advocate for the integration of ICT tools into the curriculum and teaching methodologies. Faculty members should be encouraged to incorporate digital tools seamlessly into their teaching practices enabling students to interact with technology in meaningful ways. Emphasising the use of digital learning resources and platforms that align with students' preferences can enhance student engagement and familiarity with technology.
- **Support programs for teachers**: Training programs for teachers will be crucial to facilitate the integration of technology into their teaching practice. These training programs should encompass a wide range of ICT skills that cater to teachers' varying levels of proficiency. Providing a balanced mix of face-to-face and online training sessions can accommodate different learning preferences and schedules. Practical skills such as designing engaging online lessons, creating interactive activities, and effectively managing online discussions should be emphasised.
- **Addressing gender and regional disparities**: Targeted interventions are essential to bridge gender and regional gaps in technology readiness. Support for female students and students in rural areas in embracing technology will ensure that they have equal access to technology and learning opportunities thereby minimising disparities.
- **Research and innovation**: Encouraging research initiatives that explore emerging trends in technology adoption and readiness among teachers and students is imperative. This research can yield insights into effective strategies for integrating technology into education. Furthermore, fostering a culture of innovation among educators can lead to the development of approaches that cater to the unique needs and preferences of Cambodians in the country's educational context.

References

Abdon, Buenafe R., Seishi Ninomiya, and Robert T. Raab. 2007. "E-Learning in Higher Education Makes Its Debut in Cambodia: Implications of the Provincial Business Education Project." *The International Review of Research in Open and Distributed Learning* 8 (1). https://doi.org/10.19173/irrodl.v8i1.333.

Alfy, Shahira El, Jorge Marx Gómez, and Danail Ivanov. 2017. "Exploring Instructors' Technology Readiness, Attitudes and Behavioral Intentions towards e-Learning Technologies in Egypt and United Arab Emirates." *Education and Information Technologies* 22 (5): 2605–27. https://doi.org/10.1007/s10639-016-9562-1.

Alqabbani, Samiah, Afrah Almuwais, Nada Benajiba, and Fatmah Almoayad. 2021. "Readiness towards Emergency Shifting to Remote Learning during COVID-19 Pandemic among University Instructors." *E-Learning and Digital Media* 18 (5): 460–79. https://doi.org/10.1177/2042753020981651.

Al-Qirim, Nabeel, Kamel Rouibah, Ali Tarhini, Mohamed Adel Serhani, Aishah Rashid Yammahi, and Maraim Ahmed Yammahi. 2018. "Towards a Personality Understanding of Information Technology Students and Their IT Learning in UAE University." *Education and Information Technologies* 23 (1): 29–40. https://doi.org/10.1007/s10639-017-9578-1.

AlSaqqaf, Asmaa, and Hu Ke. 2021. "Investigating E-Learning Readiness During the COVID-19 Pandemic Among Malaysian ESL Teachers: What Are the Limitations of Current Scales?" *KnE Social Sciences*, June, 41–46. https://doi.org/10.18502/kss.v5i6.9176.

Alsoud, Anas Ratib, and Ahmad Ali Harasis. 2021. "The Impact of COVID-19 Pandemic on Student's E-Learning Experience in Jordan." *Journal of Theoretical and Applied Electronic Commerce Research* 16 (5): 1404–14. https://doi.org/10.3390/jtaer16050079.

ASEAN Secretariat. 2020. "ASEAN Sustainable Development Goals Indicators Baseline Report 2020." Jakarta.

Aydin, Cengiz, and Deniz Tasci. 2005. "Measuring Readiness for E-Learning: Reflections from an Emerging Country." *Journal of Educational Technology & Society* 8 (4): 244–57.

Ayres, David M. 2000. *Anatomy of a Crisis: Education, Development, and the State in Cambodia, 1953-1998*. Honolulu: University of Hawaii Press.

Badri, Masood A, Jihad Mohaidat, and Asma Al Rashedi. 2013. "Technology Readiness of School Teachers - An Empirical Study of Measurement and Segmentation." *Industrial Engineering & Management* 02 (04): 1–10. https://doi.org/10.4172/2169-0316.1000117.

Chapnick, Samantha. 2000. "Are You Ready for E-Learning?" *Learning Circuits: ASTD's Online Magazine All About ELearning*.

Chea, Phal, Seyhakunthy Hun, and Sivkim Cheam. 2020. "Disruption and Opportunities during the COVID-19 Pandemic in Cambodian Higher Education: Perspective from Teaching Staff." *Cambodia Development Review* 24 (4): 1–7.

Chet, Chealy. 2006. "Cambodia." In *Higher Education in South East Asia*, 13–33. Bangkok: UNESCO Asia and Pacific Regional Bureau for Education.

———. 2009. "Higher Education in Cambodia." In *The Political Economy of Educational Reforms and Capacity Development in Southeast Asia: Cases of Cambodia, Laos and Vietnam*, edited by Yasushi Hirosato and Yuto Kitamura, 153–65. Berlin: Springer.

Chet, Chealy, and Serey Sok. 2020. “Dangers and Opportunities Related to the COVID-19 Pandemic for Higher Education Institutions in Cambodia.” *Cambodia Journal of Basic and Applied Research (CJBAR)* 2 (1): 20–26.

Chung, Ellen, Geetha Subramaniam, and Laura Christ Dass. 2020. “Online Learning Readiness Among University Students in Malaysia Amidst Covid-19.” *Asian Journal of University Education* 16 (2): 45. https://doi.org/10.24191/ajue.v16i2.10294.

Clay, Melanie N., Stacey Rowland, and Abbot Packard. 2008. “Improving Undergraduate Online Retention through Gated Advisement and Redundant Communication.” *Journal of College Student Retention: Research, Theory & Practice* 10 (1): 93–102. https://doi.org/10.2190/CS.10.1.g.

Cameron, Colin A., and Douglas L. Miller. 2015. “A Practitioner’s Guide to Cluster-Robust Inference.” *Journal of Human Resources* 50 (2): 317–72. https://doi.org/10.3368/jhr.50.2.317.

Contreras, Jennifer, and Shadi M S Hilles. 2014. “Assessment in E-Learning Environment Readiness of Teaching Staff, Administrators, and Students of Faculty of Nursing-Benghazi University.” *International Journal of the Computer, the Internet and Management* 23 (1): 53–58.

Corrado, Riccardo, Erica Pretorius, and Gert van der Westhuizen. 2021. “Undergraduate Students’ Experiences of the Use of MOOCs for Learning at a Cambodian University.” *Education Sciences* 11 (7): 336. https://doi.org/10.3390/educsci11070336.

D. Borrero, Juan, Shumaila Y. Yousafzai, Uzma Javed, and Kelly L. Page. 2014. “Perceived Value of Social Networking Sites (SNS) in Students’ Expressive Participation in Social Movements.” *Journal of Research in Interactive Marketing* 8 (1): 56–78. https://doi.org/10.1108/JRIM-03-2013-0015.

Elwood, James, and George MacLean. 2009. “ICT Usage and Student Perceptions in Cambodia and Japan.” *Australian Journal of Emerging Technologies and Society* 7 (2): 65–82.

Engzell, Per, Arun Frey, and Mark D. Verhagen. 2021. “Learning Loss Due to School Closures during the COVID-19 Pandemic.” *Proceedings of the National Academy of Sciences* 118 (17). https://doi.org/10.1073/pnas.2022376118.

Eslaminejad, Tahereh, Mona Masood, and Nor Azilah Ngah. 2010. “Assessment of Instructors’ Readiness for Implementing e-Learning in Continuing Medical Education in Iran.” *Medical Teacher* 32 (10): 407–12. https://doi.org/10.3109/0142159X.2010.496006.

Gay, Glenda H. E. 2016. “An Assessment of Online Instructor E-Learning Readiness before, during, and after Course Delivery.” *Journal of Computing in Higher Education* 28 (2): 199–220. https://doi.org/10.1007/s12528-016-9115-z.

Händel, Marion, Melanie Stephan, Michaela Gläser-Zikuda, Bärbel Kopp, Svenja Bedenlier, and Albert Ziegler. 2022. “Digital Readiness and Its Effects on Higher Education Students’ Socio-Emotional Perceptions in the Context of the COVID-19 Pandemic.” *Journal of Research on Technology in Education* 54 (2): 267–80. https://doi.org/10.1080/15391523.2020.1846147.

Hung, Min-Ling, Chien Chou, Chao-Hsiu Chen, and Zang-Yuan Own. 2010. “Learner Readiness for Online Learning: Scale Development and Student Perceptions.” *Computers & Education* 55 (3): 1080–90. https://doi.org/10.1016/j.compedu.2010.05.004.

Junus, Kasiyah, Harry Budi Santoso, Panca Oktavia Hadi Putra, Arfive Gandhi, and Titin Siswantining. 2021. "Lecturer Readiness for Online Classes during the Pandemic: A Survey Research." *Education Sciences* 11 (3): 139. https://doi.org/10.3390/educsci11030139.

Kaushik, Mohit Kant, and Devika Agrawal. 2021. "Influence of Technology Readiness in Adoption of E-Learning." *International Journal of Educational Management* 35 (2): 483–95. https://doi.org/10.1108/IJEM-04-2020-0216.

Mahyoob, Mohammad. 2020. "Challenges of E-Learning during the COVID-19 Pandemic Experienced by EFL Learners." *Arab World English Journal* 11 (4): 351–62. https://doi.org/10.24093/awej/vol11no4.23.

Martha, Ati Suci Dian, Kasiyah Junus, Harry Budi Santoso, and Heru Suhartanto. 2021. "Assessing Undergraduate Students' e-Learning Competencies: A Case Study of Higher Education Context in Indonesia." *Education Sciences* 11 (4): 189. https://doi.org/10.3390/educsci11040189.

MoEYS. 2004. "Policy and Strategies on Information and Communication Technology in Education in Cambodia." Phnom Penh, Cambodia: MoEYS.

———. 2010. "Master Plan for Information and Communication Technology in Education." Phnom Penh, Cambodia: MoEYS.

———. 2019. "Education Strategic Plan 2019-2023." Phnom Penh, Cambodia: MoEYS.

Ngoun, Sovanroth. 2015. "Information, Communication and Technology and Higher Education in Cambodia." *Human Behavior, Development and Society* 11 (1): 58–63.

Obeidat, Alaa, Rana Obeidat, and Mohanned Al-Shalabi. 2020. "The Effectiveness of Adopting E-Learning during COVID-19 at Hashemite University." *International Journal of Advanced Computer Science and Applications* 11 (12): 96–104.

Obi, IE, AN Charles-Okoli, CC Agunwa, BI Omotowo, AC Ndu, and OR Agwu-Umahi. 2018. "E-Learning Readiness from Perspectives of Medical Students: A Survey in Nigeria." *Nigerian Journal of Clinical Practice* 21 (3): 293. https://doi.org/10.4103/njcp.njcp_108_17.

OECD. 2020. "Education and COVID-19: Focusing on the Long-Term Impact of School Closures." Paris: OECD Publishing.

Oketch, Hada Achieng. 2013. "E-Learning Readiness Assessment Model in Kenyas' Higher Education Institutions: A Case Study of University of Nairobi." Doctoral dissertation, University of Nairobi.

Paliwal, Manisha, and Archana Singh. 2021. "Teacher Readiness for Online Teaching-Learning during COVID − 19 Outbreak: A Study of Indian Institutions of Higher Education." *Interactive Technology and Smart Education* 18 (3): 403–21. https://doi.org/10.1108/ITSE-07-2020-0118.

Parasuraman, A. 2000. "Technology Readiness Index (TRI) a Multiple-Item Scale to Measure Readiness to Embrace New Technologies." *Journal of Service Research* 2 (4): 307–20. https://doi.org/10.1177/109467050024001.

Parasuraman, A., and Charles L. Colby. 2015. "An Updated and Streamlined Technology Readiness Index." *Journal of Service Research* 18 (1): 59–74. https://doi.org/10.1177/1094670514539730.

Parkes, Mitchell, Christine Reading, and Sarah Stein. 2013. "The Competencies Required for Effective Performance in a University E-Learning Environment." *Australasian Journal of Educational Technology* 29 (6). https://doi.org/10.14742/ajet.38.

Phan, Thanh Thi Ngoc, and Ly Thi Thao Dang. 2017. "Teacher Readiness for Online Teaching: A Critical Review." *International Journal Open Distance E-Learn. IJODeL* 3 (1): 1–16.

Pit, Chamnan, and David Ford. 2004. "Cambodian Higher Education: Mixed Visions." In *Asian Universities: Historical Perspectives and Contemporary Challenges*, edited by Philip G Altbach and Toru Umakoshi, 333–62. Baltimore, MD: The Johns Hopkins University Press.

Rabe-Hesketh, Sophia, and Anders Skrondal. 2008. *Multilevel and Longitudinal Modeling Using Stata*. 2nd edition. Stata Press.

Rafique, Ghulam Murtaza, Khalid Mahmood, Nosheen Fatima Warraich, and Shafiq Ur Rehman. 2021. "Readiness for Online Learning during COVID-19 Pandemic: A Survey of Pakistani LIS Students." *The Journal of Academic Librarianship* 47 (3): 102346. https://doi.org/10.1016/j.acalib.2021.102346.

Rokibul Kabir, Mohammad. 2020. "Impact of Faculty and Student Readiness on Virtual Learning Adoption amid Covid-19." *Revista Internacional de Educación Para La Justicia Social* 9 (3): 387–414. https://doi.org/10.15366/riejs2020.9.3.021.

Roper, Kerianne. 2006. "The Relationship between Faculty Use of Technology as a Teaching Tool and Student Satisfaction in Higher Education." *PhD Dissertation*. Doctoral Dissertation, Indiana: Anderson University.

Scherer, Ronny, Sarah K. Howard, Jo Tondeur, and Fazilat Siddiq. 2021. "Profiling Teachers' Readiness for Online Teaching and Learning in Higher Education: Who's Ready?" *Computers in Human Behavior* 118 (May): 106675. https://doi.org/10.1016/j.chb.2020.106675.

Summak, M. Semih, Murat Bağlıbel, and Mustafa Samancıoğlu. 2010. "Technology Readiness of Primary School Teachers: A Case Study in Turkey." *Procedia - Social and Behavioral Sciences* 2 (2): 2671–75. https://doi.org/10.1016/j.sbspro.2010.03.393.

Tang, Yuk Ming, Pen Chung Chen, Kris M.Y. Law, C.H. Wu, Yui-yip Lau, Jieqi Guan, Dan He, and G.T.S. Ho. 2021. "Comparative Analysis of Student's Live Online Learning Readiness during the Coronavirus (COVID-19) Pandemic in the Higher Education Sector." *Computers & Education* 168 (July): 104211. https://doi.org/10.1016/j.compedu.2021.104211.

Un, Leang, and Say Sok. 2018. "Higher Education Systems and Institutions, Cambodia." In *Encyclopedia of International Higher Education Systems and Institutions*, 1–10. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-017-9553-1_500-1.

Ünal, Yurdagül, Gülten Alır, and İrem Soydal. 2014. "Students Readiness for E-Learning: An Assessment on Hacettepe University Department of Information Management." In *Challenges of Information Management Beyond the Cloud. IMCW 2013*, edited by John N Gathegi, Yaşar Tonta, Serap Kurbanoğlu, Umut Al, and Zehra Taşkın, 423:137–47. Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-662-44412-2_13.

UNESCO. 2021a. "COVID-19: Reopening and Reimagining Universities, Survey on Higher Education through the UNESCO National Commissions." Paris: UNESCO.

———. 2021b. "One Year into COVID-19 Education Disruption: Where Do We Stand?" June 15, 2021.

———. 2021c. "New UNESCO Global Survey Reveals Impact of COVID-19 on Higher Education." July 15, 2021. https://en.unesco.org/news/new-unesco-global-survey-reveals-impact-covid-19-higher-education.

Williams, James H., Yuto Kitamura, and C. Sopcheak Keng. 2016. "Higher Education in Cambodia." In *The Political Economy of Schooling in Cambodia*, edited by Yuto Kitamura, D.Brent Edwards, Sitha Chhinh, and James H Willians, 167–86. New York: Palgrave Macmillan US. https://doi.org/10.1057/9781137456007_9.

Wooldridge, Jeffrey M. 2010. *Econometric Analysis of Cross Section and Panel Data*. Second Edition. Massachusetts: The MIT Press.

Appendix

Table A.1: 16-item questions capturing Technology Readiness Index (TRI 2.0)

TRI components	TRI questions for both teachers and students
Optimism	1. New technologies contribute to a better quality of life 2. Technology gives me more freedom of mobility 3. Technology gives people more control over their daily lives 4. Technology makes me more productive in my personal life
Innovativeness	1. Other people come to me for advice on new technologies 2. In general, I am among the first in my circle of friends to capture new technology when it appears 3. I can usually figure out new high-tech products and services without help from others 4. I keep up with the latest technological developments in my areas of interest
Discomfort	1. When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do 2. Technical support lines are not helpful because they do not explain things in terms I understand 3. Sometimes, I think that technology systems are not designed for use by ordinary people 4. There is no such thing as a manual for a high-tech product or service that is written in plain language
Insecurity	1. People are too dependent on technology to do things for them 2. Too much technology distracts people to a point that is harmful 3. Technology lowers the quality of relationships by reducing personal interaction 4. I do not feel confident doing business with a place that can only be reached online

Source: Parasuraman and Colby (2015)

CDRI Working paper series

WP 143) Yuki Kanayama. (November 2023). *Early Cohabitation and Intimate Partner Violence: Evidence from Cambodia.*

WP 142) Joakim Öjendal, Nong Monin, Sean Chanmony, Bunnath Zoe Sidana and Ngin Chanrith. (November 2023). *The Political Economy of Land-Water Resource Governance in the Context of Food Security in Cambodia.*

WP 141) Chea Phal, Tek Muytieng, and Nok Sorsesekha. (July 2023). *Gender Gap Reversal in Learning and Gender-Responsive Teaching in Cambodia.*

WP 140) Roth Vathana and Benghong Siela Bossba. (June 2023). *Impacts on the Lives and Livelihoods of Factory Workers during COVID-19: A Gender-sensitive Analysis.*

WP 139) Hing Vutha. (May 2023). *The Effects of COVID-19 on the Export Industry and Comparative Advantage of Cambodia*

WP 138) Heng Kimkong. (May 2023). *Cambodia's Aspirations to Become a Knowledge-Based Society: Perspectives of Cambodian University Students*

WP 137) Thy Savrin, Ly Tong and Ean Sokunthy. (May 2023). *Cambodian Upper Secondary School Education amid COVID-19 Pandemic: Challenges and Opportunities*

WP 136) You Saokeo Khantey, Alvin Leung, In Leavsovath, and Song Sopheak. (January 2023). *A Quantitative Study on Entrepreneurial Intention of University Students in Cambodia*

WP 135) Tek Muytieng, Nok Sorsesekha and Chea Phal (December 2022) *Faculty Engagement in Cambodian Higher Education Internationalisation*

WP 134) Chea Phal, Bo Chankoulika and Minami Ryuto (May 2022) *Cambodian Secondary School Teachers' Readiness for Online Teaching During the Covid-19 Pandemic*

WP 133) Kao Sovansophal, Chea Phal and Song Sopheak (March 2022) *Upper Secondary School Tracking and Major Choices in Higher Education: To Switch or Not to Switch*

WP 132) Ang Len and Young Sokphea (October 2021) *Civil Society Organisations and Youth Civic Engagement in Cambodia*

WP 131) Veung Naron and Ven Seyhah (October 2021) *Exploring Insights into Vocational Skills Development and Industrial Transformation in Cambodia*

WP 130) Chea Phal, Hun Seyhakunthy and Song Sopheak (September 2021) *Permeability in Cambodian Post-secondary Education and Training: A Growing Convergence*

WP 129) Sry Bopharath, Hiev Hokkheang, and Benghong Siela Bossba (August 2021) *Vending in the city: unprotected yet better off*

WP 128) Sim Sokcheng, Keo Socheat, Sarom Molideth (August 2021) *Pesticide Use Practices in Cambodia's Vegetable Farming*

WP 127) Leng Phirom, Khieng Sothy, Chhem Rethy and Gregory Smith (May 2021) *De-framing STEM discourses in Cambodia*

WP 126) Chea Vatana, You Saokeo Khantey and Song Sopheak (May 2021) *What Skills Training Do Cambodian Garment Workers Need?*

WP 125) Nong Monin (March 2021) *The Impacts of Climate Change on Agriculture and Water Resources in Cambodia: From Local Communities' Perspectives*

WP 124) Chea Sathya, Song Sopheak and Hun Seyhakunthy (December 2020) *Competency-Based TVET in Cambodia: Promise and Reality*

WP 123) Eam Phyrom, Heng Sambath, Ravy Sophearoth, Tim Bunly, Song Sopheak (July 2020) *Characteristics and Issues of Internship at Cambodian Private Firms: A Scoping Study*

WP 122) Ven Seyhah and Veung Naron (July 2020) *The Contribution Vocational Skills Development to Cambodia's Economy*

WP 121) Eam Phyrom, Ros Vutha, Heng Sambath and Ravy Sophearoth (July 2020) *Understanding Cambodian Dean's Conceptions and Approaches to University Accountability*

WP 120) Ros Vutha, Eam Phyrom, Heng Sambath and Ravy Sophearoth (Janyuary 2020) *Cambodian Academics: Identities and Roles*

WP 119) Ven Seyhah and Hing Vutha (October 2019) *Cambodia in the Electronic and Electrical Global Value Chains*

WP 118) Sothy Khieng, Sidney Mason and Seakleng Lim (October 2019) *Innovation and Entrepreneurship Ecosystem in Cambodia: The Roles of Academic Institutions.*

WP 117) Un Leang, Saphon Somolireasmey and Sok Serey (September 2019) *Gender Analysis of Survey on Cambodia's Young and Older Generation: Family, Community, Political Knowledge and Attitudes, and Future Expectations*

WP 116) Eng Netra, Ang Len, So Hengvotey, Hav Gechhong, Chhom Theavy (March 2019) *Cambodia's Young and Older Generation: Views on Generational Relations and Key Social and Political Issues*

WP 115) Mak Ngoy, Sok Say, Un Leang with Bunry Rinna, Chheng Sokunthy and Kao Sovansophal (May 2019) *Finance in Public Higher Education in Cambodia*

WP 114) Mak Ngoy, Sok Say, Un Leang with Bunry Rinna, Chheng Sokunthy and Kao Sovansophal (Apr 2019) *Governance in Public Higher Education in Cambodia*

WP 113) Ear Sothy, Sim Sokcheng, Chhim Chhun and Khiev Pirom (Dec 2017) *Rice Policy Study: Implications of Rice Policy Changes in Vietnam for Cambodia's Rice Policy and Rice Producers in South-Eastern Cambodia*

WP 112) Roth Vathana, Abdelkrim Araarz, Sry Bopharath and Phann Dalis (March 2017) *The Dynamics of Microcredit Borrowings in Cambodia*

WP 111) Ear Sothy, Sim Sokcheng and Khiev Pirom (March 2016) *Cambodia Macroeconomic Impacts of Public Consumption on Education – A Computable General Equilibrium Approach*

WP 110) Vong Mun (December 2016) *Progress and Challenges of Deconcentration in Cambodia: The Case of Urban Solid Waste Management*

WP 109) Sam Sreymom, Ky Channimol, Keum Kyungwoo, Sarom Molideth and Sok Raksa. (December 2016). *Common Pool Resources and Climate Change Adaptation: Community-based Natural Resource Management in Cambodia*

WP 108) Ly Tem (January 2016), *Leadership Pathways for Local Women: Case Studies of Three Communes in Cambodia*

WP 107) Chhim Chhun, Buth Bora and Ear Sothy (September 2015), *Effect of Labour Movement on Agricultural Mechanisation in Cambodia*

WP 106) Chhim Chhun, Tong Kimsun, Ge Yu, Timothy Ensor and Barbara McPake (September 2015), *Impact of Health Financing Policies on Household Spending: Evidence from Cambodia Socio-Economic Surveys 2004 and 2009*

WP 105) Roth Vathana and Lun Pide (August 2015), *Health and Education in the Greater Mekong Subregion: Policies, Institutions and Practices – the Case of Cambodia* in Khmer

WP 104) Sum Sreymom and Khiev Pirom (August 2015), *Contract Farming in Cambodia: Different Models, Policy and Practice*

WP 103) Chhim Chhun, Tong Kimsun, Ge Yu, Timothy Ensor and Barbara McPake (June 2015), *Catastrophic Payments and Poverty in Cambodia: Evidence from Cambodia Socio-Economic Surveys 2004, 2007, 2009, 2010 and 2011*

WP 102) Eng Netra, Vong Mun and Hort Navy (June 2015), *Social Accountability in Service Delivery in Cambodia*

WP 101) Ou Sivhouch (April 2015), *A Right-Based Approach to Development: A Cambodian Perspective*
WP 100) Sam Sreymom with Ouch Chhuong (March 2015), *Agricultural Technological Practices and Gaps for Climate Change Adaptation*
WP 99) Phay Sokcheng and Tong Kimsun (December 2014), *Public Spending on Education, Health and Infrastructure and Its Inclusiveness in Cambodia: Benefit Incidence Analysis*
WP 98) Srinivasa Madhur (August 2014), *Cambodia's Skill Gap: An Anatomy of Issues and Policy Options*
WP 97) Kim Sour, Dr Chem Phalla, So Sovannarith, Dr Kim Sean Somatra and Dr Pech Sokhem (August 2014), *Methods and Tools Applied for Climate Change Vulnerability and Adaptation Assessment in Cambodia's Tonle Sap Basin*
WP 96) Kim Sean Somatra and Hort Navy (August 2014), *Cambodian State: Developmental, Neoliberal? A Case Study of the Rubber Sector*
WP 95) Theng Vuthy, Keo Socheat, Nou Keosothea, Sum Sreymom and Khiev Pirom (August 2014), *Impact of Farmer Organisations on Food Security: The Case of Rural Cambodia*
WP 94) Heng Seiha, Vong Mun and Chheat Sreang with the assistance of Chhuon Nareth (July 2014), *The Enduring Gap: Decentralisation Reform and Youth Participation in Local Rural Governance*
WP 93) Nang Phirun, Sam Sreymom, Lonn Pichdara and Ouch Chhuong (June 2014), *Adaptation Capacity of Rural People in the Main Agro-Ecological Zones in Cambodia*
WP 92) Phann Dalis (June 2014), *Links between Employment and Poverty in Cambodia*
WP 91) Theng Vuthy, Khiev Pirom and Phon Dary (April 2014), *Development of the Fertiliser Industry in Cambodia: Structure of the Market, Challenges in the Demand and Supply Sidesand the Way Forward*
WP 90) CDRI Publication (January 2014), *ASEAN 2030: Growing Together for Economic Prosperity–the Challenges (Cambodia Background Paper)*
WP 89) Nang Phirun and Ouch Chhuong (January 2014), *Gender and Water Governance: Women's Role in Irrigation Management and Development in the Context of Climate Change*
WP 88) Chheat Sreang (December 2013), *Impact of Decentralisation on Cambodia's Urban Governance*
WP 87) Kim Sedara and Joakim Öjendal with the assistance of Chhoun Nareth (November 2013), *Gatekeepers in Local Politics: Political Parties in Cambodia and their Gender Policy*
WP 86) Sen Vicheth and Ros Soveacha with the assistance of Hieng Thiraphumry (October 2013), *Anatomy of Higher Education Governance in Cambodia*
WP 85) Ou Sivhuoch and Kim Sedara (August 2013), *20 Years' Strengthening of Cambodian Civil Society: Time for Reflection*
WP 84) Ou Sivhuoch (August 2013), *Sub-National Civil Society in Cambodia: A Gramscian Perspective*
WP 83) Tong Kimsun, Lun Pide and Sry Bopharath with the assistance of Pon Dorina (August 2013), *Levels and Sources of Household Income in Rural Cambodia 2012*
WP 82) Nang Phirun (July 2013), *Climate Change Adaptation and Livelihoods in Inclusive Growth: A Review of Climate Change Impacts and Adaptive Capacity in Cambodia*
WP 81) Hing Vutha (June 2013), *Leveraging Trade for Economic Growth in Cambodia*
WP 80) Saing Chan Hang (March 2013), *Binding Constraints on Economic Growth in Cambodia: A Growth Diagnostic Approach*

WP 79) Lun Pidé (March 2013), *The Role of Rural Credit during the Global Financial Crisis: Evidence From Nine Villages in Cambodia*

WP 78) Tong Kimsun and Phay Sokcheng (March 2013), *The Role of Income Diversification during the Global Financial Crisis: Evidence from Nine Villages in Cambodia*

WP 77) Saing Chan Hang (March 2013), *Household Vulnerability to Global Financial Crisis and Their Risk Coping Strategies: Evidence from Nine Rural Villages in Cambodia*

WP 76) Hing Vutha (March 2013), *Impact of the Global Financial Crisis on the Rural Labour Market: Evidence from Nine Villages in Cambodia*

WP 75) Tong Kimsun (March 2013), *Impact of the Global Financial Crisis on Poverty: Evidence from Nine Villages in Cambodia*

WP 74) Ngin Chanrith (March 2013), *Impact of the Global Financial Crisis on Employment in SMEs in Cambodia*

WP 73) Hay Sovuthea (March 2013), *Government Response to Inflation Crisis and Global Financial Crisis*

WP 72) Hem Socheth (March 2013), *Impact of the Global Financial Crisis on Cambodian Economy at Macro and Sectoral Levels*

WP 71) Kim Sedara and Joakim Öjendal with Chhoun Nareth and Ly Tem (December 2012), *A Gendered Analysis of Decentralisation Reform in Cambodia*

WP 70) Hing Vutha, Saing Chan Hang and Khieng Sothy (August 2012), *Baseline Survey for Socioeconomic Impact Assessment: Greater Mekong Sub-region Transmission Project*

WP 69) CDRI Publication (March 2012), *Understanding Poverty Dynamics: Evidence from Nine Villages in Cambodia*

WP 68) Roth Vathana (March 2012), *Sectoral Composition of China's Economic Growth, Poverty Reduction and Inequality: Development and Policy Implications for Cambodia*

WP 67) Keith Carpenter with assistance from PON Dorina (February 2012), *A Basic Consumer Price Index for Cambodia 1993–2009*

WP 66) TONG Kimsun (February 2012), *Analysing Chronic Poverty in Rural Cambodia Evidence from Panel Data*

WP 65) Ros Bansok, Nang Phirun and Chhim Chhun (December 2011), *Agricultural Development and Climate Change: The Case of Cambodia*

WP 64) Tong Kimsun, Sry Bopharath (November 2011), *Poverty and Evironment Links: The Case of Rural Cambodia*

WP 63) Heng Seiha, Kim Sedara and So Sokbunthoeun (October 2011), *Decentralised Governance in Hybrid Polity: Localisation of Decentralisation Reform in Cambodia*

WP 62) Chea Chou, Nang Phirun, Isabelle Whitehead, Phillip Hirsch and Anna Thompson (October 2011), *Decentralised Governance of Irrigation Water in Cambodia: Matching Principles to Local Realities*

WP 61) Ros Bandeth, Ly Tem and Anna Thompson (September 2011), *Catchment Governance and Cooperation Dilemmas: A Case Study from Cambodia*

WP 60) Saing Chan Hang, Hem Socheth and Ouch Chandarany with Phann Dalish and Pon Dorina (November 2011), *Foreign Investment in Agriculture in Cambodia*

WP 59) Chem Phalla, Philip Hirsch and Someth Paradis (September 2011), *Hydrological Analysis in Support of Irrigation Management: A Case Study of Stung Chrey Bak Catchment, Cambodia*

WP 58) Hing Vutha, Lun Pide and Phann Dalis (August 2011), *Irregular Migration from Cambodia: Characteristics, Challenges and Regulatory Approach*

WP 57) Tong Kimsun, Hem Socheth and Paulos Santos (August 2011), *The Impact of Irrigation on Household Assets*

Cambodia Development Resource Institute
56 Street 315, Tuol Kork
PO Box 622, Phnom Penh, Cambodia
+855 23 881 701/881 916/883 603
cdri@cdri.org.kh
www.cdri.org.kh

9 789924 500476