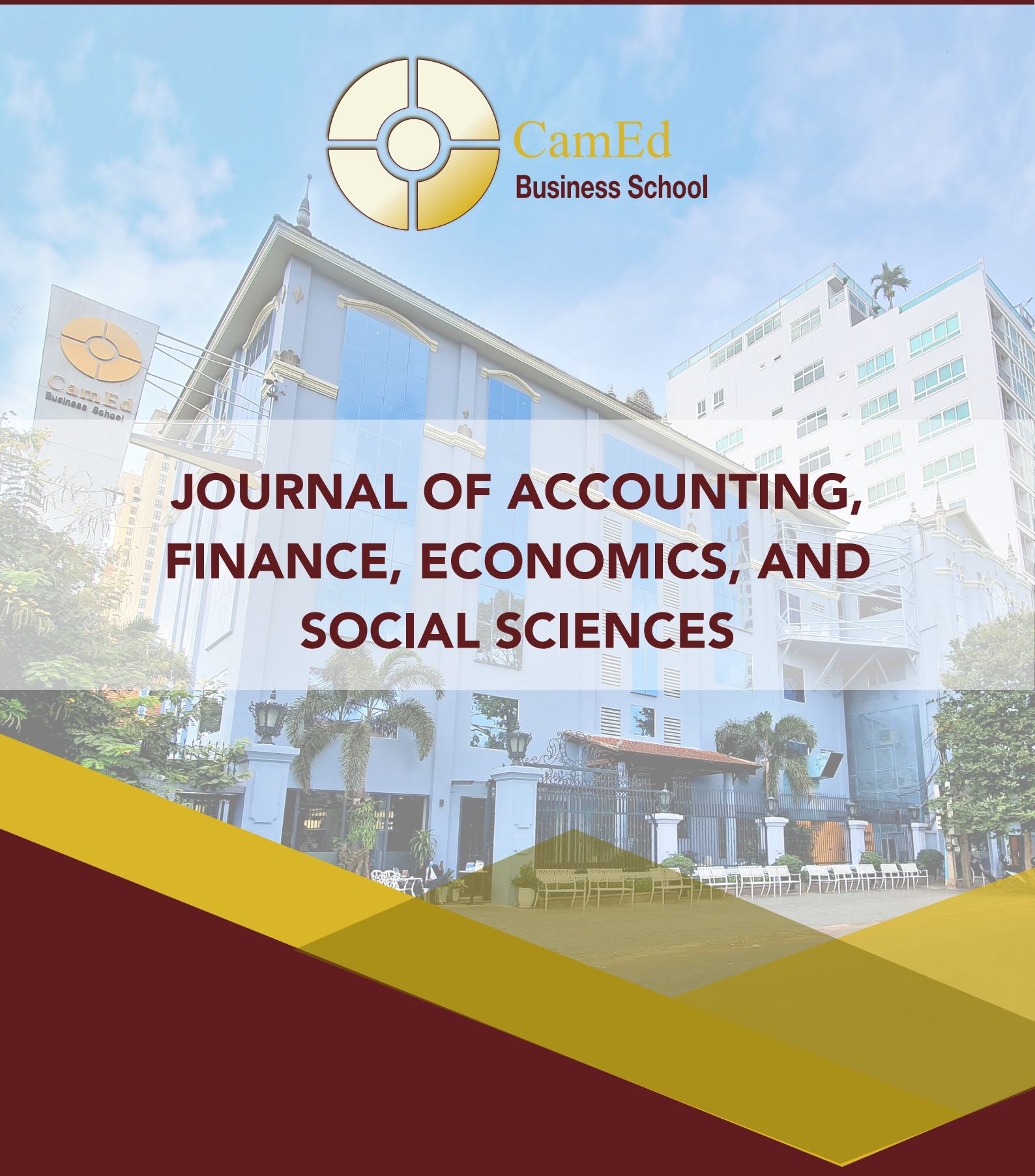
Vol 5, No 1, July – December 2020

Print ISSN : 2708-616X
Online ISSN : 2708-6178

CamEd
Business School



JOURNAL OF ACCOUNTING, FINANCE, ECONOMICS, AND SOCIAL SCIENCES

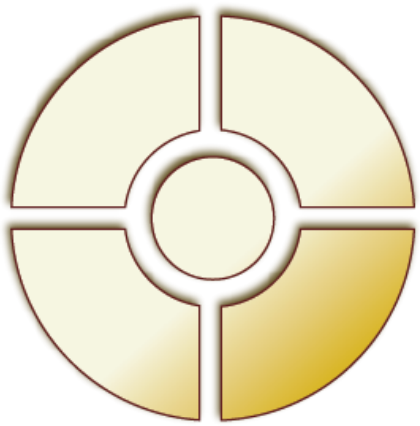
JAFESS Editorial Office

• Bunthorn Yem Email: ybunthorn@cam-ed.com	CamEd Business School, Cambodia
• Narin Choeun Email: cnarin@cam-ed.com	CamEd Business School, Cambodia

CamEd Business School

Building 64, Street 108, Wat Phnom, Daun Penh, Phnom Penh, Cambodia

Inquiries: editorial@jafess.com



Journal of Accounting, Finance, Economics, and Social Sciences

Publisher
CamEd Business School
Phnom Penh, Cambodia

Printer
CamEd Business School
Phnom Penh, Cambodia

Editor-in-Chief
Prof. Tapas R. Dash
CamEd Business School
Phnom Penh, Cambodia

Printed at
CamEd Business School
64 Street 108, Phnom Penh, Cambodia
Phone: (855)-23 986 522

Membership

Contents

Journal of Accounting, Finance, Economics, and Social Sciences
Vol 5, No 1, July – December 2020, pp. 1-8
Received: Mar 2020 | Revised: May 2020 | Accepted: Jun 2020
DOI: https://doi.org/10.62458/jafess.160224.5(1)1-8

Cambodia's Pathway to Education 4.0

Martin Sviatko*

ABSTRACT

This research paper seeks to analyze an ongoing fourth industrial revolution and its implications for tertiary education. The paper starts with a brief review of the Industry 4.0 framework, highlighting its trajectory, features, and main attributes. As technological advancement, disruption, and automation of processes appear to be the undeniable hallmarks of Industry 4.0, the global economy is undergoing a significant transformation – thus creating new economic winners and losers, while dodging the conventional East-West, North-South geo-economic divide. With these changes occurring on an unprecedented scale, the limits of traditional tertiary education are being laid bare, revealing a growing mismatch between skills acquisition provided by public universities, and the skills required by businesses. Thus, this paper argues that Education 4.0 should not only be viewed as a necessary requirement for bridging the widening gap between industry and academia, it has become a critical interface for Industry 4.0, with its added focus on relevant and up-to-date acquisition of knowledge, skills, values, and attitudes that are required in the workplace. The section of the paper which presents an analysis of Education 4.0's implementation in Cambodia, proposes a course of action that the relevant stakeholders are compelled to take in order to allow tertiary education to carry out its predominant function: producing future-ready graduates. In its conclusion, the research paper argues that given the magnitude of the ongoing industrial revolution, technological disruptions will only intensify in the future. Therefore, creating a set of comprehensive Education 4.0 policies will become a task of utmost urgency, which policy makers can no longer ignore.

Keywords: Industrial revolutions, industry 4.0, technology, disruption, automation, education 4.0, Cambodia.

1. INTRODUCTION

In 2019, numerous countries around the world were rocked by civil unrest, triggering deep internal political crises in the context of prolonged global economic uncertainty. Late last year, thousands of discontented citizens gathered in public places in countries and autonomous communities such as Chile, Lebanon, Catalonia, and Iraq to protest against their own governments' particular policies. Although these countries are as mutually diverse as is possible, with the degree of protests also varying from country to country in terms of their intensity and nature – bearing in mind that some of them took an ugly, violent form – it has become increasingly evident that there must be some common denominators behind these anti-government rallies.

Firstly, in almost all of the cases, the protests were initiated by non-partisan activists, who vented their frustrations in a very public manner by organizing protests, but on a relatively small- scale. In spite of the different social fabric of those countries where these protests took place, the fact that large segments of society quickly identified themselves with the initial acts of discontent – allowing protests to take center stage in the nation's politics – indicates that a large reservoir of discontent was already dormant below the surface well before the first round of protests erupted. That is certainly true with regards to Lebanon and Iraq, where the faulty lines of a political divide have distinct religious and ethnic dimensions. In other words, marginal dissatisfaction has allowed the rise of mass discontent – a textbook example of a nation's act of defiance against its elected representatives. Not surprisingly, the protests led to the collapse of the governments in both countries, therefore bearing a striking similarity with the Arab Spring that swept through the Middle East region in 2011.

Secondly, perhaps with the exception of Catalonia where nationalism or independentismo tends to overshadow Spain's economic woes, what these

* Martin Sviatko, PhD. Associate Professor, CamEd Business School.
Email: martin@cam-ed.com

non-partisan activists have in common is that an overwhelming majority of them consist of public university students, who are voicing their discontent over rising tuition fees and a lack of proper employment opportunities. Public education, especially in its tertiary form – widely regarded as a pathway to a good life – no longer seemed to deliver on its promises, thereby wrecking both the theory of upward social mobility, as well as the standard economic theory which claims that public education is a prerequisite for a country's economic development. Simply put, having a university degree is no longer enough for getting a decently remunerated white-collar job. This notion was widely acknowledged in Chile and Lebanon, where students' protests right from their onset highlighted a growing mismatch between the skills acquisition advertised and provided by public universities, and those required by businesses.

Furthermore, in all the above-mentioned countries, the problem was further compounded by the fact that students' protests have uncovered another latent economic issue – rising income inequality. Although this element is an integral part of any market economy, and will continue to be so for many years to come, very recent changes in the global economy have heightened this problem, with some economists calling the inequality crisis "as one of the three existential crises that the world is facing today."[1] Understandably, this situation has left many people feeling perplexed, disoriented and discontented. Fingers of blame have been pointed at the governments of the day, which have quickly become symbols of institutional breakdown, where the social contract or trust between citizens and their elected representatives has been irreversibly damaged. The purpose of this research paper is to understand how this mismatch came to be and what needs to be done to address it.

2. INDUSTRY 4.0 ARRIVES

Although there is no universally agreed academic definition of this term, Industry 4.0 refers to the fourth stage of the industrial change that the world has been experiencing continuously over the past 250 years. Industry 1.0, which started around 1760 on the back of steam power, brought about a dramatic departure from the human-dominated workplace once and for all. As machines slowly took over manufacturing processes – marking the onset of mechanical production – productivity and efficiency rose to previously unseen levels. The modern age of technological disruption had begun. Creating a work environment where machinery and people coexist has not only marked a crucial milestone for a capitalist economy – setting off a process of disruption of jobs and skills that has lasted until today – but has also been seen as the only feasible strategy to transform agrarian society in the fastest and cheapest possible way.

Industry 2.0, or the second industrial revolution, was launched around the 1840s thanks to the creation of railway networks, which linked previously disconnected geographical regions, and the progress made in the field of electrical engineering. If the steam engine enabled the first industrial revolution, then electrification fuelled the second one. As the use of electricity expanded, other technological advancements blossomed, allowing more and more countries to embrace the industrialization process. On the one hand, this stage of development saw increased rates of productivity, largely thanks to mass production techniques. Progress in science enabled medical discoveries and this, in turn, increased people's life expectancy. On the other hand, the work environment witnessed a significant rise in the use of machinery and equipment at the expense of humans, placing machines and people at odds. This pattern was replicated during the last stages of the third industrial revolution, and is likely to become a distinct feature of the fourth industrial revolution.

Unfortunately, indisputable progress achieved during the Industry 2.0 era was squandered by two world wars. In the Western Hemisphere, a period of postwar policies resulted in workers' rights to a fair share of productivity gains, giving rise to a new middle class, particularly between 1946 and 1964. It was members of this urban-based middle class, who spearheaded the third industrial revolution, with digitalization at its core. Perhaps the best embodiment of Industry 3.0 was the creation of computer technology. Technological progress, aided by integration processes within the postwar international economy, made the world connected on an unprecedented basis. And because investments in technology, IT, and telecommunication began producing higher returns than ever before, digitalization has become a focal point of an increasingly globalized economy. The inability to embrace these technological changes contributed to the rapid demise of obsolete, centrally-planned economic systems between 1989 and 1991. The sudden fall of communism is also an indication of the fate of those who decide to abstain from trade, innovation, and investment in technology – be it political organizations, private entities, or ordinary

citizens. And at the turn of the twenty-first century, it has become clear that the new economic winners or losers will not emerge from the conventional East-West or North-South geopolitical divisions, but from within the global market. This stage of industrial development has also been recognized by increased automation, which has significantly reduced the role of humans in the workplace. Obviously, automation in the early stages of the third industrial revolution looks very different from what occurred in its last stage. Enabled by the rise of Artificial Intelligence (AI), automation has been able to absorb more and more complex functions that have traditionally been assigned to humans. In summary, we can say that if the third industrial revolution started with digitalization, then automation of workplace processes does not only appear to represent its last stage, but it can also serve as a link to Industry 4.0 – a term introduced by K. Schwab, the founder and executive chairman of the World Economic Forum.

According to Schwab, "we stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society. Now, a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. There are three reasons why today's transformation represents merely not a prolongation of the Third Industrial Revolution but rather the arrival of a Fourth and distinct one: velocity, scope and systems impact. The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance."[2]

As technological advancement, disruption, and automation of processes appear to be the indisputable hallmark of Industry 4.0, the global economy will undergo a significant transformation, affecting everyone – regardless of one's race, religion, ethnicity or social status. With these changes happening on an unprecedented scale, the limits of traditional tertiary education are being laid bare. Public protests and riots, mentioned earlier, are clear testimonies to that. Such reality compels us to find solutions to the problems posed by the rise of Industry 4.0. Attempting to overcome a disjoint between industry and academia, Education 4.0 has appeared to address some of these challenges.

3. EDUCATION 4.0

Education 4.0 is not only viewed as a necessary requirement for bridging the widening gap between industry and academia, but by catering for the needs of Industry 4.0, Education 4.0 is poised to become its critical academic interface as it focuses on the acquisition of relevant and up-to-date knowledge, skills, values, and attitudes that are required in the workplace. In short, it aims to seek alignment between academia and the ongoing fourth industrial revolution by means of a comprehensive overhaul of traditional education. In doing so, it urgently calls for the attention of policy makers to make education a top priority for the advancement of the economy.

Given the magnitude of the current, ongoing industrial revolution, it is reasonable to expect that technological disruption will only intensify in the future, but this will not be the only factor that will negatively affect the job market. Industry 4.0 comes at a time when the planet's population will reach 7.8 billion by February 2020. As this number steadily increases, automation will continue to obliterate occupations. Consequently, the educational sector is facing a perfect storm. Thus, Education 4.0 proposes a course of action that the relevant stakeholders are compelled to take in order to allow tertiary education to produce future-ready graduates with the necessary skills: creativity, innovation, critical thinking, technical skills, and emotional intelligence.

The Industrial Revolution 4.0 is transforming the world through technologies like the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI), which are impacting major industries and jobs. It can be considered similar to the replacement of manual jobs by machine-handled tasks that occurred in the past. This means that Industry 4.0 will not only affect industries, but will also transform the way jobs and education are seen and understood. This has resulted in the evolution of Education 4.0. Thus, it can be said that the fourth industrial revolution

is affecting the roles for which today's students are being prepared. This requires educational institutions to produce a workforce suitable for this technologically transformed era. Furthermore, it also requires the current workforce to upgrade their skills and knowledge to match these newly created job roles. For this, a revolution in education is essential to enable people worldwide to harness the opportunities created by the advent of these technologies. This transformation of the education industry will make it more personalized, peer-to-peer, and it will be a continuing process.[3]

Having explained the changing landscape of the global economy, we can now attempt to highlight the defining characteristics of Education 4.0. In other words, we will primarily focus on the horizontal interplay between the two systems.

It has become clear that Education 4.0 must be designed as a dynamic and highly responsive system, which can accommodate the requirements of Industry 4.0. In doing so, Education 4.0 is poised to become a critical platform for cultivating the work-readiness skills of future graduates. At the same time, it must be designed in such a way that any existing workforce would be able to re-enter academia in order to upgrade their skills. Thus, we foresee the emergence of a two-way cooperation model between Industry 4.0 and Education 4.0. Horizontal alignment between the two entities does not only embody the essence of lifelong learning, it urges private organizations, their employees, and, of course, universities to fully embrace this principle. Furthermore, such alignment allows both systems to tap into those processes that naturally lie outside their domain – a critical step in overcoming the above-mentioned disjoint.

Education 4.0 is working with a narrative that suggests that workplace diversity and its highly competitive environment – aspects of Industry 4.0 – can be replicated in academia. Creating an academic environment which nurtures students' competitiveness – taking the form of a hidden curriculum – would allow students to be fully prepared for the workplace reality. Such replication would allow universities to create the substance of its hidden curriculum, which constitutes a significant part of the learning process. Thanks to the vertical alignment of learning outcomes between academic programs and courses, and between academic courses and lessons, the elements of Industry 4.0 can be streamed into the daily operations of tertiary institutions. Then there is the issue of acquiring those skills which will secure graduates' employability. Advanced technical, IT, and digital skills will continue to be in high demand – at least until 2030 – when the 6 G Network is expected to be implemented.

These, along with advanced cognitive skills, will remain the threshold requirement for successful employment as "the dominant technologies of Industry 4.0 will be IT, electronics and robotics. But it will also embrace other knowledge areas such as biotech and nanotech. It is to be expected that business in Industry 4.0 will need both enhanced social and technical skills. There will be a shift toward design thinking instead of production thinking."[4] Thus, the towering dominance of digital skills will not undermine the overall importance of social and emotional competencies in the workplace. One's ability to work in teams, and one's capability to influence, motivate, and lead other organizational members will remain crucial. In other words, one's ability to succeed in the workplace will be determined by emotional intelligence.

As D. Goleman, a leading expert on emotional intelligence, has explained: emotional intelligence or (EI) sets apart which leaders, professionals, or scientists will be the best leaders. Emotional intelligence competencies are learned abilities that distinguish the best leaders from the average: self-awareness, which both lets you know your strengths and limitations, and strengthens your inner ethical radar; self-management, which lets you lead yourself effectively; and empathy, which lets you read other people accurately. You put all those together in every act of leadership. The ability to manage yourself – to have self-awareness and self-regulation – is the very basis of managing others. For instance, science has shown that if you are tuned out of your own emotions, you will be poor at reading them in other people. And if you can't fine-tune your own actions – keeping yourself from blowing up or falling to pieces, marshaling positive drives – you'll be poor at handling the people you deal with. Star leaders are stars at leading themselves, first.[5]

Overall, Education 4.0 must be designed as a highly responsive system, able to tap into processes stemming from breakthrough discoveries in the field of science and technology, as well as from the latest industrial developments. On the other hand, a close collaboration with industry would see businesses adopting the results of research and development carried out by tertiary institutions. After all, this has already been the case right from the beginning

of the third industrial revolution. Thus, mutual understanding and collaboration between industry and academia is crucial, especially if tertiary education wishes to retain its relevance in an environment characterized by constant technological disruptions. The very creation of such an ecosystem, however, requires the critical involvement of another key stakeholder: government, whose role in providing an up-to-date modern infrastructure and a set of social services in this process is indispensable.

4. CAMBODIA AND EDUCATION 4.0

If high-income economies and newly industrialized countries are confronted by the growing discrepancy between industry and academia, the process of creating Education 4.0 is even more challenging for developing countries, whose education systems are often characterized by internal fragmentation and a lack of cohesion. As we will mention later, harmonizing primary, secondary, and tertiary education is a problem which has to be tackled prior to devising any collaborative efforts to bridge the gap between academia and industry. Thus, Cambodia finds itself in a very peculiar situation when it comes to creating a comprehensive Education 4.0 framework.

On the one hand, being a lower-middle-income economy means that the country is yet to fully experience the challenges of Industry 4.0 – although technological disruptions and automation are not complete strangers in the country. Technological transfers in business do occur here, but on a small-scale, largely thanks to multinational corporations and other foreign investors. This reality buys Cambodia some time to prepare itself for the shocks that Industry 4.0 will bring when it arrives. The real problem, however, lies elsewhere. Given the fact that up to 94 % of all jobs are low-skilled occupations[6], a large section of the population will be at risk of unemployment when the automation and technological disruptions intensify – particularly if we consider the fact Cambodia is already an integral part of the world's economy and its supply chain. In order to withstand the pressure of Industry 4.0 and, more importantly, to prepare for the economy of tomorrow, the country needs to do more in terms of overcoming a major threat of its economic advancement – an inadequately educated workforce.[7] This is exactly where the Education 4.0 framework fits in to offer solutions that the business sector desperately needs.

The presence of tertiary institutions of a private nature offers Cambodia a chance to address both problems – harmonization of its educational sector as well as bridging the gap between industry and academia. In other words, by relying largely on foreign curricula, private education – in most cases – supports the changing structure of the country's economy. To a large extent, it is the country's private education which facilitates the knowledge transfer, and it is doing so more effectively than public education. Because the primary and secondary education offered in public schools fails to provide students with advanced cognitive skills, or equip them with fundamental EI attributes – such as self-control, self-awareness, self-confidence – a tremendous amount of time and energy is consumed to correct students' deficiencies once they enroll at universities. It is therefore not surprising to see universities' foundation years, devised exclusively to prepare students for the university curriculum, spending several weeks teaching those topics that should have been covered in the primary or secondary schools. Then there is the issue of communicating in foreign languages, particularly those that are crucial for mastering STEM subjects. English – a critical element of the knowledge economy and Industry 4.0 – isn't widely taught in Cambodia to the extent that is common in other countries in the region. "Despite massive efforts to improve the English language skills of its people, Cambodia still lags behind much of the world. The annual English Proficiency Index ranked the Kingdom 94th out of 100 countries included in the study. Cambodia was in the very low proficiency category together with 29 other countries, mostly from Africa and Central Asia." [8] Sadly, this is the reality which necessarily hampers the overall process of nurturing and developing those skills that businesses deem crucial.

To counter such an imbalance in Cambodia's education sector, tertiary institutions have to rely on more than just traditional scholastic procedures. To thrive and succeed, they must deploy a variety of complex strategies. Having integrated principles of outcome-based education in its curriculum, as well as having incorporated workplace reality in its daily academic processes, CamEd Business School is spearheading efforts to lay a comprehensive pathway for the emergence of Education 4.0 in the country.

By linking academia with industry as a key feature of its educational philosophy, the university has already proved to be successful in producing present-ready graduates. By equipping them with those skills that are already in demand in more developed economies,

80% of CamEd Business School graduates have their white-collar employment secured within three month of finishing studies[9] – a very decent number attained in an economic region characterized by high rates of youth unemployment. Having been able to place graduates in jobs consistently over the past decade, thus meeting a crucial requirement of output-based education, CamEd Business School is now fully concentrating on strategies related to improving the living conditions of Cambodians – another key element of outcome-based education.

Accordingly, various corporate social responsibility projects and charity activities, coupled with other field projects, are deployed in order to reinforce principles of project-based learning. Students are required to come up with their own charity projects and implement them during the semester. A successful delivery of such projects is assessed and evaluated, and consequently, rewarded with a certain score which, in turn, carries weight in the overall grading and assessment for particular subjects.

The university's project-based learning operates with a narrative that the students' cognitive, functional, personal, and ethical competencies need to be developed and applied already throughout their academic studies. Such projects provide students with valuable experiences and also lay the foundation for developing their ability to think critically and act proactively – critical enablers of innovation and value-creation. And because Industry 4.0 expects graduates to be technologically savvy, digitalization of teaching and learning lies at the center of the university's academic processes. If Education 4.0 attempts to focus on producing innovators and entrepreneurs, then elements such as project-based learning, student-centered learning, and digitalization of learning must find their way into the explicit curriculum and specific academic processes of other tertiary institutions operating in the country.

Designing sound academic policies and processes, however, is just a part of the university's overall educational philosophy. In order to reinforce student-centered learning, CamEd Business School proceeds with a student class composition strategy, which allows mixing those students who learn relatively fast with those, who can be characterized as slow learners. Informal observations, carried out throughout the academic year, showed that weaker students pay more attention to answers, questions or presentations in the classroom settings given by their stronger counterparts. This creates effective peer pressure, which ultimately allows students to learn from each other, modifying the traditional role of teachers. This is the very essence of student-centered philosophy. By contrast, creating classes, which exclusively consist of slow learners, only reinforces students' existing poor communication, critical thinking skills, and lower degree of self-regulation along with shorter attention spans. Broadly speaking, as fast learners are absent in these groups, students are unable to learn from each other. Ultimately, they depend heavily on the teacher's guidance, which represents the element of teacher-centered learning. As the vast majority of CamEd students come from the Gen Z segment of Cambodian population, teacher-centered learning – characterized by an autocratic form of teaching – loses its relevance. Though instrumental in making the second and third industrial revolution happen, teacher-centered learning is no longer able to adequately support the needs and requirements of Industry 4.0.

Lastly, mixing fast learners with slow learners also provides the university with an opportunity to instill competitiveness, particularly when institutions of primary and secondary education fail to do so. From this perspective, universities become an instrument of last resort. As Cambodia experiences a steady population growth, whereas AI continues to threaten both blue as well as white-collar jobs, forging a competitive mindset of students becomes the university's unwritten educational philosophy. Thus, by promoting a spirit of competitiveness in the classroom setting, the university's learning process does not occur in isolation from the workplace reality. This has become a key element of the university's hidden curriculum and has further reinforced the university's reputation as a leading institution of tertiary education in the country.

5. CONCLUSION

To tackle the challenges of Industry 4.0, Cambodia has to act decisively at the soonest possibility. The rise of Industry 4.0 comes at a time when the country continues to transform its economic system. Guided by the Vision 2050, which aims to turn Cambodia into a high-income economy by 2050, the country has made a step in the right direction. As its vision aims to bring a traditionally agrarian society into the age of modernity[10], the country's education system will experience a sea change in the coming years. The main purpose of establishing Education 4.0 in Cambodia is to develop the skillset of its population in order to cater effectively to the needs of Industry

4.0. As we have shown earlier, tertiary institutions of a private nature appear to be at the forefront of such efforts. However, they will not be able to complete this task all alone. More needs to be done in terms of harmonizing the country's primary, secondary, and tertiary systems, which have clearly suffered from neglect in the past. This is exactly where the government's commitment to create a set of comprehensive Education 4.0 policies is crucial. Only when the collaborative efforts between the three key stakeholders – government, industry, and academia – are strengthened and enhanced, will the country's tertiary education be capable of fully realizing its potential by producing Industry 4.0-ready graduates.

Endnotes

1 Stiglitz, J. (2019, November 24). It's time to retire metrics like GDP They don't measure everything that matters. Retrieved from https://www.theguardian.com/commentisfree/2019/nov/24/metrics-gdp-economic-performance-social-progress.

2 Schwab, K. (2016, January 14). The Fourth Industrial Revolution: what it means, how to respond. Retrieved from https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/.

3 Future Ready Education. (2019, April 8). What is Education 4.0? How you can adapt to this learning environment. Retrieved from https://www.future-readyedu.com/what-is-education-4-0-how-you-can-adapt-this-in-the-learning-environment/.

4 Roland Berger Strategy Consultants. (2014, March). Think Act Industry 4.0: The New Industrial Revolution – How Europe will succeed. Retrieved from https://www.agefi.com/uploads/media/Roland_Berger_Industry_4.0_-_The_role_of_Switzerland_within_a_European_manufacturing_revolution_Etude_EN.pdf.

5 Schawbel, D. (2011, September 15). Daniel Goleman on Leadership and The Power of Emotional Intelligence. Retrieved from https://www.forbes.com/sites/danschawbel/2011/09/15/daniel-goleman-on-leadership-and-the-power-of-emotional-intelligence/#52f5842d6d2f.

6 Flynn, G. (2019, November 20). World Bank report warns of need for diversification and skill development. Retrieved from https://www.khmertimeskh.com/50661464/world-bank-report-warns-of-need-for-diversification-and-skills-development.

7 The World Bank. (2019, November 19). Cambodia's Future Jobs: Linking to the Economy of Tomorrow. Retrieved from https://www.worldbank.org/en/country/cambodia/publication/cambodias-future-jobs-linking-to-the-economy-of-tomorrow.

8 Senase, J. (2019, November 14). Cambodia lagging in English proficiency: index. Retrieved from https://www.khmertimeskh.com/659171/cambodia-lagging-in-english-proficiency-index/.

9 CamEd Business School (2018). Strategic Plan and 2018 Action Plans. Retrieved from https://cam-ed.com/file/Final%20CamEd%20Strategy%202018.pdf.

10 Sviatko, M. (2019, June). Vision and the Nation-State: The Ongoing Transformation of Malaysia and Cambodia. Journal of Accounting, Finance, Economics and Social sciences, 7 (1). pp.66.

REFERENCES

CamEd Business School (2018). Strategic Plan and 2018 Action Plans. Retrieved from https://cam-ed.com/file/Final%20CamEd%20Strategy%202018.pdf.

Flynn, G. (2019, November 20). World Bank report warns of need for diversification and skill development. Retrieved from https://www.khmertimeskh.com/50661464/world-bank-report-warns-of-need-for-diversification-and-skills-development.

Future Ready Education. (2019, April 8). What is Education 4.0? How you can adapt to this learning environment. Retrieved from https://www.futurereadyedu.com/what-is-education-4-0-how-you-can-adapt-this-in-the-learning-environment/.

Goleman, D. (2006). Emotional Intelligence: Why It Can Matter More Than IQ. New York, USA: Bantam.

Goleman, D. (2000). Working with Emotional Intelligence. New York, USA: Bantam.

Roland Berger Strategy Consultants. (2014, March). Think Act Industry 4.0: The New Industrial Revolution – How Europe will succeed. Retrieved from https://www.agefi.com/uploads/media/Roland_Berger_Industry_4.0_-_The_role_of_Switzerland_within_a_European_manufacturing_revolution_Etude_EN.pdf.

Rugeri, A. (2019, April 2). Why 'worthless' humanities degrees may set you up for life. Retrieved from https://www.bbc.com/worklife/article/20190401-why-worthless-humanities-degrees-may-set-you-up-for-life.

Safi, M. (2019, November 2). Frustration and anger fuel wave of youth unrest in Arab world. Retrieved from https://www.theguardian.com/world/2019/nov/02/middle-east-young-frustration-joblessness-fuels-protests.

Schwab, K. (2016, January 14). The Fourth Industrial Revolution: what it means, how to respond. Retrieved from https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/.

Schawbel, D. (2011, September 15). Daniel Goleman on Leadership and The Power of Emotional Intelligence. Retrieved from https://www.forbes.com/sites/danschawbel/2011/09/15/daniel-goleman-on-leadership-and-the-power-of-emotional-intelligence/#52f5842d6d2f.

Senase, J. (2019, November 14). Cambodia lagging in English proficiency: index. Retrieved from https://www.khmertimeskh.com/659171/cambodia-lagging-in-english-proficiency-index/.

Srey, K. (2018, May 11). New CamEd graduates ready to rule. Retrieved from https://www.khmertimeskh.com/488184/new-camed-graduat%E2%80%8Bes-ready-to-rule/.

Stiglitz, J. (2019, November 24). It's time to retire metrics like GDP They don't measure everything that matters. Retrieved from https://www.theguardian.com/commentisfree/2019/nov/24/metrics-gdp-economic-performance-social-progress.

Sviatko, M. (2019, June). Vision and the Nation-State: The Ongoing Transformation of Malaysia and Cambodia. Journal of Accounting, Finance, Economics and Social sciences, 7 (1). pp. 61-69.

The World Bank. (2019, November 19). Cambodia's Future Jobs: Linking to the Economy of Tomorrow. Retrieved from https://www.worldbank.org/en/country/cambodia/publication/cambodias-future-jobs-linking-to-the-economy-of-tomorrow.

Journal of Accounting, Finance, Economics, and Social Sciences
Vol 5, No 1, July – December 2020, pp. 19-29
Received: Jan 2020 | Revised: Apr 2020 | Accepted: Jun 2020
DOI: https://doi.org/10.62458/jafess.160224.5(1)19-29

The Relationship of Internal Audit and Risk Management: The Impact of Turbull Factors

Parmindar Singh*

ABSTRACT

This research aims to find the relationship between internal audit and factors as specified by Turbull, namely, organizational changes, internal control failings, unexplained/unacceptable events, scale, diversity and complexity of activities and risk exposure. In addition, this research also looks at any relationship between internal audit and being public-listed. The results from this research indicates that there is a relationship between having an internal audit function and being public-listed as well as the scale, diversity and complexity of activities. However, this research finds no relationship between internal audit and organizational changes, internal control failings, unexplained/unacceptable events and risk exposure. The reasons why these deviates from corporate governance best practices are then explained. This research used convenience sampling, Chi-Square analysis and nominal data.

Keywords: internal audit, corporate governance, internal controls, Chi-Square

1. INTERNAL AUDIT AND RESEARCH QUESTIONS

It is said that internal auditing, just like external auditing originates in ancient times from countries like Egypt, Greece and Rome. The internal auditing process in China might be traced back to the Zhou dynasty (1066-221 BC) when the government set up two kinds of special officers, i.e. Zai Fu (equivalent of controller) and Sikuai (equivalent of treasurer); the former was in charge of external auditing, the latter for internal auditing (Chun, 1997, p. 247).

According to the Institute of Internal Auditors (IIA):

"Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes" (global.theiia.org, 2019).

For internal audit to be effective, it should conform to certain core principles. The internal auditor must be of high integrity and demonstrates competency and undertakes due care. Moreover, the internal auditor must be independent and objective and is free from undue influence. In addition, the work of an internal auditor is aligned with organizational strategies, objectives and is aligned to the risks facing an organization. The internal audit function should be appropriately positioned and adequately resourced. The work of an internal auditor demonstrates quality and the incumbent seeks continuous improvement. The internal auditor is able to communicate effectively and has the competency, among others, to provide risk-based assurance. Finally, the internal auditor is insightful, proactive and is future-focused and also promotes organizational learning (global.theiia.org, 2019)

According to the UK Governance Code (2018, p.10), "the board should establish formal and transparent policies and procedures to ensure the independence and effectiveness of internal and external audit functions…". The functions of internal audit, among others are as follows.

Internal auditors will have to evaluate and improve risk management (Sarrens and De Beelde, 2006, p. 65). Hence, they have to conduct risk assessment and also evaluate (review and appraise the adequacy, effectiveness, and efficiency of the internal control system in order to provide and independent opinion of it) and improve internal controls (Sarrens and De Beelde, 2006, p. 72).

* Parmindar Singh, DBA, MBA, B.Sc.
Crescendo International College, Malaysia
Email: parmindar2005@gmail.com
CamEd Business School, Cambodia
Email: parmindar@cam-ed.com

Internal auditors will also have to examine financial and operating information to assess its suitability, reliability and integrity. They will also have to review the economy, efficiency and effectiveness of operations. In addition, internal auditors will have to review the safeguarding of assets and the implementation of corporate objectives. Internal auditors will also be expected to carry out special investigations, e.g. suspected fraud and review of the compliance of a firm with legislation, regulations and codes of practices. Internal auditors will also take follow-up action taken to remedy weaknesses identified by internal audit reviews and ensuring that good practice is identified and communicated widely. Furthermore, internal auditors will also test to ensure robustness – stress-, compliance-, load testing and security issues. Internal auditors can also carry out social and sustainability audits and provide advice to the board on corporate takeovers and mergers as well as on project management, if they have the necessary expertise (Singh, 2019, pp.3-4).

Turnbull (n.d. cited in Professional Accountant, 2007, p. 153) states that the need for internal audit will depend on several factors such as the scale, diversity and complexity of the company's activities, the number of employees, cost-benefit considerations, changes in organizational structures, reporting processes or underlying information systems, changes in key risks, problems with internal control systems and an increased number of unexplained or unacceptable events. Using the work of Turnbull, this research aims to identify whether some of the above factors determine the existence of an internal audit function (either in-house or outsourced) for the sample selected by the author.

Research questions:

RQ1. Is there a relationship between internal audit function and being public-listed?

RQ2. Is there a relationship between internal audit function and organizational changes?

RQ3. Is there a relationship between internal audit function and a firm's activities?

RQ4. Is there a relationship between internal audit function and unexplained/unaccepted events?

RQ5. Is there a relationship between internal audit function and internal control failures?

RQ6. Is there a relationship between internal audit function and changes in risk exposure?

Research hypotheses:

H01: there is a relationship between internal audit and being public listed.

H02: there is a relationship between internal audit and organizational changes (organizational structure, reporting relationship or Information systems).

H03: there is a relationship between internal audit and scale, diversity and complexity of a firm's activities.

H04: there is a relationship between internal audit and unexplained or unacceptable events.

H05: there is a relationship between internal audit and internal control failures.

H06: there is a relationship between internal audit and risk exposure.

2. RESEARCH METHODOLOGY

Cavana, Delahaye and Sekaran (2001, p. 107) have given a set of steps to undertake in a research design process. These are as follows:

- Decide on purpose of study
- Determine the type of investigation
- Decide on extent of researcher interference
- Decide on study setting
- Decide on unit of analysis
- Decide on time horizon
- Decide on measurement and measures
- Select data collection method(s)
- Decide on sampling design

Since the purpose of this research is to find out the relationship between internal audit and the above research questions, hypothesis testing was deemed to be the most appropriate. In hypothesis testing, studies are done to explain the nature of certain relationships or establish the differences among groups or the independence of two or more factors in a situation. Hypothesis testing is also done to explain the variance in the dependent variable or to predict organizational outcomes (Cavana, Delahaye and Sekaran, 2001, pp. 108-112).

Field studies have been chosen, as it occurs in a non-contrived setting, i.e. it occurs in the natural environment where work proceeds normally, and it is believed that this method can provide more valuable

insights that may not be obtained via laboratory experiments (Pelled, Eisenhardt and Xin, 1999, p. 11). In addition, the researcher has no control over the independent variables and therefore, field studies were deemed to be highly appropriate (Boudreau, Gefen and Straub, 2001, p.3). Moreover, field studies are often used in business research that involves hypothesis testing (Robinson Jr., Marshall and Stamps, 2004, pp. 1626-1627; Tuten and Neidermeyer, 2004, p. 29; Snipes, Oswald, LaTour and Armenakis, 2005, p. 1333; Babin and Boles, 1998, p. 81).

Being a field study, researcher interference was kept to a minimum. Study-settings as mentioned earlier were non-contrived. The unit of analysis refers to the levels of aggregation of the data collected during the subsequent data analysis stage. This unit of analysis in a research can either be individuals, dyads, groups, or organizations (Cavana, Delahaye and Sekaran, 2001, pp. 119-121). Since this research focuses on individuals in the sample, the unit of analysis chosen were individuals.

The time horizon in the research can be cross-sectional or longitudinal (Cavana, Delahaye and Sekaran, 2001, pp. 119-122; Baker, 2001, p. 393; Voelpel, Dous and Davenport, 2005, p. 10). A cross sectional study is a study in where data are gathered or collected just once, perhaps over a period of days, weeks or months in order to meet the research objectives. Such studies can therefore also be called as a one-shot study (Cavana, Delahaye and Sekaran, 2001, p. 121; Baker, 2001, p. 393). In some cases, however, the researcher might want to study people or phenomenon at more than one point in time in order to meet the research objective. Such a study is called longitudinal study (Cavana, Delahaye and Sekaran, 2001, p. 122; Baker, 2001, p. 393). Longitudinal studies take more time and effort and cost more than cross-sectional study.

This research, as in most field studies deployed a cross-sectional study due to the time, effort and cost constraint involved in collecting data over several time periods. In addition, cross-sectional studies are well accepted in most research (Robinson Jr., Marshall and Stamps, 2004, p. 1626; Tuten and Neidermeyer, 2004, p. 29; Babin and Boles, 1998, p. 81).

The instrument used to gather data in this research was a self-developed questionnaire. A questionnaire is a predetermined set of questions designed to capture data from respondents. It is a scientifically developed instrument for measurement of key characteristics of individuals, companies, events and other phenomena. A questionnaire consists of a standard set of questions with answers to the questions often limited to a few pre-determined mutually exclusive and exhaustive outcomes (Hair, Babin, Money and Samouel, 2003, pp. 130-131). The questionnaire approach has been used in many research involving quantitative methodologies (Snipes et al., 2005, pp. 1333-1334; Babin and Boles, 1998, p. 89; Robinson Jr., Marshall and Stamps, 2004, p.1627; Mummalaneni, 2005, pp. 528-529; Tuten and Neidermeyer, 2004, pp. 29-30; Brashear, Lepkowska-White and Chelariu, 2003, p. 974; Lassk et al., 2001, p. 294; Johnston et al., 1988, p. 70; Sharma and Levy, 2003, p. 525; Jaramillo, Mulki and Marshall, 2005, p. 707; Baker, 2003, p. 343).

A questionnaire will also involve a proper measurement scale to measure the variables identified. Four measurement scales normally used are nominal, ordinal, interval and ratio (Cavana, Delahaye and Sekaran, 2001, p. 195; Davis and Cosenza, 1993, pp. 167-170; Black, 2001, pp.5-7; Shi and Bennet, 2001, p. 368; Zikmund, 2003, pp. 296-298).

A nominal scale is one that allows the researcher to assign subjects to certain categories or groups. The information that can be generated from nominal scaling is to calculate the percentage or frequency in a sample. It is often used to obtain personal data such as gender, or the department in which one works, among others. Nominal scales are the lowest level of measurement and therefore provide data that is relatively low in precision. As a result, statistical analysis of the data is correspondingly low in sophistication. This research will use nominal scale as the data to be elicited are categorical in nature.

An ordinal scale is used to rank orders in some meaningful way. It provides more information than a nominal scale by rank ordering them. This scale enables the researcher to determine if an object has more or less of a characteristic than some other object. But it does not enable the researcher to determine how much more or less of the characteristic an object has. In addition, the points in an ordinal scale do not indicate equal distance between the rankings.

An interval scale uses numbers to rate objects or events and thus allows researchers to measure the distance between any two points on the scale. Therefore, with an interval scale, differences between points on the scale can be interpreted and compared

meaningfully. An interval scale has all the qualities of nominal and ordinal scales, plus the differences between the scale points is considered to be equal. However, with an interval scale, the location of the zero point is not fixed. Both the zero point and the units of measurement are arbitrary. It also allows certain arithmetical operations to be performed such as arithmetic mean, standard deviation, variance and even Pearson's product-moment coefficient of correlation.

A ratio scale, on the other hand has a unique zero origin and subsumes all the properties of the other three scales (Cavana, Delahaye and Sekaran, 2001, pp. 195-198).

This research will involve a questionnaire administered by CamEd's Learning Support Centre via email. The participants will have to read the instructions before filling the questionnaire. It is estimated that it will not take more than five minutes to fill up the questionnaire items.

Having discussed the research instrument and the data gathering method, it is also important to decide on the sampling process. This sampling process consists of defining the target population, choosing the sampling frame, sampling design, sample size and implementing the sampling plan (Hair et al., 2003, p. 209). There are two major types of sampling design, namely, probability and non-probability sampling. Probability sampling consists of simple random, systematic, stratified, cluster and multi-stage, among others while non-probability sampling consists of convenience, judgment, snowball and quota sampling (Cavana, Delahaye and Sekaran, 2001, pp. 266-267; Cooper and Schindler, 2003, p. 183; Bryman and Bell, 2003, p. 93; Zikmund, 2003, pp. 379-380; Hair et al., 2003, p. 211).

A non-probability sampling was chosen as it was not possible to access the population. As such, issues on population, sampling frame and sampling size does not arise since non-probability sampling was chosen (Cooper and Schindler, 2003, p. 184). Non-probability sampling can be chosen due to time and costs constraints. In addition, carefully controlled non-probability sampling often seems to give acceptable results (Cooper and Schindler, 2003, p. 200).

This study will use non-probability convenience sampling with ACCA students of CamEd, who are working and have reached the professional level stage of their course. Although convenience sampling represents a potential bias, this is a common problem and is shared by a large number of organizational researches (Koberg and Chusmir, 1987, p. 400). Convenience sampling is very common and indeed is more prominent than samples based on probability sampling (Bryman and Bell, 2003, p. 105). In addition, it is the best way of collecting information quickly and efficiently (Cavana, Delahaye and Sekaran, 2001, p. 263).

Statistical techniques for quantitative research can consist of non-parametric and parametric. The major difference lies in the underlying assumptions about the data. In general, when the data are measured using an interval or ratio scale and the sample size is large as well as sample data is collected from populations with normal distributions, then parametric statistics are appropriate.

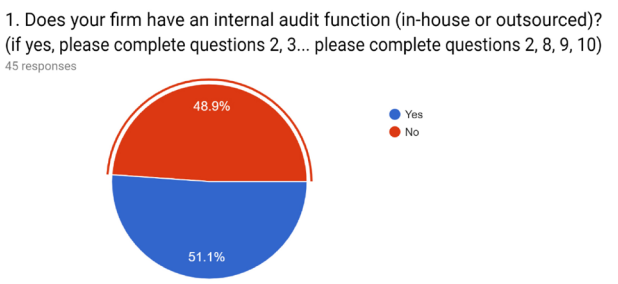
When data are measured using an ordinal or nominal scale, it is not appropriate to make the assumption that the distribution is normal and therefore a non-parametric or distribution free statistic should be used (Hair et al., 2003, p. 259).

Parametric statistic consists of uni-variate and multi-variate techniques (Galliers, 1992, p. 224; Diamantopoulos, 2000, p. 83). Univariate analysis can make use of t- or z-test while multivariate can use regression, analysis of variance (ANOVA), correlation and factor analysis. An example of non-parametric method is the Chi-Square analysis;

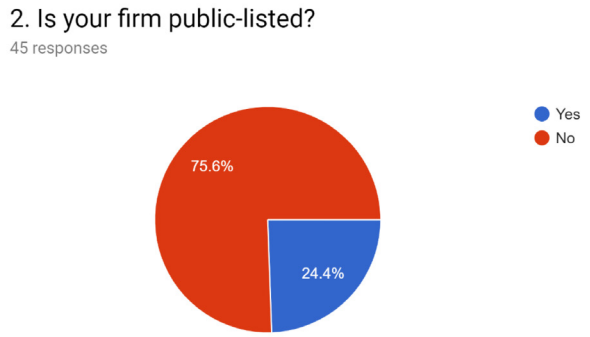
This research will make use of descriptive statistics and Chi-Square analysis as the data used in this research is nominal in nature. As mentioned, this research will use non-probability sampling, more specifically, convenience sampling. As such, sample size will not be critical.

3. ANALYSIS

The sample used for this analysis consists of 45 respondents. Some of the items are for respondents who already have an internal audit function while others are for those who do not. For the first item in the questionnaire, 23 respondents answered yes while the remaining 22 answered no. This is shown below:



For the second item, the chart below depicts the result:



There were 11 respondents whose firm have an internal audit and the remaining 34 respondents' firms have no internal audit function.

The following tabulation shows the breakdown:

Table 1: cross-tabulation between internal audit and being public-listed			
	Internal audit		
Public-listed	Y	N	Total
Y	9	2	11
N	14	20	34
Total	23	22	45

To test the first hypothesis,

H_0: There is no relationship between internal audit and being public-listed

H_1: There is a relationship

The dependent variable is internal audit and the independent variable is firm status, in this case, being public-listed or otherwise.

Using Chi-Square analysis:

$$x_c^2 = \sum \frac{(O^i - E^i)^2}{E_i}$$

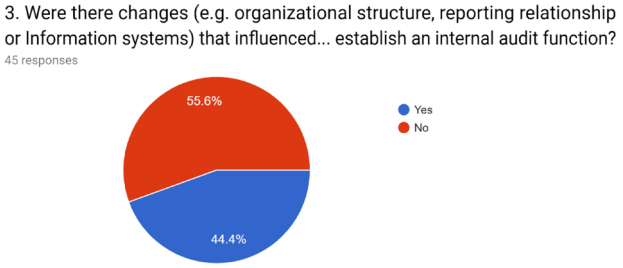
Where O_i = observed value, E_i stands for value. The expected value, E_i is calculated by the following:

(row total ÷ grand total × column total) (Beri, 2010, p. 378). Table 2 below shows the worksheet for deriving the Chi-Square value of 5.42.

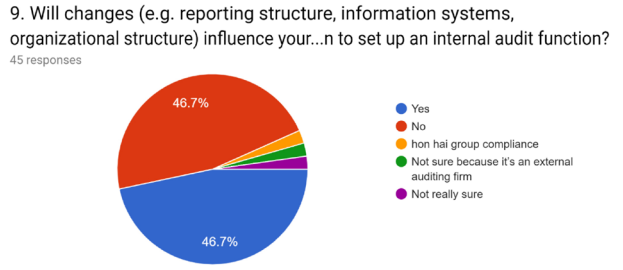
Table 2 : Worksheet for calculating Chi-Square					
	O	**E**	**O-E**	**$(O-E)^2$**	**$(O-E)^2/E$**
	9	5.62	3.38	11.41	2.03
	14	17.38	-3.38	11.41	0.66
	2	5.62	-3.62	13.12	2.33
	20	17.38	2.62	6.88	0.40
Total					5.42

At α = 0.05 and degrees of freedom (df) = (row-1) × (columns-1) = 1, critical value of Chi-Square is 3.841. Since the calculated value of 5.42 is more than the critical value of 3.841, the null hypothesis is rejected. From this analysis, the information derived is that there is a relationship between internal audit function and being public-listed. This is generally accepted as the listing requirements of many stock exchange boards necessitate an internal audit function, for example, the NYSE (Goodwin-Stewart and Kent, 2006, p.82).

For the third item, the chart represents the findings:



This item solicited whether changes (e.g. organizational structure, reporting relationship or Information systems) that have occurred influenced the firm to establish an internal audit function. A total of 25 respondents answered the question as no while the balance of 20 respondents answered yes. Related to the third item is the ninth item, shown below:



This item asked whether organizational changes in firm (organizational structure, reporting relationship or Information systems) will influence the decision to set up an internal audit function. Here, 21 respondents answered yes while another 21 respondents answered no. Three respondents answered differently. One was not really sure, while the other respondent was not sure as well as the firm where the respondent is working is an external audit firm. Another respondent stated that they followed the compliance required by its parent company, and hence there was no need for internal audit function. Focusing on those 42 respondents (21 respondents

agreeing and 21 respondents disagreeing) as well as the related third item, the following cross-tabulation is given in Table 3.

Table 3: Cross-tabulation between internal audit and organizational changes

	Internal audit		
Organizational changes	Y	N	Total
Y	13	8	21
N	10	11	21
Total	23	19	42

To test the second hypothesis,

H_0: There is no relationship between internal audit and organizational changes (organizational structure, reporting relationship or Information systems) that has taken place or may take place.

H_1: There is a relationship

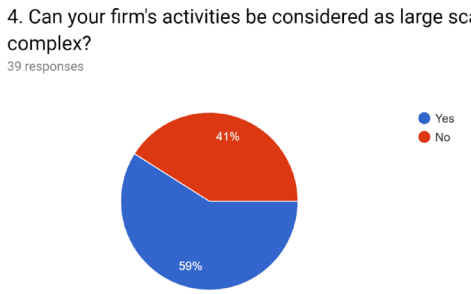
The dependent variable is internal audit and the independent variable is organizational changes. Table 4 shows the worksheet to calculate Chi-Square.

Table 4: Chi-Square worksheet

	O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
	13	11.50	1.50	2.25	0.20
	10	11.50	-1.50	2.25	0.20
	8	9.50	-1.50	2.25	0.24
	11	9.50	1.50	2.25	0.24
Total					0.86

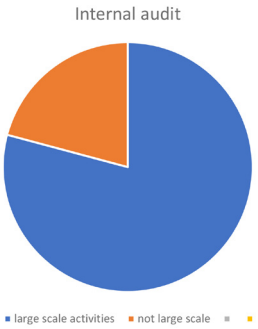
At $\alpha = 0.05$ and degrees of freedom (df) = (row-1) × (columns-1) = 1, critical value of Chi-Square is 3.841. Since the calculated value of Chi-Square is 0.86, the null hypothesis is not rejected. One reason to explain this phenomenon is that organizations do not wait for changes to happen before instituting internal audit function. These organizations may have become proactive, gleaning from lessons learnt in other organizations. Another reason may be that it is already a requirement in the firm as best practice.

The fourth item required respondents to state whether they consider their firm's activities as being large-scaled, diverse and complex. The findings are given below:

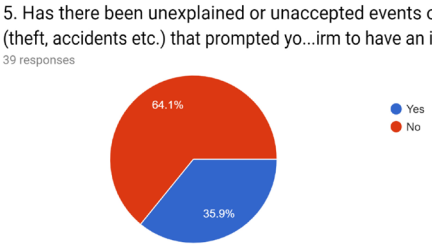


There were 39 responses and 16 mentioned that their firms' activities are not large scale while the remainder of 23 respondents agreed. However, the author realized that some respondents have not read the questions properly, as this item is only to be answered for firms that have an internal audit function. As such, there were cases of respondents whose firms did not have an internal audit function but yet answering this question as shown in the pie chart above. Consequently, the author had to literally check each respondent's questionnaire to solicit the outcome. Only those respondents whose firm have an internal audit function was checked further to identify whether their firms' activities were considered large scale, diverse and complex. The pie chart below shows that for 19 respondents, they had an internal audit function and their firms' activities were considered by them as large scale, diverse and complex. The remaining five had internal audit function but their activities were not large scale. Hence, this implies, that while all firms are encouraged to have an internal audit function, it is more relevant for firms whose activities are large scale, diverse and complex.

Hence, it can be inferred that the third hypothesis is supported.



The fifth item is explained from the chart below.



A total of 39 responses were obtained for the question on whether will unexplained or unaccepted events influence a firm to have an internal audit function. The intention of this question was also to obtain a response on whether unexplained or unacceptable events have resulted in the firm having an internal audit function. Although the question, admittedly

lacked some degree of clarity, but this was briefed to the person in charge, prior to administering the questionnaire. As such, this question looks at the internal audit function and its relationship to past or future unexplained/unacceptable events. 25 respondents replied negatively while 14 responded positively. Table 5 shows the cross-tabulation for this information.

Table 5: Cross-tabulation between internal audit and unacceptable/ unexplained events

	Internal audit		
Unexplained/unacceptable events	Y	N	Total
Y	9	5	14
N	13	12	25
Total	22	17	39

To test the fourth hypothesis,

H_0: There is no relationship between internal audit and unacceptable/unexplained events.

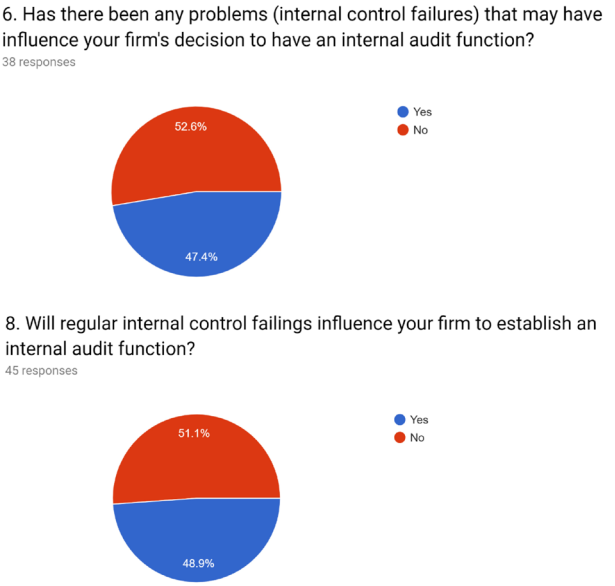
H_1: There is a relationship

The dependent variable is internal audit and the independent variable is unacceptable/unexplained events. Table 6 shows the worksheet to calculate Chi-Square.

Table 6: Chi-Square worksheet calculation

	O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
	9	7.90	1.10	1.22	0.15
	13	14.10	-1.10	1.22	0.09
	5	6.10	-1.10	1.22	0.20
	12	10.90	1.10	1.22	0.11
Total					0.55

At $\alpha = 0.05$ and degrees of freedom (df) = (row-1) × (columns-1) = 1, critical value of Chi-Square is 3.841. Since the calculated value of Chi-Square is 0.55, the null hypothesis is not rejected. It is rather surprising that this research finds no relationship between internal audit and unacceptable/unexplained events. One reason could be that there have been no major adverse unacceptable/unexplained events that have happened and as such respondents may not be able to imagine the full devastation that may occur without the presence of internal audit. There were 12 respondents (around 31%) whose firms did not have internal audit and also did not feel the need that unacceptable/unexplained events would have altered their minds to have an internal audit function. They were the ones that swayed the results to being the null hypothesis not being rejected. Also, another reason why this result was obtained was the sample size. With a larger sample size, this result might have been different.



Item 6 seeks to find out whether there were any problems that have made the respondent's firm to establish an internal audit function while item 9 seeks to question whether will internal control failings result in the respondent's firm deciding to establish an internal audit. For item 6, 20 respondents said that it was not the reason for their firm to set up an internal audit while the remaining 18 agreed. For item 8, 22 respondents agreed while the remaining 23 disagreed. These two items' information will be used to decide whether there will be a relationship between internal audit and past internal control failings or possible internal control failings in the future. Since the results of these two items are roughly split into half, there are differences in views about internal control failings and an internal audit function.

More specifically, the cross tabulation below in Table 7 gives the combined result.

Table 7: Cross-tabulation between internal audit and internal control failings

	Internal audit		
Internal control failings	Y	N	Total
Y	12	7	19
N	11	15	26
Total	23	22	45

From Table 7, for those that have internal audit function, 12 respondents believed that internal control failings have helped the firm to decide on having an internal audit function, while 11 others answered that internal control failings was not the

reason for their firms to establish an internal audit function. What is surprising is that for those whose firms have no internal audit, 15 out of 22 respondents replied that internal control failings will not influence their firms to create an internal audit function.

To test the fifth hypothesis,

H_0: There is no relationship between internal audit and internal control failings.

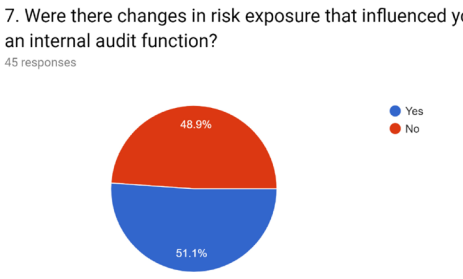
H_1: There is a relationship

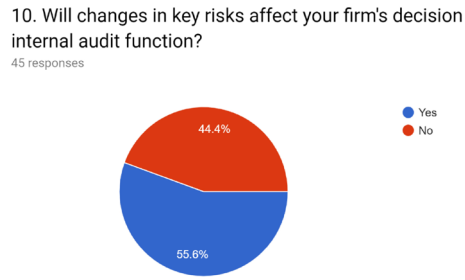
The dependent variable is internal audit and the independent variable is unacceptable/unexplained events. Table 8 shows the worksheet to calculate Chi-Square.

Table 8: Worksheet for calculating Chi-Square

	O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
	12	9.71	2.29	5.24	0.54
	11	13.29	-2.29	5.24	0.39
	7	9.29	-2.29	5.24	0.56
	15	12.71	2.29	5.24	0.41
Total					1.91

At α = 0.05 and degrees of freedom (df) = (row-1) × (columns-1) = 1, critical value of Chi-Square is 3.841. Since the calculated value of Chi-Square is 1.91, the null hypothesis is not rejected. Hence this sample respondents indicated that there is no relationship between internal audit function and internal control failings. This is rather unfortunate as best practices in corporate governance will definitely warrant that internal control failings will create agency conflict and that shareholders will then expect that internal audit function be present to ensure robust risk management and internal controls.





Item 7 of the questionnaire solicited whether changes in risk exposure resulted in the firm having an internal audit. Of these, 23 respondents agreed and 22 respondents said in the negative. For item 10, the question required respondents to give their view on whether their firm will agree to have an internal audit function if there were changes in their firms' risk exposure. A total of 25 respondents agreed and 20 respondents answered "no".

To test the sixth hypothesis,

H_0: There is no relationship between internal audit and experiencing changes in risk exposure or if there were changes in risk exposure.

H_1: There is a relationship

The dependent variable is internal audit and the independent variable is risk exposure. Table 9 shows the cross-tabulation and Table 10 shows the worksheet for Chi-Square.

Table 9: Cross-tabulation between internal audit and risk exposure

	Internal audit		
Risk exposure	Y	N	Total
Y	14	11	25
N	9	11	20
Total	23	22	45

Table 10: Worksheet for Chi-Square

	O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
	14	12.78	1.22	1.49	0.12
	9	10.22	-1.22	1.49	0.15
	11	12.22	-1.22	1.49	0.12
	11	9.78	1.22	1.49	0.15
Total					0.54

At α = 0.05 and degrees of freedom (df) = (row-1) × (columns-1) = 1, critical value of Chi-Square is 3.841. Since the calculated value of Chi-Square is 0.54, the null hypothesis is not rejected. Here respondents do not feel that risk exposure has contributed to the firm having an internal audit function nor will changes in risk exposure necessitate a firm to have an internal audit function. This goes against good corporate governance practices. Perhaps the respondents' firms involved in this research (nine respondents) may not have experienced much changes in risk and that is not the reason why their firms had an internal audit function. In addition, 11 respondents whose firms do not have an internal audit function do not feel that changes in risk exposure would warrant their firms to have an internal audit function. A larger sample size may correct this deviation from best practice.

4. CONCLUSIONS

Turnbull (n.d. cited in Professional Accountant, 2007, p. 153) had stated that the need for internal audit depends on several factors that audit committees of firms must contemplate. They are the scale, diversity and complexity of the company's activities, the number of employees, cost-benefit considerations, changes in organizational structures, reporting processes or underlying information systems, changes in key risks, problems with internal control systems and an increased number of unexplained or unacceptable events. However, this research gave some contrasting results.

The first hypothesis was accepted that there is a relationship between having an internal audit function and being public-listed. This is generally accepted as the listing requirements of many stock exchange boards requires an internal audit function, for example, the NYSE (Goodwin-Stewart and Kent, 2006, p.82).

The second hypothesis was not accepted. One reason to explain this phenomenon is that organizations do not wait for changes to happen before instituting internal audit function. These organizations may have become proactive, learning from lessons from other organizations. Another reason may be that it is already a requirement in the firm as best practice. There were also 11 respondents whose firms did not have an internal audit function and who felt that changes in organization will not result in their firms having an internal audit function. This may have affected the outcome of this second hypothesis not being accepted. A larger sample size may alleviate this unexpected outcome.

The third hypothesis gleaned from the pie chart indicated that the hypothesis was accepted, namely, firms whose activities are large scale, complex and diverse tend to have an internal audit function.

The fourth hypothesis was not accepted. One reason could be that there have been no major adverse unacceptable/unexplained events that have happened and as such respondents may not be able to imagine the full impact that may occur without the presence of internal audit. There were 12 respondents (around 31%) whose firms did not have internal audit and also did not feel the need that unacceptable/unexplained events would have altered their minds to have an internal audit function. They were the ones that swayed the results to being the null hypothesis not being rejected. Another reason why this result was obtained was the sample size. With a larger sample size, this result might have become different.

The fifth hypothesis was also not supported. Once again, a larger sample size may have given results that are in line with best corporate governance practices, namely, the need for internal audit when internal control failings occur to ensure efficient and effective operations.

Finally, the sixth hypothesis was also not supported. Here respondents do not feel that risk exposure has contributed to the firm having an internal audit function nor will changes in risk exposure necessitate a firm to have an internal audit function. This, unfortunately, goes against good corporate governance practices. Perhaps the respondents' firms involved in this research (nine respondents) may not have experienced much changes in risks and that is not the reason why their firms have an internal audit function. In addition, 11 respondents whose firms do not have an internal audit function do not feel that changes in risk exposure would warrant their firms to have an internal audit function. A larger sample size may correct this deviation from best practice.

5. LIMITATIONS AND RECOMMENDATIONS

There are several limitations in this research. This research uses convenience sampling from respondents, mainly ACCA students from CamEd Business School, Cambodia. Hence, it is not generalizable. In addition, a bigger sample size may have alleviated some of the deviations from corporate governance best practices. Another limitation in the research is that non-parametric statistic was used, namely, Chi-Square analysis using nominal data. Parametric statistics may have given more robust results.

Notwithstanding the limitations, this research gives an initial vantage point on internal audit and its possible relationship with nature of firm (being public-listed or otherwise), organizational changes, scale, diversity and complexity of company activities, events occurring, internal control failings, and risk exposure.

It is recommended that if the above limitations are addressed, better insights can be obtained. It is also recommended that a specific industry is chosen and studied more closely in terms internal audit and its relationship with the individual independent variables.

REFERENCES

Babin, B.J. and Boles, J.S. (1998), 'Employee Behavior in a Service Environment: A Model and Test of Potential Differences Between Men and Women', Journal of Marketing, Vol. 62, Iss. 2, pp. 77-91.

Baker, M.J. (2001), 'Selecting a Research Methodology', The Marketing Review, Vol. 1, Iss. 3, pp. 373-397.

Baker, M.J. (2003), 'Data Collection – Questionnaire Design', The Marketing Review, Vol. 3, Iss. 3, pp. 343-370.

Beri, G.C. (2010), Business Statistics (3rd ed.), Tata McGraw-Hill, New Delhi, India.

Black, K. (2001), Business Statistics: Contemporary Decision Making (3rd ed), South-Western College Publishing, Cincinnati, Ohio, U.S.A.

Boudreau, M.C., Gefen, D. and Straub, D.W. (2001), 'Validation in Information Systems Research: A State-Of-The-Art Assessment', MIS Quarterly, Vol. 25, No. 1, March, pp. 1-16.

BPP (2007), Professional Accountant, BPP Learning Media.

Brashear, T.G., Lepkowska-White, E. and Chelariu, C. (2003), 'An empirical test of antecedents and consequences of salesperson job satisfaction among Polish retail salespeople', Journal of Business Research, Vol. 56, Iss.12, pp. 971-978.

Bryman, A. and Bell, E. (2003), Business Research Methods, Oxford University Press, New York.

Cavana, R.Y., Delahaye, B.L. and Sekaran, U. (2001), Applied Business Research: Qualitative And Quantitative Methods, John Wiley and Sons Ltd., Australia.

Chai, C. (1997), 'On the functions and objectives of internal audit and their underlying conditions', Managerial Auditing Journal, Vol. 12, Issue 4/5, pp. 247-250.

Cooper, R.D. and Schindler, P.S. (2003), Business Research Methods (8th ed.), McGraw Hill, International Edition, Singapore.

Davis, D. and Cosenza, R.M. (1993), Business Research for Decision Making (3rd ed.), Wadsworth Publishing Company, California.

Galliers, R. (Ed) (1992), Information Systems Research: Issues, Methods, and Practical Guidelines, Blackwell Scientific Publications, London.

global.theiia,org, 2019, <https://global.theiia.org/standards-guidance/mandatory-guidance/Pages/Core-Principles-for-the-Professional-Practice-of-Internal-Auditing.aspx, access December 14th, 2019.

global.theiia.org, 2019, <https://global.theiia.org/standards-guidance/mandatory-guidance/Pages/Definition-of-Internal-Auditing.aspx, access December 14th, 2019.

Goodwin-Stewart, J. and Kent, P. (2006), 'The use of internal audit by Australian companies', Managerial Auditing Journal, Vol. 21, No. 1, pp. 81-101.

Hair, J.F. Jr., Babin, B., Money, A.H. and Samouel, P. (2003), Essentials of Business Research Methods, John Wiley and Sons Inc, U.S.A.

Jaramillo, F., Mulki, J.P. and Marshall, G.W. (2005), 'A meta-analysis of the relationship between organizational commitment and salesperson job performance: 25 years of research', Journal of Business Research, Vol. 58, Iss. 6, pp. 705-714.

Johnston, M.W., Futrell, C.M., Parasuraman, A. and Sager, J. (1988), 'Performance and Job Satisfaction Effects on Salesperson Turnover: A Replication and Extension', Journal of Business Research, Vol. 16, Iss. 1, pp. 67-83.

Koberg, C.S. and Chusmir, L.H. (1987), 'Organizational Culture Relationships with Creativity and Other Job-Related Variables', Journal of Business Research, Vol. 15, Iss. 5, pp. 397-409.

Lassk, F.G., Marhsall, G.W., Cravens, D.W. and Moncrief, W.C. (2001), 'Salesperson Job Involvement: A Modern Perspective and a New Scale', Journal of Personal Selling and Sales Management, Vol. 21, No. 4, pp. 291-302.

Mummalaneni, V. (2005), 'An empirical investigation of Web site characteristics, consumer emotional states and on-line shopping behaviors', Journal of Business Research, Vol. 58, Iss. 4, April, pp. 526-532.

Pelled, L.H., Eisenhardt, K.M. and Xin, K.R. (1999), 'Exploring the black box of work group diversity, conflict, and performance', Administrative Science Quarterly, Vol. 44, Iss. 1, March, pp. 1-27.

Ramsey, R., Lassk, F.G. and Marshall, G.W. (1995), 'A Critical Evaluation of a Measure of Job Involvement: The Use of the Lodahl and Kejner (1965) Scale with Salespeople', Journal of Personal

Selling and Sales Management, Vol. 15, No. 3, pp. 65-74.

Robinson Jr. L., Marhall, G.W. and Stamps, M.B. (2005), 'Sales force use of technology: antecedents to technology acceptance', Journal of Business Research, Vol. 58, Iss. 12, pp. 1623-1631.

Sarrens, G. and De Beelde, I. (2006), 'Internal auditors' perception about their role in risk management: A comparison between US and Belgian companies', Managerial Auditing Journal, Vol. 21, No. 1, pp. 63-80.

Sekaran, U. and Bougie, R. (2009), Research Methods for Business (5th ed.), Wiley, UK.

Sharma, A. and Levy, M. (2003), 'Salespeople's affect towards customers. Why should it be important for retailers?', Journal of Business Research, Vol. 56, Iss. 7, pp. 523-528.

Singh, P. (2019), 'Internal Audit', Strategic Business Leader, ACCA lecture notes, CamEd Business School, Cambodia.

Snipes, R.L., Oswald, S.L., LaTour, M. and Armenakis, A.A. (2005), 'The effects of specific job satisfaction facets on customer perceptions of service quality: an empirical-level analysis', Journal of Business Research, Vol. 58, Iss. 10, pp. 1330-1339.

Tuten, T.L. and Neidermeyer, P.E. (2004), 'Performance, satisfaction and turnover in call centers: The effects of stress and optimism', Journal of Business Research, Vol. 57, Iss. 1, pp. 26-34.

Voelpel, S.C., Dous, M. and Davenport, T.H. (2005), 'Five steps to creating a global knowledge-sharing system: Siemens' ShareNet', Academy of Management Executive, Vol. 19, No. 2, pp. 1-23.

Zikmund, W.G. (2003), Business Research Methods (3rd ed), Thomson South-Western, Ohio, U.S.A.

Journal of Accounting, Finance, Economics, and Social Sciences
Vol 5, No 1, July – December 2020, pp. 30-35
Received: Apr 2020 | Revised: May 2020 | Accepted: Jun 2020
DOI: https://doi.org/10.62458/jafess.160224.5(1)30-35

Understanding Cambodia's Weak Decentralization: From A Textual Approach

Virak Prum*

ABSTRACT

This short article revisits what existed in the legal framework in the first few years when Cambodia was starting to experience decentralization. By using six components to evaluate the degree of "political decentralization"—constitutional guarantee, local elections, recall, popular participation, sphere of local power, and the central-local separation of functions—this review reveals that decentralization in Cambodia was not meant to become strong.

Keywords: legal framework; decentralization; political decentralization; Cambodia

1. INTRODUCTION

By late 1990s decentralization was still a new concept for Cambodia. Following the UN-led elections in 1993, there was no policy for decentralization although the overall institutional development suggests that the central-local relations had not been truly and bureaucratically centralized (Prum 2005b). Until 2002 all sub-national units were appointed by the central government and therefore were not representatives of the local inhabitants. Eventually, Cambodian government, apparently under external pressure from aid agencies, had to adopt a decentralization law in March 2001 (Law on Khum/Sangkat Administration, LKSA). Khum/Sangkat Councils have become elected to serve a five year-term (LKSA, Art.11).

The Constitution provides for three administrative levels for both cities and provinces: cities are divided into khans (districts) which, in turn, are sub-divided into sangkats (communes). Provinces are sub-divided into sroks (districts) and sroks into khums (communes). The current decentralization policy covers only the lowest units: Khum and Sangkat.

2. LITERATURE REVIEW

Decentralization becoming a legal term. Although "it is difficult to determine from where the motivation came for the Cambodian government to pursue its policy of decentralization" (Ayres 2001:51), several overall arguments are possible. First, it was widely believed that the closer the administration is to the people, the better they can serve them and help to alleviate poverty. Such an argument appeared on the 'statement of reason' attached to the draft-law on decentralization submitted to the National Assembly. Indeed, the Cambodian government may have found decentralization a desirable policy following a remarkable success of the donor-funded SEILA Program which started in mid-1990s dealing with poverty alleviation (Seila 2000). The second and perhaps the strongest argument was that by solely applying the party-member candidacy system for Khum/Sangkat Councils elections, the ruling political parties would be able to better control or manage to win support from the bottom of society in the following national legislative elections (Prum 2005a: 125-6; Blunt and Turner 2005: 77). Third, decentralizing power to small units would not "threaten a major shift" of "state power" from the center to the peripheries for this country's "stability in economy and polity is recent" (Turner 2002: 362). The term 'decentralization' became a legal term when LKSA uses it in its first article: "The present law regulates the administration of all Khum/Sangkat in the kingdom of Cambodia in accordance with the politics of decentralization".

Rationale and Components of Political Decentralization. Classic theorists such as Alexis de Tocqueville and John Stuart Mill firmly believed that local self-government system had a set of political values: political education and the respect of local interests. Thus,

[T]he strength of free peoples resides in the commune. Communal institutions are to liberty what primary schools are to science; they put it within people's reach; they teach people to appreciate its peaceful enjoyment and accustom them to make use of it (Tocqueville, reprint, 1961: 59).

* Dr. Virak Prum is adjunct professor of law and teaches Cambodian Business Law diploma course at CamEd Business School. Article submitted in January 2020.

For Mill:

The very object of having a local representation, is in order that those who have any interest in common, which they do not share with the general body of their countrymen, may manage that joint interest by themselves (Mill, Representative Government, Reprint 1977).

Contemporary proponents for political decentralization contend that it could lead to political education, training in political leadership, political stability and political equality. Smith (1985: 18-30) believes in:

- Political education: This helps people to understand the role of political debate, the selection of representatives, and the nature of policies, plans, and budgets. "Through experience in local government people learn to choose between priorities and leaders" (1985: 188).
- Training in political leadership: Prospective political leaders learn to develop skills in policy making…The quality of national politicians is enhanced.
- Political stability: People's trust in government can be strengthened through popular participation in formal politics such voting and other practices. "Social harmony, community spirit and political stability" can also be attained.
- Political equality: Greater participation associated with decentralization reduces the likelihood of the concentration of power in a few hands at the center and distributes political power to localities, thus better meeting the needs of the poor and the disadvantaged.

Likewise, Olowu (1997: 108) attaches to decentralization some political values in three ways:

First, [local governments] can help educate citizens in the art and discipline of responsible government… Second, local governments help to recruit and train the new political leadership which can afterwards aspire to national-level leadership. Third, they make possible the participation of the greatest number of citizens in the political and democratic process. This is because local governments are more proximate to the public than the central government. As a result,… local authorities provide a window of democratic opportunity for the public to assert and extract higher levels of accountability from government officials at this level. The process is greatly assisted by the fact that local politicians are closer geographically, socially, and economically to their public compared to any other level of government.

In this reasoning, political decentralization (also called 'democratic decentralization') tends to describe a series of arrangements aiming at empowering both local governments as representative elected offices and local inhabitants through an informed participation. Representative politics and popular participation can usually advance local development and create a more responsive and accountable government (World Bank 1997: 110-120). To achieve these aims, political decentralization often needs a Constitutional guarantee or at least a statutory basis (See e.g., Rondinelli 1999, Manor 1999, Cohen and Peterson 1999). Political decentralization emphasizes the relationship between state and its citizens through various participation mechanisms leading to a "participatory development" (Vedeld 2003: 160). Seddon (1999: 15-7) sees participation as both a means ('precondition') and a goal of democratic decentralization.

If political decentralization means "some reduction in the degree of accountability of sub-national governments to the central government" (Smoke 2003: 11), it clearly implies that political decentra lization should be supported by two major pillars local power and local participation. In other words, political decentralization broadly means two things: empowerment of local government, and empowerment of local inhabitants. The empowerment of local government takes three components as its basis, namely, Constitutional or statutory guarantee, a meaningful sphere of devolved power and a clear separation of central-local functions, while the empowerment of local inhabitants is done through the election of local councilors, the participation in decision-making, and the right of inhabitants to recall unpromising local councilors. Thus, the strength of a political decentralization is evaluated based on the strength of these components.

It implies that political decentralization depended on at least six components namely, Constitutional guarantee, a meaningful sphere of devolved power, clear separation of central-local functions, democratic election of local councilors, popular participation, and the right of the inhabitants to recall unpromising local councilors. Thus, political decentralization may be defined as a process which tends to give more power to both elected local authorities and participatory inhabitants with the effectiveness of the

process being assessed by whether or not the sphere of devolved power has a Constitutional or statutory guarantee and also by whether or not inhabitants can truly influence local politicians over policies.

3. TEXTUAL APPROACH

Government's Policy of Decentralization. Cambodian government did not have any grand and comprehensive policy leading to the adoption of the decentralization system except an overall understanding revolving around two pieces of methods dominated by French system: décentralisation and déconcentration.[1] To French readers, décentralisation denotes the recognition of a set of local affairs as well as the transfer of roles and responsibilities from the central level to the lowest sub-national levels, that is- communes under a Constitutional guarantee of the local autonomy known as the principle of the libre administration, while déconcentration refers to the administration of other local levels which merely function as the state agents in the fields, and therefore do not hold any such local autonomy (Gruber 1996).

In the Cambodian case, a Governance Action Plan (GAP) was adopted by the government in March 2001 and highlighted eight priority areas of governmental reforms in which "decentralization and local governance" appeared as one.[2] However, the government fell short as to 'how' this reform could be achieved. Ironically, GAP was agreed upon after the decentralization law itself had been adopted (by the National Assembly on January 12th 2001 and the Senate on February 1st 2001). GAP also mentioned "the adoption of a policy framework" as one of its benchmarks. Clearly the LKSA was done without any comprehensive agreed policy beforehand as to how it would be implemented. This lack of an a priori policy will simply fuel conflicting interpretations among agencies and stakeholders afterwards. Without any grand comprehensive policy, it would be necessary to discern a framework from the text of the law itself.

Table 1: Law on Khum/Sangkat Administration, 2001

Article(s)	Description
2-4	Khum/Sangakat as legal entity (corporate status)/ Acquisition of power through elections
21, 23	Meetings at least once a month and shall be public and democratic
27-28	Khum/Sangkat mayor can create committees/ A clerk appointed by the Minister of Interior
41	Recognition of local affairs within the respect of national interests
42-44	Dual responsibility for Khum/Sangkat: General socio-economic local affairs and Agency functions. Art. 43 reads: • Maintaining security and public order • Managing necessary public services and make them work well • Encourage the improvement of contentment and welfare of the citizens • Promoting social and economic development and upgrading the living standard of the citizens • Protecting, preserving the environment, natural resources, culture and national heritages • Reconciling citizens' concept to seek for mutual understanding and tolerance • Performing general affairs to respond to the citizens' needs.
45	Excluded from the Khum/Sangkat functions: forest, post and telecommunication, national defense, national security, monetary, foreign policy, fiscal policies, and other fields as specified by law and regulations
47	Roles and functions of Khum/Sangkat to be specified in detail by cabinet orders (sub-decrees)
48-49	Powers of Khum/Sangkat to adopt and execute deika (by-laws) within law and other regulations
53-55	Control of legality on Khum/Sangkat decisions and power of substitution by the Minister of Interior
57-58	Dissolution of Khum/Sangkat by the Minister of Interior
59	Creation of a body subordinate to the Ministry of Interior to deal with local administration (Now known as the Department of Local Administration, DoLA)
61-62	Conformity of Khum/Sangkat development plans with the national socio-economic plan/ Khum/Sangkat plans to be updated every year
64	Khum/Sangkat plans must ensure the popular participation in the whole process
73	Khum/Sangkat have own budget and assets
74-75	Incomes from fiscal and non-fiscal taxes and other service charges/ Local Tax Act to be adopted/ Income from transfers and subventions from the national budget
76	Incomes charged from performing agency functions
80	Khum/Sangkat banned from borrowing and any other financial obligations
87-88	Creation of an inter-ministerial body called the National Committee to Support Communes (NCSC) (commune=khum/sankat). NCSC has the DoLA as its secretariat. The most important task of NCSC is to decide the allocation of functions between the central government and communes.

Some quick comments can be made regarding the framework adopted by the law. What did decentralization intend to cover? Khum/Sangkat got vested with a very broad competency including the 'general competency clause', but in reality their works were reduced to adopting development plans and making civil registrations. Their power was restrained within a strict compliance with all higher norms (Prum 2005a). The question as to

1 The vast majority of textbooks at the faculty of law in 1996 (the only one state law school available in Cambodia at that time) were in French and all about the French system. And it was only from early 1990s that décentralisation and déconcentration started to appear on handouts to students of administrative law.

2 See "Governance Action Plan" (GAP), Speech by SOK An, Minister in charge of The Office of the Council of Ministers, and Chairman of the Council for Administrative Reform, at the Consultative Group Meeting, Phnom Penh 19- 21 June 2002.

why the government had come up with the idea of decentralization could never find a clearer answer except a general idea that decentralization could help local governments to better provide services. Cambodian decentralization did not come from either local people's demanding voice or fear of separatism. The geographical boundaries to be covered by decentralization were clear, however. The law clearly tells where. Indeed, Khum/Sangkat are the only decentralized authorities. A big question was lingering on as to who would actually be tasked with carrying out the decentralization dream. The law created the DoLA and the NCSC (see Table 1) but failed to give principles or guidelines to govern the relationships between these two bodies as well as between them and other existing bodies at that time, i.e., the Seila Task Force (responsible body for the Seila Program), making it unclear whether the NCSC's instructions would be binding on these and other agencies and line ministries. In practice, it is DoLA that is daily involved in the process. However, a big puzzle was that since DoLA was a part of the Ministry of Interior, who could expect the one to lose power the most to be active? Timeframe was yet another issue. The law was unclear as to when decentralization should be implemented. This absence of time sequences resulted in many major ministries (i.e., health, education) being reluctant to delegate power to Khum/Sangkat. Now, almost two decades following the promulgation of the law, Khum/Sangkat still have nothing to do with elementary schools in their territory. Above all, it was the question of how which commanded attention to the fullest. As shown in Table 1 above, Khum/Sangkat had (still have) a dual responsibility: local affairs (including general competency) and agency functions (through delegations), but nothing could tell what the functions under the label of local affairs were; also there was no legal obligation on central ministries to delegate functions to Khum/Sangkat either. Within such environment, the success of Cambodian decentralization should be very much unpredictable. But was it so in political terms?

The Six Components in Cambodian Political Decentralization. The current Constitution (promulgated in 1993) mentions nothing about the decentralization. Political decentralization in Cambodia has had no Constitutional guarantee. The statutory basis (LKSA) was indeed re-centralizing the administration albeit in some new popular terms. Prum's analysis (2005a) clearly pointed out that the sphere of local power was theoretically almost non-existent. Blunt and Turner (2005: 83) further confirm that the actual decision-making power of Khum/Sangkat was virtually none. Indeed, there was no clear central-local separation of functions so as to formulate a sphere of local power distinct from the central government's competency. Article 45 which excludes some specific areas from Khum/Sangkat's competency does not mean that the local power covers everything that is not excluded. In fact, not only there was no central-local separation of functions, the legislature improperly delegated power (Art. 47) to the central government to fix at will what should be the functions of Khum/Sangkat (Prum 2005a: 130-35).

Until mid-2005 no legal documents had materially clarified the allocation of functions as posited by the Art. 88. Note that the internal report "Memorandum Outline of the Scope and Content of Decentralization in Cambodia" prepared by the Ministry of Interior had made it clear that "specific or general functions and powers for Khum/sangkat must still be identified by sub-decree" and that it was necessary to develop guidelines to establish what functions to be decentralized (devolved) and also those to be deconcentrated. The awaited Government's order, unfortunately, did not live up to this expectation. Indeed, Art.61 of the "Anukret on the Decentralization of Power, Roles, and Functions to Khum/Sangkat" (government order, dated 25 march 2002) merely repeated exactly the same vague wording of the LKSA's Art. 43 (See Table 1). One still legitimately wonders what the functions of Khum/Sangkat would really be. Khum/Sangkat Councils became elected through direct popular vote (LKSA, Art.4). The popular participation in the "whole process" of the development plan was guaranteed (LKSA, Art.64). Indeed, the "Inter-Ministerial Prakas on the Khum/Sangkat Development Planning" (Co-signed by Minister of Interior and Minister of Planning, dated 7 February 2002) reiterated the necessity of the "participation of all people concerned" in the implementation of Khum/Sangkat development plans in its Art.4.

The periodic elections should occur once in five years and the idea of participation was still embryonic. Inhabitants of Khum/Sangkat were not to have right to dismiss any local officer. Within the interval, inhabitants would hold no verdict on eventually unpromising local councilors for the mechanism of recall was not recognized. Interestingly, the dissolution of a Khum/Sangkat council was resting

with the power of the Minister of Interior (LKSA, Art. 57-58). The development planning was to be made only once for the whole five year-term (with possible annual modifications). Thus, it would be in the implementation phase that one could expect more frequent participations. Surprisingly, the Inter-Ministerial Prakas mentioned above only required the participation during the implementation phase from "those who would benefit" (Art.21).

In brief, assuming that each component is equally important, the textual approach ranks Cambodian political decentralization in a very low position (2 out of 6).

Table 2: The Six Components and Cambodian Political Decentralization

	Yes	No	Virtually No
Constitutional Guarantee		X	
Local elections	X		
Recall		X	
Participation	X		
The sphere of local power (Khum/ Sangkat)			X
Central-local separation of functions			X

Note: For analysis on the sphere of local power and central-local separation of functions, see Prum (2005a)

4. CONCLUSION

At least on the face of the law, political decentralization has hardly existed in Cambodia. Indeed, the six components of political decentralization, namely 1) Constitutional guarantee, 2) local elections, 3) recall, 4) popular participation, 5) the sphere of local power, and 6) the central-local separation of functions, were in a poor shape from the beginning. While the components 5 and 6 were virtually non-existent, the only available components, elections and participation, were not very assertive and frequent enough. Revisiting the textual (legal) approach could prove its usefulness in understanding in which ways a governance system was built to behave. In the case of political decentralization in Cambodia, this review article indicates that for a political decentralization to be effective, the law would need to be much more decentralization friendly right from the start.

REFERENCES

Ayres, David (2001) Decentralisation: A Review of Literature, Phnom Penh: CCSP (Commune Council Support Project).

Blunt, Peter and Turner, Mark (2005) 'Decentralisation, Democracy and Development in A Post-Conflict Society : Commune councils in Cambodia', Public Administration and Development 25 (1).

Cohen, John M and Peterson, Stephen B (1999) Administrative Decentralization : Strategies For Developing Countries, Connecticut : Kumarian Press.

Gruber, Annie (1996) La Décentralisation et Les Institutions Administratives, Paris: Armand Colin.

Manor, James (1999) The Political Economy of Democratic Decentralizaton, Washington, D.C : The World Bank.

Mill, John Stuart (1977) Representative Government, in Collected Works, Essays on Politics and Society. London: Routlegge and Kegan Paul.

Ministry of Interior (2000) 'Memorandum Outline of the Scope of Content of Decentralization in Cambodia', unpublished report, Phnom Penh : MoI.

Olowu, Dele (1997) ''Comment'', Regional Development Dialogue 18 (2) : 107-117.

Prum, Virak (2005a) 'Decentralization Within the Centripetal Expression of State Power: Re-Guiding Cambodian Statutory Devolution', Forum of International Development Studies 28.

_____ (2005b) 'Reforming Cambodian Local Administration: Is Institutional History Unreceptive For Decentralization?', Forum of International Development Studies 30 (forthcoming publication).

Rondinelli, Dennis (1999) 'What is Decentralization?' in Litvack J. and Seddon J (eds.) Decentralization Briefing Notes, Washington, D.C: World Bank Institute.

Seddon, Jessica (1999) "Participation, Civil Society, and Decentralization" in Litvack J. and Seddon J (eds) Decentralization Briefing Notes. Washington, D.C: World Bank Institute.

Seila (2000) Seila Program Document 2001-2005, Seila Task Force: Phnom Penh.

Smith, B.C (1985) Decentralization: The Territorial Dimension of the State. Allen and Unwin.

Smoke, Paul (2003) "Decentralisation in Africa: Goals, Dimensions, Myths and Challenges', Public Administration and Development 23(1): 7-16.

Turner, Mark (2002) 'Whatever Happened to Deconcentration? Recent Initiatives In Cambodia', Public Administration and Development 22 (4).

Tocqueville, Alexis de (1961) De La Démocratie en Amérique (Oeuvres Complètes, Tome I, under J.-P. Mayer). Paris: Firmin-Didot.

Vedeld, Trond (2003) "Democratic Decentralization and Poverty Reduction: Exploring the Linkages", Forum for Development Studies 30 (2): 159-204.

World Bank (1997) World Development Report. New York: Oxford University Press.

Journal of Accounting, Finance, Economics, and Social Sciences
Vol 5, No 1, July – December 2020, pp. 36-48
Received: Feb 2020 | Revised: Apr 2020 | Accepted: Jun 2020
DOI: https://doi.org/10.62458/jafess.160224.5(1)36-48

Applying Value-at-Risk on A Portfolio Investment in The Cambodia Securities Exchange

Siphat Lim*

ABSTRACT

Value-at-Risk (VaR) is a very famous and popular model which has been widely used to measure the potential exposure of the value of loss of an underlying asset or an investment portfolio at a certain confidence level and holding period. The main objective of this paper is the implement all of the three approaches applicable to estimate VaR namely non-parametric, parametric, and Monte-Carlo simulation VaR on the synthetic investment portfolio which consists of HKL's bond and five stocks listing and trading in CSX besides the securities the portfolio also includes the FX and commodity, such as, gold and crude oil. At the position date the initial market value of this portfolio is KHR 591,514,539. With the confidence level of 95% and the holding period of 1 day VaR is KHR 6,198,453, KHR 5,523,467 and KHR 5,354,189 estimated by the non-parametric, parametric and Monte-Carlo simulation respectively. This research also indicates that the non-parametric VaR is very simple to implement; therefore, this approach is highly recommended for the investors who intention is the estimate the risk exposure of the value of the assets or portfolio. On the other, the parametric and Monte-Carlo simulation approaches, which is perceivably more difficult than the non-parametric, are highly recommended for the study which intention is to seek high accuracy.

Keywords: VaR, CSX, Monte-Carlo Simulation, investment portfolio.

1. INTRODUCTION

The value of the assets and the investment portfolios can change anytime at any moment by many factors namely the market factor of demand and supply of the underlying assets, and the risk encounter by the investors now and in the future. The uncertainty in the value of the underlying assets, especially the value of the financial assets and the commodity, has posted as an obstacle to the investors to maximize the profit of the investment portfolios hold in the balance sheet. Both the internal and external factors can cause an investment portfolio to loss its value at a short period of time and make the prediction a job of expertise which requires a lot of time, efforts and resources, yet vital to do. Although, the financial analysts cannot be 100 per cent sure about the future, their job is vital to ensure that the future is comprehensible and necessary measures is undertaken effectively to protect the investors and their investment from the potentially liquidity risk which can result in financial recession and bankruptcy.

In fact, various approaches have been developed by the professionals and researchers to predict and estimate the change in the value of the underlying assets and the investment portfolios. Significantly, the prediction and estimation of the variation of value of the underlying assets and investment portfolios are pivotal for managing risk, constructing the financial report and managing the finance to guarantee that the capital are effectively invested to maximize the profit, and the liquidity risk and insolvency risk are minimized to lowest level possible.

Among the many approaches, the Value at Risk (VaR) was developed in 1980s and has become a popular quantitative measurement technique in the early 1990s. VaR, moreover, is widely recognized and adopted by the analysts, professionals and researchers as a prolific technique to accurately measure the risk exposure of the underlying assets and investment portfolios. In accordance to Jorion (2007) claimed that with a predetermined confident level, VaR is able to generate the worst loss over a target horizon. With the ability to comprehend the worst future, the model enables the investors to make necessary preparation to ensure that they are secured from the liquidity risk. Basically, three

* This research was supported by a grant from the CamEd Business School. Correspondence concerning this article should be address to addressed Siphat Lim, CamEd Business School, No. 64 Street 108, Phnom Penh, Cambodia. Contact: lsiphat@cam-ed.com

different methods have been adopted to calculate VaR namely the historical stimulation also known as the non-parametric VaR, the parametric VaR or delta-gamma VaR and the Monte-Carlo simulation VaR.

The main purpose of this research paper is to calculate the Value at Risk of an investment portfolio which includes the financial assets, such as, all of five stocks and the Hattha Kaksekar Limited's bond which are listed and trading at Cambodia Securities Exchange (CSX), two commodities, gold and crude oil, and the foreign exchange (FX) are included in this investment portfolio. This study will employ all of three methods including the non-parametric VaR, the parametric VaR and the Monte-Carlo simulation VaR, as specified above to calculate the Value at Risk of this investment portfolio.

2. LITERATURE REVIEW

Measuring the capital at risk in the portfolio investment under the extreme scenario plays a vital role to enable the traders to foreseen the potential maximum capital loss at a particular time frame. The Value-at-Risk (VaR) is extensively adopted by the numerous financial institutions, investors and creditors as a risk assessment method to measure the maximum capital loss to an investment portfolio or risky assets over a period of time under the provided confidence interval. Soon after, it was introduced by J. P. Morgan in 1998 in their RiskMetrics which purposefully aims to publish the volatility and correlation information for stocks listed on the major markets in the world (Kaura, n.d.). Pafka and Kondor (2001) argued that the popular RiskMatrics is the artifice of the choice of risk assessment. Provided that the exceptional performance of volatility estimates is because of the short forecasting horizon and the satisfactory performance in obtaining the VaR is because of the choice of the confidence level.

The VaR method, however, is comprehensively conducted to determine the exposure of the capital to the potential market risks which is the extensively used by the creditors, such as, commercial and investment banks to study about the exposure of their portfolio investment to risk over a particular time to ensure that their capital and cash reserve can cover the value-at-risk without putting the firms at the financial distress. (Kaura, n.d.), Koch (2006), Goorbergh and Vlaar (1999), Shirazi (n.d.), Gregory and Reeves (2008), Hong, Hu, and Liu (2014), Linsmeier and Pearson (2000), Borgdan, Baresa, and Ivanovic (2015), Jorion (2007) and Wong, Cheng, and Wong (2003) have all comprehensively employed the VaR method in studying the exposure of the market risks on the portfolio investment. The Value at Risk can be computed by three methods, namely, the historical VaR, the parametric VaR and the Monte Carlo Simulation VaR with each method offers certain pros and cons.

The historical analysis, first and foremost, adopts the historical data from the market ratio or prices to empirically analyse the value at risk. Considered as the easiest method to measure the value at risk, this nonparametric method uses essentially the empirical distribution of portfolio returns, and is not required to fulfil any distributional assumptions (Goorbergh and Vlaar, 1999). The realistic historical information of the past event enables the researchers to accurately predict the possible future event (Kuara, n.d.). The readily available data also adds more simplicity to the method. For example, the historical trading data, such as, securities, is publicly available (Borgdan, Baresa, and Ivanovic, 2015). Only predetermining the time horizon of the data is required, and no mapping is required in comparison with the parametric method. On the contrary, the major drawback of this method is if the composition of the portfolio investment changes over time, collecting large sample size is unmanageable. Therefore, making this method becomes less feasible (Koch, 2006). The historical simulation approach using the historical asset returns data, however, is applicable to dealt with this problem. Yet, intensive computation is required for the large portfolio investment (Kuara, n.d.).

The parametric VaR method, which is also called by other names, including variance-covariance, and linear or delta normal VaR, is another popular method to measure the value-at-risk. According to Lausbch (1999), the parametric method also uses the historical data to measure the potential risk. Unlike the previous method, this method does not require long historical data which allows this method to be quickly and easily calculated. The mean value of the yield rate and the standard deviation of the same data are the two major variables used by the parametric method in the calculation. The primary requirement of the parametric method, however, is the data has to be normal distribution (Value-at-Risk, n.d.). Meaning that the mean value, arithmetic mean, mode and median are the same size and it has a bell shape. Lausbch (1999), on the other hand, stated that the hypothesis of the normal distribution is main disadvantage of the parametric model which makes it

less feasible for the nonlinear portfolios and distorted distribution. Jackson, Maude and Perraudin (1997) which VaR was applied on the trading book of an anonymous bank, have concluded that the simulation approach provides more accurate measures of tail probabilities comparing to the parametric VaR. This can happen due to the arise of a serious non-normality of financial return. Lausbch also anticipated that the major limitation of the parametric model is the constancy of the computed standard deviation and correlation coefficients, in which value changes throughout the time. Hence, if the researchers fail to modify the computation due to the extreme values of VaR, it will result in the misinterpretation of the results.

Last but not least, Monte Carlo Simulation is last method for forecasting VaR. The Monte Carlo, basically, is a justify name for the stochastic method for computing VaR. Due to the fact that the method involves the computer simulation of various influences on the observed portfolio of securities (Borgdan, Baresa, and Ivanovic, 2015). Similar to the historical method, this method involves complex computation of the historical data to predict the future risk and potential loss with a statistical confidence interval. The complex computation which involves hundreds or thousands of possible scenarios and generates the feasible solution makes this method to be the most reliable method to compute VaR (Borgdan, Baresa, and Ivanovic, 2015). This method, additionally, can be employed to calculate both the value of stochastic and non-stochastic. Vose (1997) indicated that Monte Carlo is the mathematical risk analysis techniques which describe the impact of risk and uncertainty on the problem. The uncertain parameters in the model are characterised by distribution of probabilities. While that shape and size of these distribution describes range of values that parameters can have with their relative probabilities. Ostojić, Pokorni, Rakonjac, and Brkićm (2012) and Lausbch (1999) agreed that a major advantage for Monte Carlo method would be its effectiveness to accurately calculate the risk value of various financial instruments, yet this method does not necessarily require large historical data. Significantly, the Monte Carlo method support the use of different distribution, including t-distribution, normal and similar. While the major drawbacks for this method are the requirement for complex analysis and really time consuming. Finally, selecting the proper distribution is also vital to quantify the risk of thickened tail distribution.

VaR, in conclusion, is the maximum potential loss to a portfolio investment at a particular period of time. This risk assessment method is very handy for the investors and creditors to estimate the potential loss due to its applicability and simplicity, and the model itself has passed numerous modifications which aim to improve the precision to forecast the value-at-risk. Hendricks (1996) applied the VaR on 1,000 randomly selected foreign exchange portfolios from 1983-94. The study suggested that among the twelve approaches which was applied, none is perceived to have more superiority over the others. The choice on the confidence level, however, appears to have significant influence on the performance of VaR. Borgdan, Baresa, and Ivanovic, (2015), on the other hand, claimed that besides the many advantages that this model contains, the model should be applied with some precautions, for example, the model focus mainly on the portfolio losses but cannot entirely forecast the future losses. Most importantly, the dramatic price fluctuations can probably influence the computed value-at-risk and generate false security, such as, undervalued or overvalued risk. Hence, the VaR method has the best applicability in the stable market conditions.

In this paper, the VaR methods will be applied to study the expected loss of a constructed portfolio investment in the Cambodia Securities Exchange (CSX). This paper will employ the three estimated methods of VaR which are historical VaR, parametric VaR, and Monte Carlo Simulation VaR on a constructed portfolio investment in the CSX. The assets which are going to include in the constructed portfolio are fixed-income security, equities, commodities and FX.

3. METHODOLOGY

The main purpose of this research paper is to calculate the Value at Risk of an investment portfolio which includes the financial assets, such as, all of five stocks and the Hattha Kaksekar Limited's bond which are listed and trading at Cambodia Securities Exchange (CSX), two commodities, gold and crude oil, and the foreign exchange (FX) are included in this investment portfolio. This study will employ all of three methods including the non-parametric VaR, the parametric VaR and the Monte-Carlo simulation VaR, as specified above to calculate the Value at Risk of this investment portfolio. The position of this investment portfolio was constructed in January 22, 2019. Considering from that time period, only five stocks from five different companies were listed and trading at CSX. The detail information, the synthetic

investment portfolio and the number of the position which are hold in this investment portfolio are all listed in Table 1.

Table 1: Synthetic Portfolio

Classification	Assets	Name	Units
Fixed-income Security	Bond	Hattha Kaksekar Limited	100
Equity	PWSA	Phnom Penh Water Supply Authority	1,000
	GTI	Grand Twin International	1,000
	PPAP	Phnom Penh Autonomous Port	1,000
	PPSP	Phnom Penh SEZ Plc.	1,000
	PAS	Sihanoukville Autonomous Port	1,000
Commodity	Gold	Gold	100
	Crude Oil	Crude Oil	100
Foreign Exchange	FX	Khmer Riel/US Dollar	500

This study will use the daily data from January 2, 2018 to January 22, 2019 which the last date is regarded as the position date. Furthermore, the daily data is retrieved from the Bloomberg Terminal. On the other hand, the data of the Hattha Kaksekar Limited's bond are collected from CSX. Last but not least, to quote the daily bond price, the zero coupon yield (ZCY) will be used. However, because ZCY data of Cambodia is not available, Thailand ZCY will be adopted as the proxy. The ZCY will be retrieved from the Thai BMA which includes the ZCY-3-month, ZCY-6-month, ZCY-1-year, ZCY-2-year and ZCY-3-year. However, due to the fact that all of those ZCY are not fit with the time of cash of the HKL's bond, hence, the interpolated yield will, instead, be used to solve this problem.

$$Z_{0.3068} = Z_{0.2493} + \frac{(t_{0.3068} - t_{0.2493})(Z_{0.4986} - Z_{0.2493})}{(t_{0.4986} - t_{0.2493})}$$

$$Z_{0.8110} = Z_{0.4986} + \frac{(t_{0.8110} - t_{0.4986})(Z_1 - Z_{0.4986})}{(t_1 - t_{0.4986})}$$

$$Z_{1.3096} = Z_1 + \frac{(t_{1.3096} - t_1)(Z_2 - Z_1)}{(t_2 - t_1)}$$

$$Z_{1.8137} = Z_1 + \frac{(t_{1.8137} - t_1)(Z_2 - Z_1)}{(t_2 - t_1)}$$

$$Z_{2.3096} = Z_2 + \frac{(t_{2.3096} - t_2)(Z_3 - Z_2)}{(t_3 - t_2)}$$

$$Z_{2.8137} = Z_2 + \frac{(t_{2.8137} - t_2)(Z_3 - Z_2)}{(t_3 - t_2)}$$

The calculated result of the interpolated yield will be used as the discount rate to calculate the present value of the expected future cash flow of HKL's bond and the daily bond price using the below formula:

$$Bond\ Price = \sum_{i=1}^{N} \frac{CF_i}{\left(1 + \frac{ZYC_i}{100}\right)^i}$$

To calculate the VaR, two factors are required the confidence level and holding period or horizon. Five main step are required to calculate the VaR.

1. Mark position to market
2. Measure variability of the risk factors
3. Set time horizon
4. Set confidence level
5. Report potential loss

3.1. Non-parametric VaR

The initial value of the investment portfolio is notated by W_0 which create the return of investment R. In this study, the holding period is 1 day. Therefore, the value of this portfolio can be written as below after the next 1 day.

$$W = W_0 + W_0R = W_0(1+R)$$

Where, the expected value of R is and the standard deviation or volatility is .

Other the hand, the minimum value of portfolio with the confidence level, c can be written as the following:

$$W^* = W_0 + W_0R^* = W_0(1+R^*)$$

The money loss in comparison with the mean is called relative VaR.

$$\begin{aligned} VaR(mean) &= E(W) - W^* = W_0 + W_0E(R) - W_0 - W_0R^* \\ &= -W_0R^* + W_0E(R) = -W_0[R^* - E(R)] \\ &= -W_0(R^* - \mu) \end{aligned}$$

Since, $E(R) = \mu$

Thus,

$$VaR(0) = -W_0R^*$$

Other than this, VaR can also be calculated using the probability distribution of the future value of the portfolio f(w). The estimated minimum value of the portfolio W* which the probability can exceed W* is the confidence level, c which can we written as the below:

$$c = \int_{W^*}^{\infty} f(w)dw$$

Or

$$1 - c = \int_{-\infty}^{w^*} f(w)dw = P(w \leq W^*)$$

3.2. Parametric VaR

This method relies on the standard deviation of the portfolio which require the assumption of normal distribution. The expected value of the portfolio, f(w) is assumed to follow the standard normal distribution, $\Phi(\epsilon)$ where $\epsilon \sim (0,1)$ As demonstrated above, the minimum value of the portfolio can be written as:

W* = w (1+R*) which R* has a negative number, $-|R^*|$

Thus,$-Z_\alpha$ score of$-|R^*|$ can be written as the following:

$$-Z_\alpha = \frac{-|R^*|-\mu}{\sigma} \qquad (*)$$

Which is equivalent to:

$$1 - c = \int_{-\infty}^{W^*} f(w)dw = \int_{-\infty}^{-|R^*|} f(r)dr = \int_{-\infty}^{-Z_\alpha} \Phi(\epsilon)d\epsilon$$

From equation (*), the cutoff return is:

$$R^* = -Z_\alpha \sigma + \mu$$

According to the equation (*) and time interval, Δt

$$VaR(mean) = -W_0(R^* - \mu) = W_0 Z_\alpha \sigma \sqrt{\Delta t}$$

As demonstrated in equation (*) the main variables to calculate VaR is portfolio standard deviation. The first step required to undergo is to define the risk factor (RF) of each underlying asset in the portfolio (See Table 2.). The second step is to calculate the percentage of daily change of risk factor of each underlying asset using the formula below:

$\Delta RF = (S_t - S_{t-1}) \times 100$, for ZCY and FX

$\Delta RF = LN(S_t / S_{t-1})$, for fixed income security, equity and commodity

Table 2. Asset Classification and Risk Factor

Classification	Assets	Risk Factor
Fixed-income Security	Bond	ZCY
Equity	PWSA	PROP
	GTI	PROP
	PPAP	PROP
	PPSP	PROP
	PAS	PROP
Commodity	Gold	Gold Price and FX
	Crude Oil	Crude Oil Price and FX
Foreign Exchange	FX	USD

After ΔRF is calculated. The next step is calculate the Variance-Covariance Matrix (VCM) of ΔRF of all assets in the portfolio. In fact, a number of method, such as, Equal Weight (EW), Moving Average (MA), GARCH and ARCH, all can be employed for the calculation of VCM. In this research, however, EW will be adopted in the calculation of VCM. After the VCM is calculated, the portfolio standard deviation $SD(\sigma)$ can be calculated as below:

$$\sigma = \sqrt{\delta^T \Omega \delta}$$

Where:

σ : Portfolio standard deviation,

δ : Vector of change of value profit/loss with respect to change of risk factors,

Ω : Variance-Covariance Matrix

The parametric VaR can be written in a specific form as the following:

$$VaR = -Z_\alpha \times \sqrt{\delta^T \Omega \delta} \times \sqrt{HP}$$

Because this study chooses to use the 5% level of significant. Therefore, the Z-value is equal to 1.64. Additionally, the holding period (HP) is 1 day.

Down below is illustration of the Delta-Normal Method or change of value profit/loss with respect to change of risk factor of each asset.

Fixed-Income Security (Bond)

To estimate the change in Profit/Loss (P/L) of the investment on the fixed-income security or bond, in this research, the dollar value per one basis point (DV01) will be used and can be calculated using the formula below:

$$DV01 = \sum_{i=1}^{N} -\frac{t_i}{10000} \times CF_i \times \frac{1}{\left(1 + \frac{ZCY_{t_i}}{100}\right)^{t_i+1}}$$

Actually, HKL's Bond created cash flow six times counting from the issuing date until the maturity date which consists of three years from 2019 to 2021. Each year, the bond interest will be paid twice during May 14 and Nov 14 of each year. Due to the fact that the ZCY consists of only five periods which is ZCY-3-month, ZCY-6-month, ZCY-1-year, ZCY-2-year and ZCY-3-year, thus, mismatch with the cash flow of six periods. Therefore, to match the zero coupon yield with the cash flow, the cash flow mapping will be used with the adoption of weight (α). To calculate the weight which is notated by α, a quadratic form of equation is constructed as the following:

$$\alpha\ \alpha^2 + b\alpha + c = 0$$

To solve for α the below formula can be applied.

$$\alpha = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Where:

$$a = \sigma_i^2 - 2\rho_{ij}\sigma_i\sigma_j$$

$$b = 2\rho_{ij}\sigma_i\sigma_j - 2\sigma_i^2$$

$$c = \sigma_j^2 - \sigma_i^2$$

Where:

σ_i^2 : Variance of ZCY_i

σ_i : Standard deviation *of* ZCY_i

σ_j^2 : Variance of ZCY_j

σ_j : Standard deviation of ZCY_j

ρ_{ij} : Correlation between of ZCY_i and ZCY_j

Table 3. Cash Flows Mapping

Cash Flows	ZCY-3M	ZCY-6M	ZCY-1Y	ZCY-2Y	ZCY-3Y
PVCF1	$\alpha_1 \times PVCF_1$	$(1-\alpha_1) \times PVCF_1$			
PVCF2		$\alpha_2 \times PVCF_2$	$(1-\alpha_2) \times PVCF_2$		
PVCF3		$\alpha_3 \times PVCF_3$	$(1-\alpha_3) \times PVCF_3$		
PVCF4			$\alpha_4 \times PVCF_4$	$(1-\alpha_4) \times PVCF_4$	
PVCF5				$\alpha_5 \times PVCF_5$	$(1-\alpha_5) \times PVCF_5$
PVCF6				$\alpha_6 \times PVCF_6$	$(1-\alpha_6) \times PVCF_6$
Synthetic Cash Flows of HKL21A	Total	Total	Total	Total	Total

Equity (Stocks)

The Delta-Normal for stock can be estimated using the method as the following:

$$MV \text{ of } Stock_i \times \beta_i$$

Where:

Market Value (MV) of $Stock_i$

= Number of Invested Shares × Current Market Price Per Share

While β (Beta) of $Stock_i$ can be estimated using the below formula:

$$\beta_i = \frac{\sigma_{i,CSX}}{\sigma_i^2}$$

Where:

$\sigma_{i,CSX}$: Covariance between return of $Stock_i$ and return of stock market index, CSX,

σ_i^2 : Variance return of $Stock_i$

Commodity

The Delta-Normal of commodity can be estimated using the method as the following:

MV of $Commodity_i$ in KHR = MV of $Commodity_i$ in US Dollar × FX

Where:

MV of $Commodity_i$ in US Dollar

= Number of Position Hold × Current Market Price in US Dollar

Foreign Exchange (FX)

$$Delta\ normal\ of\ FX = Number\ of\ Position\ Hold \times \frac{1}{100}$$

$$Delta\ normal\ of\ FX, Commodity_i = MV\ of\ Commodity_i\ in\ US\ Dollar \times \frac{1}{100}$$

3.3. Monte-Carlo Simulation VaR (MCS VaR)

MCS VaR can be estimated following four major steps:

1. Choose the stochastic process and parameters
2. Construct the stochastic value of the assets:

   $S_{t+1}, S_{t+2}, \ldots, S_{t+n}$
3. Calculate the value of the portfolio at the target horizon, $F_{t+n} = F_T$ based on the series of value in the portfolio
4. Repeating step 2 and 3 over and over again, this research will replicate 1,000 scenario simulations, K= 1,000.

After fulfilling all of the four steps and creating 1,000 portfolio values of $F_T^1, \ldots, F_T^{1,000}$. Then, all of the portfolio values will be arranged from smallest values to the largest values and the quantile Q (F,c), which is the value exceeded in C times 1,000 replications. Relative VaR can be estimated using the following formula:

$$VaR\ (c,T) = E(F_T) - Q(F_T, c)$$

or

$$VaR\ (c,T) = -Q(F_T, c), \text{ if } E(F_T) = 0$$

4. EMPIRICAL RESULT

The main purposes of this research paper are to implement all the approaching in estimating the VaR namely historical simulation VaR, parametric VaR and Monte-Carlo simulation on the synthetic portfolio investment which consists of HKL's bond, gold, crude oil, FX and the equity of PWSA, GTI, PPAP, PPSP, and PAS. As demonstrated, the estimation of VaR requires

two major variables the confidence level which is 95% and the holding period which is assumed to be 1 day.

First, estimating the VaR using the non-parametric or the historical simulation VaR, is beginning with the estimation of the market value of each asset by multiplying the number of each invested asset with the market value. Then, the daily market portfolio value can be can calculated by add up the daily market value of each asset. After that, the daily portfolio profit or loss can be calculated by minus the daily market value today with the daily market value of tomorrow. Last but not least, the estimated daily portfolio's profit or loss will be sorted from the smallest to the highest. The 5% percentile of daily portfolio can be generated thanks to the holding period which is 1 day. Therefore, the square root of 1 day equals 1. Hence, the 5% percentile of daily portfolio's profit or loss is the value at risk. However, before the result of the historical simulation VaR is shown, the summary statistics of return of each individual asset and portfolio's profit or loss will be shown first in Table 4.

Table 4. Summary Statistics of Return of Each Individual Asset and Portfolio's Profit/Loss

	Bond	*USD*	*Gold*	*CO*	*PWSA*	*GTI*	*PPAP*	*PPSP*	*PAS*	*CSX*	*Portfolio's Profit/Loss*
Mean	-2E-05	-2E-05	-0.0001	-0.0003	0.0008	0.0010	0.0032	0.0004	0.0039	0.0023	-11468
Standard Error	2E-05	5.2E-05	0.00041	0.0013	0.0010	0.0020	0.0013	0.0011	0.0014	0.0008	214949
Median	-2E-05	0	-3E-05	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	80893
Mode	0	0	#N/A	#N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	#N/A
Standard Deviation	0.00031	0.00081	0.00638	0.0197	0.0161	0.0307	0.0209	0.0178	0.0216	0.0125	3371340
Sample Variance	9.6E-08	6.6E-07	4.1E-05	0.0004	0.0003	0.0009	0.0004	0.0003	0.0005	0.0002	1.13659E+13
Kurtosis	4.92614	6.94705	0.91093	2.4189	13.9665	4.1997	6.8017	16.2599	8.9305	8.3844	0.8687
Skewness	-0.3794	0.7843	-0.0888	-0.6383	-0.2493	0.0372	1.1124	0.1754	1.3638	1.4645	-0.1863
Range	0.00289	0.00704	0.03815	0.1475	0.1981	0.2007	0.1890	0.1999	0.1842	0.1193	20365163
Minimum	-0.0015	-0.0027	-0.0206	-0.0718	-0.1041	-0.1054	-0.0937	-0.1045	-0.0899	-0.0397	-10498621
Maximum	0.0014	0.00434	0.01754	0.0758	0.0940	0.0953	0.0953	0.0953	0.0942	0.0795	9866542
Sum	-0.0059	-0.006	-0.0332	-0.0658	0.1875	0.2508	0.7789	0.1054	0.9487	0.5623	-2821249
Count	246	246	246	246	246	246	246	246	246	246	246

Table 5. Historical Simulation (HS) VaR	
Confidence Level	95%
Holding Period	1
VaR	-6,198,453
VaR as % of MV	-1.05%

Figure 1. Historical Simulation VaR

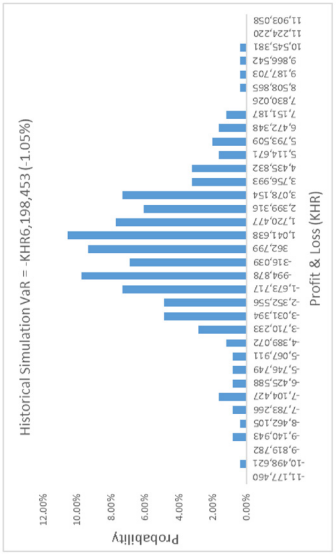


Table 6. Profit and Loss Distribution, HS VaR		
For Graphic Display on PandL Distribution		
Classification	**Assets**	**Risk Factor**
Bin Range	Frequency	% Frequency
-11,177,460	0	0.00%
-10,498,621	1	0.41%
-9,819,782	0	0.00%
-9,140,943	2	0.81%
-8,462,105	1	0.41%
-7,783,266	2	0.81%
-7,104,427	4	1.63%
-6,425,588	2	0.81%
-5,746,749	2	0.81%
-5,067,911	2	0.81%
-4,389,072	3	1.22%
-3,710,233	7	2.85%
-3,031,394	12	4.88%
-2,352,556	12	4.88%
-1,673,717	18	7.32%
-994,878	24	9.76%

-316,039	17	6.91%
362,799	23	9.35%
1,041,638	26	10.57%
1,720,477	19	7.72%
2,399,316	15	6.10%
3,078,154	18	7.32%
3,756,993	8	3.25%
4,435,832	8	3.25%
5,114,671	4	1.63%
5,793,509	5	2.03%
6,472,348	4	1.63%
7,151,187	3	1.22%
7,830,026	0	0.00%
8,508,865	1	0.41%
9,187,703	1	0.41%
9,866,542	1	0.41%
10,545,381	1	0.41%
11,224,220	0	0.00%
11,903,058	0	0.00%

Counted from Jan 2, 2018 to Jan 22, 2019, the total observations are 247 because 1 observation is loss when the portfolio's profit or loss is calculated. Therefore, the total observations have only 246 left. Based on the steps demonstrated above with the confidence level of 95% and the holding period of 1 day, VaR equals to KHR 6,198,453 which is approximately 1.05% of total portfolio value of KHR 591,514,539.83 calculated at the position date.

In fact, the estimation of VaR using the parametric approach is more difficult than the previous approach which requires to undergo many steps. Among that the Delta-Normal Method is most important and difficult step to achieve before the portfolio standard deviation and parametric VaR can be estimated.

To construct the Delta-Normal for the HKL's bond, first of all, the zero coupon yield correlation matrix needs to be generated. Table 7 indicated the zero coupon yield which the interpolated yield been applied to make the it fit to use with the expected cash flow of the HKL's bond.

Table 7. Correlation Matrix, Zero Coupon Yield (ZCY)

Correlation Matrix	$ZYC_{0.3068}$	$ZYC_{0.8110}$	$ZYC_{1.3096}$	$ZYC_{1.8137}$	$ZYC_{2.3096}$	$ZYC_{2.8137}$
$ZYC_{0.3068}$	1	0.9490	0.8616	0.8059	0.7781	0.7682
$ZYC_{0.8110}$	0.9490	1	0.9690	0.9263	0.9068	0.9021
$ZYC_{1.3096}$	0.8616	0.9690	1	0.9231	0.9081	0.9114
$ZYC_{1.8137}$	0.8059	0.9263	0.9231	1	0.9980	0.9900
$ZYC_{2.3096}$	0.7781	0.9068	0.9081	0.9980	1	0.9955
$ZYC_{2.8137}$	0.7682	0.9021	0.9114	0.9900	0.9955	1

The correlation between ZCY which is shown above including with the quadratic form as below:

$$a\alpha^2 + b\alpha + c = 0$$

Where:

$$a = \sigma_i^2 - 2\rho_{ij}\sigma_i\sigma_j$$

$$b = 2\rho_{ij}\sigma_i\sigma_j - 2\sigma_i^2$$

$$c = \sigma_j^2 - \sigma_i^2$$

Where:

σ_i^2 : Variance of ZCY_i

σ_i : Standard deviation of ZCY_i

σ_j^2 : Variance of ZCY_j

σ_j : Standard deviation of ZCY_j

ρ_{ij} : Correlation between of ZCY_i and ZCY_j

Weight (α) for each time to maturity can be calculated using the below formula and selected Weight (α) is illustrated in Table 8.

Table 8. Present Value of Expected Future Cash Flows of HKL's Bond and Selected Weight

Time to Maturity (TTM), Day	112	296	478	662	843	1,027
Time to Maturity (TTM), Year	0.3068	0.8110	1.3096	1.8137	2.3096	2.8137
ZCY InterYield on Position Date	1.6480	1.7426	1.7919	1.7562	1.7815	1.8246
Cash Flow (CF), HKL	4,250	4,250	4,250	4,250	4,250	104,250
Present Value of CF	4,228.74	4,190.87	4,152.29	4,117.90	4,080.16	99,078.93
ZCY SD InterYield	0.1435	0.1562	0.1541	0.2131	0.2250	0.1994
ZCY Variance InterYield	0.0206	0.0244	0.0238	0.0454	0.0506	0.0398
a	0.0023	0.0016	0.0016	0.0099	0.0002	0.0014
b	-0.0050	-0.0042	-0.0042	-0.0353	0.0001	0.0117
c	0.0022	0.0010	0.0017	0.0054	-0.0001	-0.0023
Selected α	0.5764	0.2688	0.4783	0.1600	0.4882	0.1912

The present value of the expected cash flow of HKL's bond and the selected weight (α) are used to generate the cash flows mapping which is way of fitting the cash flow with the zero coupon yield as shown in Table 9.

Table 9. Cash Flows Mapping

Cash Flows	ZCY-3M	ZCY-6M	ZCY-1Y	ZCY-2Y	ZCY-3Y	Total
PVCF1	2,437.39	1,791.34				4,228.74
PVCF2		1,126.50	3,064.37			4,190.87
PVCF3		1,986.15	2,166.14			4,152.29
PVCF4			658.83	3,459.07		4,117.90
PVCF5				1,991.77	2,088.39	4,080.16
PVCF6				18,941.54	80,137.38	99,078.93
Synthetic Cash Flows of HKL21A	2,437.39	4,904.00	5,889.34	24,392.38	82,225.77	119,848.88

The above result of the synthetic cash flow of HKL's bond will then be used to calculate the Delta-Normal of the bond which is known as the dollar value per one basis point (DV01). DV01 is used to measure the volatility of the bond price when the discount rate change by one basis point.

Table 10. Price per Unit of Each Asset on the Position Date, 22 January 2019

Assets	USD (KHR/ USD)	Gold ($)	CO ($)	PWSA (KHR)	GTI (KHR)	PPAP (KHR)	PPSP (KHR)	PAS (KHR)
Price/ Unit	4,017.50	1,282.11	62.70	4,680	6,040	11,200	3,000	12,860

The market value of each asset at the position date, Jan 2, 2018 to Jan 22, 2019 is indicated in Table 10 above. With the number of each asset which is designated by the synthetic portfolio as shown in Chapter 3 at the position date, market value of the synthetic portfolio has the total value of KHR 591,514,539.83 (See Table 11). Please be noted that the market value of each asset and the market value of the portfolio are all characterized in Khmer Riel.

Table 11. Portfolio Value on the Position Date, 22 January 2019

Trading Position				Market Value
Type of Asset	Asset	Risk Factor	Unit	KHR
Fixed-Income Security	Bond	ZCY	100	11,448,372.33
Foreign Exchange	FX	USD	500	2,008,750.00
Commodity	Gold	Gold price and FX	100	515,087,692.50
Commodity	Crude Oil	Crude oil price and FX	100	25,189,725.00
Equity	PWSA	PROP	1,000	4,680,000.00
Equity	GTI	PROP	1,000	6,040,000.00
Equity	PPAP	PROP	1,000	11,200,000.00
Equity	PPSP	PROP	1,000	3,000,000.00
Equity	PAS	PROP	1,000	12,860,000.00
			Initial value of portfolio =	591,514,539.83

Table 12. Delta-Normal Method

Delta-Normal Method													
Change of value of (P/L) with respect to changes of risk factor													
	ZCY-3M	ZCY-6M	ZCY-1Y	ZCY-2Y	ZCY-3Y	USD	Gold	CO	PWSA	GTI	PPAP	PPSP	PAS
Time	0.24932	0.49863	1	2	3								
HKL21A's Synthetic CF	2,437.39	4,904.00	5,889.34	24,392.38	82,225.77								
HKL21A's PV	2,427.59	4,862.67	5,787.40	23,558.19	77,847.86								
HKL21A's DV01/PVBP	-0.05955	-0.23839	-0.56872	-4.63037	-22.93229								
FX						5							
Gold						1,282.11	515,087,693						
Crude Oil						62.7		25,189,725					
PWSA									1,606,795				
GTI										1,049,476			
PPAP											2,939,663		
PPSP												528,037	
PAS													6,182,993
Delta	-0.05955	-0.23839	-0.56872	-4.63037	-22.93229	1,349.81	515,087,692.50	25,189,725.00	1,606,794.77	1,049,476.47	2,939,663.46	528,037.37	6,182,993.39

Table 13. Variance-Covariance Matrix (VCM), Change in Risk Factor of Assets

VCM	ZCY-3M	ZCY-6M	ZCY-1Y	ZCY-2Y	ZCY-3Y	USD	Gold	CO	PWSA	GTI	PPAP	PPSP	PAS
ZCY-3M	1.9857	1.4848	0.6060	0.8586	0.4683	31.24	0.0001	-0.0022	0.0025	0.0006	0.0004	0.0022	-0.0014
ZCY-6M	1.4848	1.4202	0.5889	0.8709	0.5179	37.11	0.0000	-0.0011	-0.0008	-0.0002	0.0007	0.0010	-0.0006
ZCY-1Y	0.6060	0.5889	0.4740	0.5403	0.3266	42.61	-0.0001	0.0008	-0.0002	-0.0010	0.0006	-0.0002	0.0007
ZCY-2Y	0.8586	0.8709	0.5403	3.2166	1.4637	130.85	-0.0004	0.0023	-0.0013	0.0012	-0.0001	-0.0012	0.0000
ZCY-3Y	0.4683	0.5179	0.3266	1.4637	1.5858	49.07	-0.0006	0.0028	-0.0010	0.0002	-0.0023	-0.0009	-0.0011
USD	31.24	37.11	42.61	130.85	49.07	108823	0.0326	0.2279	-0.3420	-0.3994	-0.6339	-0.1468	-0.1437
Gold	0.0001	0.0000	-0.0001	-0.0004	-0.0006	0.0326	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	-0.0022	-0.0011	0.0008	0.0023	0.0028	0.2279	0.0000	0.0004	0.0001	0.0001	0.0000	0.0000	0.0000
PWSA	0.0025	-0.0008	-0.0002	-0.0013	-0.0010	-0.3420	0.0000	0.0001	0.0003	0.0000	0.0001	0.0000	0.0000
GTI	0.0006	-0.0002	-0.0010	0.0012	0.0002	-0.3994	0.0000	0.0001	0.0000	0.0009	0.0000	0.0000	0.0001
PPAP	0.0004	0.0007	0.0006	-0.0001	-0.0023	-0.6339	0.0000	0.0000	0.0001	0.0000	0.0004	0.0000	0.0001
PPSP	0.0022	0.0010	-0.0002	-0.0012	-0.0009	-0.1468	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
PAS	-0.0014	-0.0006	0.0007	0.0000	-0.0011	-0.1437	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0005

After the Delta-Normal of each asset: HKL's bond, FX, gold, crude oil, PWSA, GTT, PPAP, PPSP, and PAS, is calculated (See Table 12), also the matrix variance and the covariance of change in risk factor of assets in the portfolio (See Table 13), the portfolio standard deviation can be calculated using the formula below:

$$\sigma = \sqrt{\delta^T \Omega \delta} = KHR3{,}358{,}029$$

The parametric VaR is calculated as below

$$VaR = -Z_\alpha \times \sqrt{\delta^T \Omega \delta} \times \sqrt{HP}$$

$$VaR = -1.64 \times 3{,}358{,}029 \times \sqrt{1} = -KHR5{,}523{,}467$$

Which is about 0.93% of the market value of the portfolio in the period of one day.

Table 14. Parametric VaR	
Confidence Level	95%
Holding Period	1
Portfolio Stdev	3,358,029
z	-1.64
VaR (KHR)	-5,523,467
VaR as % of MV	-0.93%

Figure 2. Parametric VaR

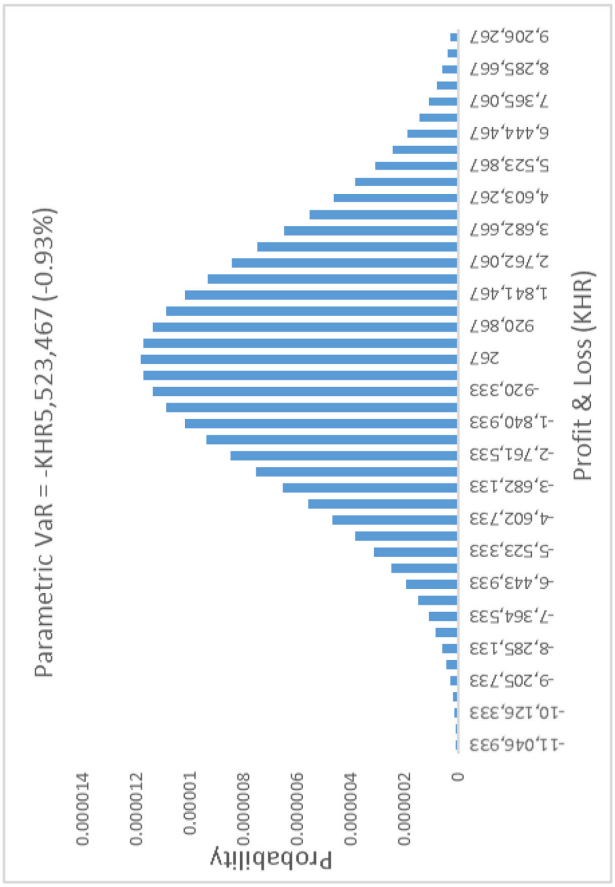


Table 15. P/L Distribution, Parametric VaR	
For Graphic Display Normal VaR	
Classification	**Assets**
Bin Range	Frequency
-11,046,933	5.578E-08
-10,586,633	8.64E-08
-10,126,333	1.314E-07
-9,666,033	1.96E-07
-9,205,733	2.871E-07
-8,745,433	4.128E-07
-8,285,133	5.825E-07
-7,824,833	8.068E-07
-7,364,533	1.097E-06
-6,904,233	1.464E-06
-6,443,933	1.917E-06
-5,983,633	2.464E-06
-5,523,333	3.109E-06
-5,063,033	3.851E-06
-4,602,733	4.681E-06
-4,142,433	5.586E-06
-3,682,133	6.542E-06
-3,221,833	7.52E-06
-2,761,533	8.484E-06
-2,301,233	9.396E-06
-1,840,933	1.021E-05
-1,380,633	1.09E-05
-920,333	1.141E-05
-460,033	1.173E-05
267	1.183E-05
460,567	1.172E-05
920,867	1.139E-05
1,381,167	1.087E-05
1,841,467	1.017E-05
2,301,767	9.351E-06
2,762,067	8.436E-06
3,222,367	7.47E-06
3,682,667	6.492E-06
4,142,967	5.538E-06
4,603,267	4.637E-06
5,063,567	3.811E-06
5,523,867	3.074E-06
5,984,167	2.434E-06
6,444,467	1.892E-06
6,904,767	1.443E-06
7,365,067	1.08E-06
7,825,367	7.939E-07
8,285,667	5.726E-07
8,745,967	4.054E-07
9,206,267	2.817E-07

Besides the two approach used above, Monte-Carlo simulation will also be applied in the estimation of VaR. The most important port of the MCS is the simulation of profit or loss (P/L) of the investment portfolio. This study the simulations will be conducted for 1,000 times. First, the matrix of random number which consists of 1,000 rows and 13 columns based on the number of simulations and the risk factor respectively will be generated. Then the Lower Cholesky Matrix (LCM) will be constructed based on the variance and co-variance matrix (See Table 16).

Table 16. Lower Cholesky Matrix

LCM	ZCY-3M	ZCY-6M	ZCY-1Y	ZCY-2Y	ZCY-3Y	USD	Gold	CO	PWSA	GTI	PPAP	PPSP	PAS
ZCY-3M	1.4092	0	0	0	0	0	0	0	0	0	0	0	0
ZCY-6M	1.0537	0.5567	0	0	0	0	0	0	0	0	0	0	0
ZCY-1Y	0.4300	0.2439	0.4792	0	0	0	0	0	0	0	0	0	0
ZCY-2Y	0.6093	0.4111	0.3713	1.5932	0	0	0	0	0	0	0	0	0
ZCY-3Y	0.3323	0.3012	0.2300	0.6603	0.9464	0	0	0	0	0	0	0	0
USD	22.166	24.701	56.465	54.115	-15.272	318.389	0	0	0	0	0	0	0
Gold	0.0001	-0.0002	-0.0002	-0.0002	-0.0004	0.0001	0.0063	0	0	0	0	0	0
CO	-0.0016	0.0010	0.0026	0.0012	0.0018	0.0002	0.0016	0.0192	0	0	0	0	0
PWSA	0.0018	-0.0048	0.0004	-0.0003	0.0000	-0.0008	0.0001	0.0035	0.0148	0	0	0	0
GTI	0.0004	-0.0011	-0.0020	0.0013	0.0000	-0.0011	-0.0024	0.0059	0.0014	0.0299	0	0	0
PPAP	0.0003	0.0007	0.0006	-0.0005	-0.0026	-0.0022	0.0004	0.0013	0.0038	0.0007	0.0202	0	0
PPSP	0.0016	-0.0012	-0.0012	-0.0007	-0.0003	-0.0002	-0.0021	0.0005	0.0015	0.0001	0.0004	0.0174	0
PAS	-0.0010	0.0008	0.0020	-0.0003	-0.0014	-0.0008	-0.0011	-0.0008	0.0029	0.0024	0.0047	-0.0001	0.0205

The multiplication of random number matrix (1,000 rows x 13 columns) with Lower Cholesky Matrix (13 rows x 13 columns) will generate another matrix (1,000 rows x 13 columns). The sum-product of this matrix with delta-normal vector in Table 12 will generate 1,000 simulations of profit or loss of the portfolio. The Monte-Carlo Simulation VaR is the 5% percentile of simulations of profit or loss. Since the holding period is 1 day which equals to –KHR 5,354,189.

Table 17. Monte Carlo Simulation (MCS) VaR	
Confidence Level	95%
Holding Period	1
VaR (KHR)	-5,354,189
VaR as % of MV	-0.91%

Figure 3. Monte Carlo Simulation VaR

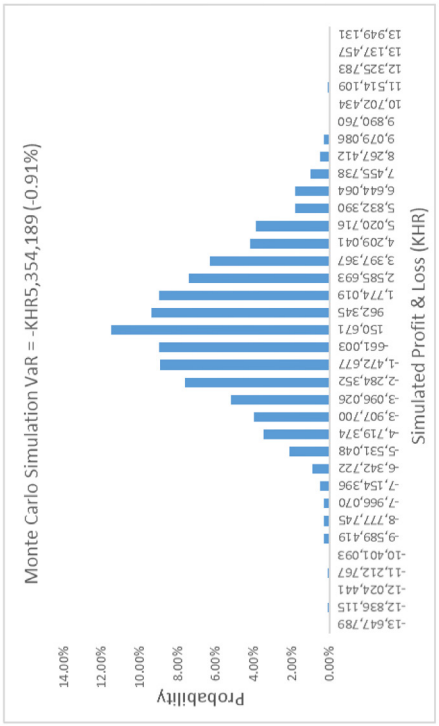
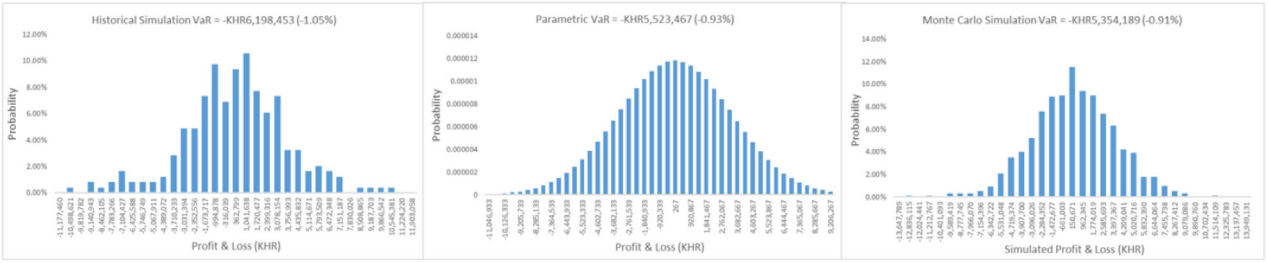


Table 18. Profit and Loss Distribution, MCS VaR		
For Graphic Display on PandL Distribution		
Bin Range	**Frequency**	**% Frequency**
-13,647,789	0	0.00%
-12,836,115	1	0.10%
-12,024,441	0	0.00%
-11,212,767	1	0.10%
-10,401,093	0	0.00%
-9,589,419	3	0.30%
-8,777,745	3	0.30%
-7,966,070	3	0.30%
-7,154,396	5	0.50%
-6,342,722	9	0.90%
-5,531,048	21	2.10%
-4,719,374	35	3.50%
-3,907,700	40	4.00%
-3,096,026	52	5.20%
-2,284,352	76	7.60%
-1,472,677	89	8.90%
-661,003	90	9.00%
150,671	115	11.50%
962,345	94	9.40%
1,774,019	90	9.00%
2,585,693	74	7.40%
3,397,367	63	6.30%
4,209,041	42	4.20%
5,020,716	39	3.90%
5,832,390	18	1.80%
6,644,064	18	1.80%
7,455,738	10	1.00%
8,267,412	5	0.50%
9,079,086	3	0.30%
9,890,760	0	0.00%
10,702,434	0	0.00%
11,514,109	1	0.10%

12,325,783	0	0.00%
13,137,457	0	0.00%
13,949,131	0	0.00%

Table 19. Comparison Value-at-Risk (VaR)

Historical Simulation VaR		Parametric VaR		Monte Carlo Simulation VaR	
VaR	VaR as % of MV	VaR	VaR as % of MV	VaR	VaR as % of MV
-KHR 6,198,453	-1.05%	-KHR 5,523,467	-0.93%	-KHR 5,354,189	-0.91%



5. CONCLUSION

In fact, estimating the potential loss or value loss of the investment portfolio hold by an individual investor or an investment institution is not easy job, yet pivotal to do. For instance, the measure of liquidity risk not only did it play a vital for the private firm for risk management but it also plays a significant role for the regulators in drafting the regulations and laws to serve the purpose of maintaining the stability and robustness of the whole financial institution.

The Value-at-Risk is one of the most popular approach for estimating the potential loss or value loss of an underlying asset or investment portfolio at a particular confidence level and holding period. Three main approaches can be implemented to estimate VaR namely the non-parametric VaR, parametric VaR and Monte-Carlo simulation. The result of this study indicated that with the confident level of 95% and the holding period of 1 day, the value at risk of the synthetic portfolio with the approximately of KHR591,514,539 is KHR 6,198,453, KHR5,523,467 and KHR 5,354, 189 based upon the approaches of historical VaR, parametric VaR and Monte-Carlo simulation VaR respectively. The study also suggested that in the case that the historical VaR is adopted the investment portfolio contains the highest value at risk which equivalent to approximately 1.05% at the holding period of 1 day. On the other hand, if the parametric VaR and Monte-Carlo simulation VaR are implement the value at risk is very similar at around 0.93% and 0.91% respectively. The small variation between this two approaches, perceivable, caused by the fact that these two approaches share the same delta normal vector.

Among the three approaches implemented, the historical VaR is considered as the simplest one because this approach uses the historical data which does not specifically define the distribution return of each asset as well as the distribution of portfolio profit or loss. In contrast, the parametric VaR is a bit challenging to implement due to the fact that the approach predetermines the distribution of each asset and the portfolio value (Normal distribution is set for this research). Meanwhile, the calculation of the delta-normal of each asset to serve the purpose of calculating the standard deviation of the portfolio also posts extra challenge for the implementation of this approach. Although, the result generated by the parametric VaR is considered to more accurate in comparison with historical VaR, the approach still depends heavily on the historical data. Finally, the Monte-Carlo simulation VaR, however, is considered to be the most accurate approach for estimating the VaR thanks to the fact that the portfolio's profit or loss are randomly generated and in this study a large scenario of 1,000 simulations are produced which further increases its accuracy. Giving its accuracy comparing to the two prior approaches, this approach is also considered as the most difficult approach to implement.

The estimating of VaR may appears challenging, yet provide a rewarding result for both an individual investor and firms to measure the risk exposure of their underlying assets or portfolio value to be aware of the potential future loss for the purpose of risk management. The study also further suggested that for the simple calculation of VaR, the historical VaR is recommended. However, for the desire to

pursue better accuracy for estimating the VaR, the parametric VaR and Monte-Carlo simulation are highly recommended.

Finally, for the future research which intended to extend the study of the VaR in the future for the investment portfolio at CSX or other security market the Back Test and the Stress Test are highly recommended to be included.

REFERENCES

Borgdan, S., Baresa, S. and Ivanovic, Z. (2015). Estimating risk on the capital market with VaR method. UTMS Journal of Economics, 6(1), 165-175.

Choudhry, M. (2013). An introduction to value-at-risk. West Sussex, United Kingdom: John WIley and Sons Ltd.

Duffie, D. and Pan, J. (1997). An overview of value at risk. The Journal of Derivatives, 4(3), 7-49.

Goorbergh, V. D. R. and Vlaar, P. . (1999). Value-at-risk analysis of stock returns historical simulation, variance techniques or tail index estimation . 1-37.

Gregory, W. A. and Reeves, J. J. . (2008). Interpreting value at risk (VaR) forecasts . Economic System , 32, 167-176.

Hendricks, D. (1996). Evaluation of value-at-risk models using historical data. FRBNY Economic Policy Review , 39-70.

Hong, J. L., Hu, X. and Liu, G. (2014). Monte Carlo methods for value-at-risk and conditional value-at-risk: A review. ACM Transactions on Modeling and Computer Simulation, 24(4). doi:http://dx.doi.org/10.1145/2661631

Jackson, P., Maude, J. D. and Perraudin, W. (1997). Bank capital and value at risk. THe Journal of Derivatives, 4(3), 73-89.

Jorion, P. (2007). Value at risk: The new benchmark for managing financial risk (3rd ed.). NY: The McGraw-Hill.

Kaura, V. (n.d.). Portfolio optimisation using value at risk.

Koch, S. (2006). Using value-at-risk for IS/IT project and portfolio appraisal and risk management. Electronic Journal of Information Systems Evaluation , 9(1), 1-6.

Linsmeier, J. T. and Pearson, D. N. (2000). Value at risk. Financial Analysts Journal, 56(2), 47-67. Retrieved from http://www.jstor.org/stable/4480232

Luabsch, J. A. (1999). Risk management: A practical guide. New York : RiskMatrics Group .

Ostojić, D. D., Pokorni, J. S., Rakonjac I. P. and Brkićm M. D. . (2012). Accuracy of reliability calculated by the Monte Carlo simulation method. 47-58.

Pafka, S., and Kondor, I. . (2001). Evaluating the RiskMetrics methodology in measering volatility and value-at-risk in financial markets. Elsevier Science , 305-310.

Saunders, A. and Allen, L. . (2002). Credit risk measurement: New approaches to value at risk and other paradigms . New York: John Wiley and Sons, Inc.

Shirazi, A. (n.d.). Value at risk (VaR) backtesting techniques and P-Value risk. 1-15.

Value at risk . (n.d.).

Vose, D. (1997). Monte Carlo Risk Analysis Modeling. In V. Molak, Fundamentals of Risk Analysis and Risk Management . Cincinnati: CRC Press.

Wong, M. C. S., Cheng, W. Y. and Wong, C. Y. P. (2003). Market risk management of banks: Implications from the accuracy of value-at-risk forecasts. Journal of Forecasting, 22, 23-33. doi:10.1002/for.842

LEARN, SHARE, CONNECT.

FOR MORE INFORMATION:
64 Street 108, Phnom Penh
023 986 522 / 523 / 960 / 961
reception@cam-ed.com
Apply online at: www.cam-ed.com