KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI
MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION



CASE STUDIES ON COVID-19

VACCINATION ROLL-OUT PROGRAMME

MERAKYATKAN SAINS
MENGINSANKAN TEKNOLOGI
MENGARUSPERDANAKAN INOVASI

MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

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VACCINATION ROLL-OUT PROGRAMME

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EXECUTIVE SUMMARY

The purpose of this report is to present the Case Studies on COVID-19 Vaccination Roll-out Programme to MOSTI. This report is prepared by UPUM Sdn Bhd (UPUM) which represents groups of researchers in four universities who are conducting research on four different angles of the COVID-19 vaccination roll-out programme (PICK). The universities are UCSI University, Universiti Teknologi Malaysia (UTM), Universiti Teknologi Mara (UiTM) and Universiti Malaya (UM). The report contains sections on each of the projects (or referred to as "cases") describing the findings, conclusions and recommendations of each case. The study covers the important segments of the society which are directly and indirectly affected by the PICK programme which include individuals, businesses, ministries, Government agencies and regulators.

The vaccination implementation process under the National COVID-19 Immunisation Programme covers the enrolment process of the target groups based on the priorities of each phase right up to the vaccination and monitoring of adverse effects. The registration process was carried out through the MySejahtera application, a dedicated website, or done manually for those who did not have access to the MySejahtera application. A total of 54 Vaccine Storage Centres had been identified with Ultra Low-Temperature Chest Freezer (ULTF) to store the vaccines. Consequently, vaccinations were carried out at 605 Vaccination Administration Centres (VACs) which had been identified by the MOH. In addition, temporary vaccination centres like stadiums, convention centres, community halls, universities, and other appropriate facilities were set up according to the need. Vaccine delivery and storage involved the integrated operations of multi-government agencies through the MOH, the Malaysian Armed Forces, and other security authorities.

The COVID-19 outbreak had also significantly disrupted societies worldwide. These prolonged periods of lockdown and the lack of human contact outside the immediate family had an unprecedented impact on the community's mental health. Additionally, many countries also imposed travel restrictions and closed their international borders to foreign travellers. Economically, consumers were also less inclined to spend to make up for their lost income due to the pandemic, and as a result, many business activities remained sluggish. Prohibition of movement and mass assembly in business, education, religion, and sports were also introduced. As vaccination acceptance reflected the general population's overall perception, there was a need to understand these acceptance factors of the COVID-19 vaccination among Malaysians.

In addition, the COVID-19 pandemic was taking a heavy toll on Malaysian social and economic settings. Issues of job loss, living in poverty, equal access to education, and food security were some of the challenges. Economically, COVID-19 had affected the micro-, small-, and medium-sized enterprises (MSMEs) across all sectors, with salary payments, no customers, and rental payments as the main challenges for business survival, and companies were looking for financial assistance of subsidies and tax exemption to survive. Emergency responses and Government actions together with industrial and community collaborations were in the race to develop intervention programmes to provide comprehensive support. There were variations of cross-sectional impacts of COVID-19, and the rapid pace of the Malaysian COVID-19 vaccination roll-out programme was offering a ray of socioeconomic hope and positive directions after a year of extended lockdowns. Somewhat less predictable were the many social changes associated with

COVID-19 vaccination and the economic response to the immunisation programme. Although it was hard to estimate and quantify the values of COVID-19 vaccination, past studies which had confirmed vaccines to reduce the burden of communicable disease, indicated significant improvements in social and psychological wellbeing, and advancement in economic development.

The present study is mostly concerned with how the vaccination roll-out programme was implemented in response to controlling the spread of the COVID-19 virus. In specific, the study documented a compilation of cases related to the COVID-19 vaccination programme that cover a few key areas as follows:

- Case 1: User Acceptance of First Roll-Out of COVID-19 Vaccination in Malaysia
- Case 2: Thriving for Agility and Resilience in the Roll-Out Vaccination Programme of COVID-19
- Case 3: Social and Economic Impacts of COVID-19 Vaccination Roll-Out
- Case 4: Cold Chain Management and the Role of ICT for COVID-19 Vaccination Roll-Out

Thus, the findings of these four case studies were able to provide explanations on various perspectives of the COVID-19 Vaccination Rollout Programme. As far as COVID-19 vaccination was concerned, the low vaccination acceptance can pose a major huddle to achieving herd immunity and preventing the spread of COVID-19 infection in Malaysia. Low vaccination acceptance can pose a major huddle to achieving herd immunity. Henceforth, with the adequate knowledge received, the Malaysian government can plan an appropriate strategy to enhance the level of trust and acceptance of the vaccine roll-out for the masses in Malaysia. Like all major strategies, there was no single intervention that was likely to be effective and thus a combination of different approaches was important. In addition, effective marketing campaigns with sufficient information were important in alleviating the concerns of Malaysians and boosting public trust.

This case also intended to document workable strategies and tactics based on the National COVID-19 Immunisation Programme for COVID-19. Similar crises and pandemics might occur in the future. The experience attained in gaining maximum population immunity against COVID-19 may not be applicable in totality as different health crises may generate contrasting spectres of waves and phases. Still, lessons learned from this case called for the urgency to start developing continuous strategic preparedness. Such readiness required a broader base of competent pivotal leaders, deeper investment, higher capacity building, and clearer knowledge-based communication than what had been laid during the COVID-19 pandemic. Thus, strategic preparedness would lead to improved prevention, detection, and response to any crises or *black swan* in the future.

The COVID-19 vaccination programme in general was a well-accepted programme by the general public. The programme was perceived to be successful in improving the quality of life of the public, enhancing their survival, and protect them other people from infection. Although the pandemic was under control, the Government and the public must continue with the new normal or practices so that public safety can be guaranteed. The vaccination was not a guarantee that a person would not get infected by the virus but rather a mechanism to reduce the health implications of the infection. When the public was confident to resume their normal working lives, the socioeconomic situation of the

country could be expected to improve. COVID-19 had impacted the lives of every human being in the world. At the beginning of the pandemic, life was no longer the same. Many were quarantined and most of the people have to work from home. The programme was big in scale and had never been implemented before. One of the biggest challenges of the programme was that vaccines required special infrastructure and resources.

This study also aimed to demonstrate how the COVID-19 vaccine cold chain management was managed during the COVID-19 roll-out programme in Malaysia. The study was examining the processes, procedures, issues, challenges, and ICT applications used in managing the cold chain logistics of the COVID-19 vaccines programme. The main lesson was that managing the vaccine cold chain logistics required a collaborative effort from all stakeholders not only the Government. Hence, it was suggested that all the relevant bodies work together to ensure a more effective and efficient vaccine cold chain logistics management to prepare the country if and when the need arises.



FACT SHEET

USER ACCEPTANCE OF FIRST ROLL-OUT OF COVID-19 VACCINATION IN MALAYSIA

UCSI University

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BACKGROUND

According to WHO, vaccination is the best hope to end this pandemic and as such several vaccines have been rolled out in numerous countries. The eventual success in overcoming this pandemic relies on vaccine coverage and community participation. Thus, public acceptance to COVID-19 vaccination was very

OBJECTIVES

- To identify the factors influencing the acceptance of COVID-19 vaccination among Malaysians and whether there are differences in terms of geographical and demographic disparities.

METHODOLOGY

APPROACH

A mixed-method approach was adopted. First phase, a focus group consisted of 7 participants from various age groups. Second phase 2,336 respondents were involved in a survey from all over Malaysia.

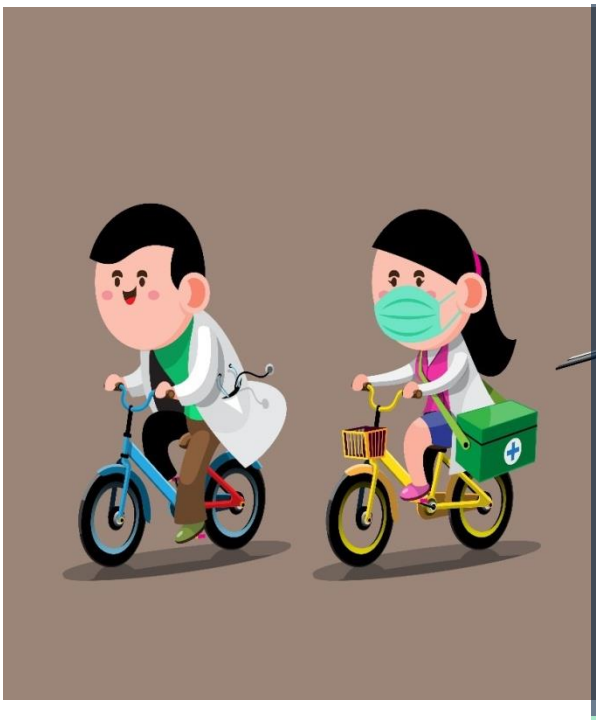
FINDINGS

The study indicated that the relationship between CA, CIG, ISE, PBBA, PBEN, PC, PCM, SEPP, VISE and VPS are supported in this study. There are no differences in gender apart from the relationship between PBEN, VISE and VPS with BI.

LESSONS LEARNED

Active participation by government social media agencies is needed to ensure more sufficient content of news and information for social media users on COVID-19 vaccination. A proper social media strategy should be crafted. Malaysians are dominated by other users' behaviours which will eventually lead to the formation of acceptance.

Note: Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)



FACT SHEET

THRIVING FOR AGILITY AND RESILIENCE IN THE ROLL-OUT VACCINATION PROGRAMME OF COVID-19

Universiti Teknologi Malaysia

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BACKGROUND

In managing the pandemic, countries explore and experiment various strategies, processes, and protocols to ensure implementation, control and success toward population immunity. This study focuses on the Malaysian strategic and tactical plans of COVID-19 preparedness for the country. We focus on the processes and protocols in developing maximum immunity across Malaysia. vaccination programme.

OBJECTIVES

- To develop an understanding of Malaysia's strategic and tactical plans of preparedness in addressing the COVID-19 pandemic.
- To depict the project management, processes, protocols, and approaches in developing maximum population immunity.
- To explore capacity building across all stakeholders/actors in Malaysia's ecosystem to address COVID-19 through PICK.

METHODOLOGY

APPROACH

Using qualitative approach, interviews were conducted involving relevant decision makers, policy makers, and policy implementers in MOSTI and other related ministries. Focus Group Discussion (FGD) was also conducted with relevant stakeholders to understand the process of capacity building in generating a resilient and agile eco-system.

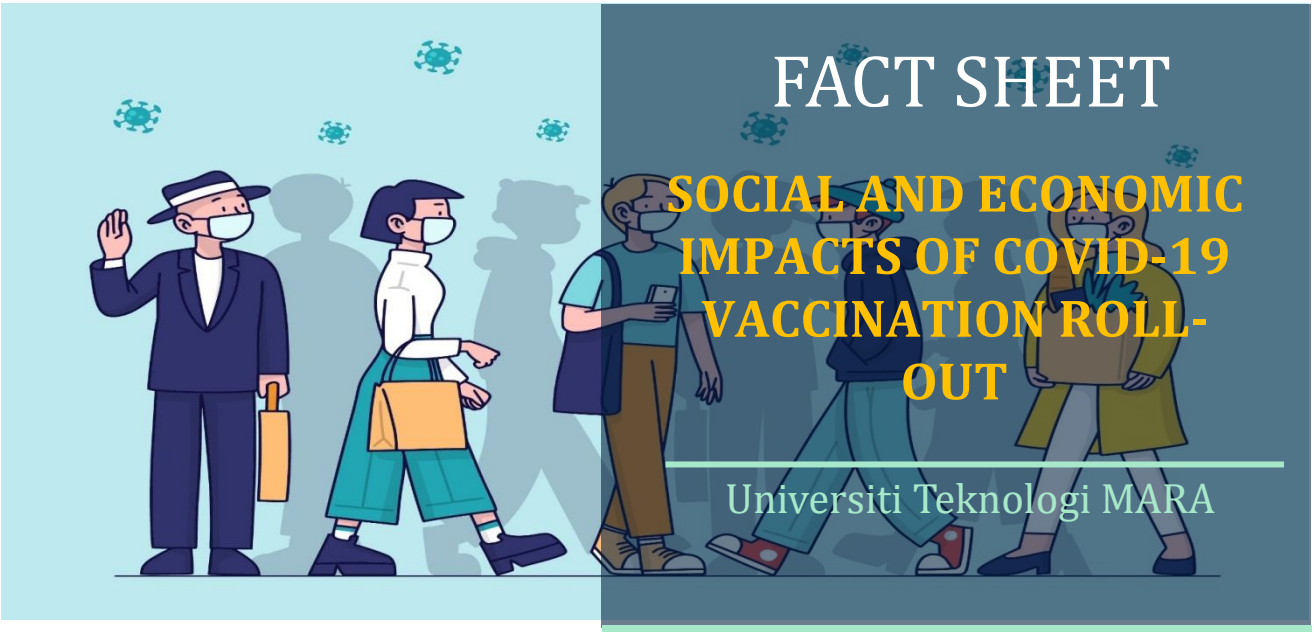
FINDINGS

From zero understanding and solutions (*Drought and Darkness)* to a cycle of the agile planning and actions (*Vaccine Drops and Vaccine Flood),* that progressively evolves into a tapestry of public trust (*Rainbow)* and impact (*Green Growth).* The Malaysia COVID-19 vaccination roll-out programme suggest valuable lessons that can be learned such as:

I. **P**ivotal Leadership
II. **I**nvestment with Integrity
III. **C**apacity Building
IV. **K**nowledge gained from effective communication

LESSONS LEARNED

In facing pandemic or similar crises, a nation should fundamentally raise resilience across four fundamental conditions, namely a) preparedness, b) prevention, c) detection and d) response.



FACT SHEET

SOCIAL AND ECONOMIC IMPACTS OF COVID-19 VACCINATION ROLL-OUT

Universiti Teknologi MARA

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BACKGROUND

Past studies which have confirmed on vaccines to reduce the burden of communicable disease indicated for significant improvements in the social and psychological wellbeing, and advancement to the economic development. Hence, it is important to assess, identify and examine how COVID-19 vaccination will impact the social and economic conditions and highlight the benefits in order to keep information and references of ongoing practical experiences, retain public trust in vaccination, if necessary, policies and interventions and to redefine priorities in light of lesson learned and unresolved challenges.

OBJECTIVES

- To showcase how COVID-19 vaccination was promoted and enforced to the people.
- To identify the impacts of vaccination initiatives to the economy and business.
- To identify the impacts of vaccination initiatives to the society.

METHODOLOGY

APPROACH

A mixed-method approach. For objective 1, data was collected from secondary sources. For objective 2, the approach was reviewing reports on economic development, a case on reopening of the tourism industry, and a survey. For objective 3, the main approach was a social survey.

FINDINGS

The vaccination roll-out programme is found to have a significant role to reduce societal and economic burden in Malaysia; important for improving the quality of life, for survival during the pandemic, and not only to protect oneself, but also to protect others. It ensures relevancy, coherence, and sustainability of businesses. Respondents who took the COVID-19 booster are more braved in facing the cave syndrome, compared to those who did not take the booster. In this study, cave syndrome refers to a situation when people are worried and anxious about returning to the everyday normal activities after getting used to the new norms of living.

LESSONS LEARNED

Government has laid out numerous initiatives, which include understanding the effect of the post-COVID-19 roll-out vaccination programme. The COVID-19 vaccination programme is important for the society's quality of life, survival during pandemic, self-protection and also to protect others especially those close to the individuals.



FACT SHEET

COLD CHAIN MANAGEMENT AND THE ROLE OF ICT FOR COVID-19 VACCINATION ROLL-OUT

Universiti Malaya

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BACKGROUND

One of the major challenges of vaccination programmes are associated with the vaccine cold chain management because vaccines are considered as a perishable product and temperature-sensitive. In rolling out the national vaccines programmes, the Malaysian government has built several Information Communication Technology (ICT) applications to manage the cold chain logistics of the COVID-19 vaccines.

OBJECTIVES

- To identify the existing processes and procedures in place to maintain/preserve the integrity of the COVID-19 vaccines from the airport terminal to the respective vaccinees.
- To explore the issues and challenges in the cold chain logistics COVID-19 vaccines in Malaysia.
- To identify the current ICT applications used in managing the cold chain logistics of the COVID-19 vaccines.

METHODOLOGY

APPROACH

Qualitative research where data were collected using three techniques: document analysis, observations, and semi-structured interviews. The document analysis was complemented by semi-structured interviews. The semi-structured interviews were conducted with the relevant individuals or groups of individuals of each process in the vaccine cold chain logistics.

FINDINGS

PSVs and PPVs interviewed follow closely the SOPs and guidelines thus the processes and procedures were standardised and streamlined thus making the management of vaccine effective and efficient. There are at least 3 main ICT applications that are used in managing the vaccines cold chain logistics. They are the Vaccine Management System, Blockchain System for Vaccination Records and Public Health Analytics: The COVID-19 Dashboard.

LESSONS LEARNED

Two major factors that pushes Malaysia to progress to the endemic phase is the successful implementation of the vaccination roll-out and Malaysia's structured healthcare system. There were specific practices that were put in place to improve the operations in the PPV that supplemented the SOPs and guidelines provided by the MOH. The need for agile ICT governance during emergencies. The existing governance's structure and process are too slow for emergency situations.

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ABBREVIATIONS

APM	Angkatan Pertahanan Awam Malaysia
ATM	*Angkatan Tentera Malaysia*
CITF	Covid-19 Immunisation Task Force
CMCO	Conditional MCO
EMCO	Enhanced MCO
FAQs	Frequently Asked Question
GDP	Gross Domestic Product
HPC	High Performance Computing
ICT	Information Communication Technology
ICU	Intensive Care Unit
IPI	Industrial Production Index
IS	Information System
IT	Information Technology
JKJAV	Special Committee for Ensuring Access To COVID-19 Vaccine Supply
JKN	*Jabatan Kesihatan Negeri*
KKM	*Kementerian Kesihatan Malaysia*
KLIA	Kuala Lumpur International Airport
KPWKM	Ministry of Women, Family and Community Development
MCO	Movement Control Order
MITI	Ministry of International Trade and Industry
MKN	*Majlis Keselamatan Negara Malaysia*
MNSC	Malaysian National Security Council
MOF	Ministry of Finance
MOH	Ministry of Health
MOHE	Ministry of Higher Education
MOSTI	Ministry of Science, Technology & Innovation
MRCS	Malaysian Red Crescent Society
MSMEs	Micro-, Small-, And Medium Sized Enterprises
MyVAC	Malaysian Vaccine Support Volunteers
MyVAS	Malaysia Vaccine Administration System
NADMA	National Disaster Management Agency
NGO	Non-Governmental Organizations
NMRR	National Medical Research Resister
NPRA	National Pharmaceutical Regulatory Agency
NRP	National Recovery Plan
PhIS	Pharmacy Information System
PICK	National Covid-19 Immunisation Programme
PICC	Planning Implementation, Coordination & Control
PIKAS	Public-Private Partnership Covid-19 Industry Immunisation Programme
PPV	Pusat Pemberian Vaksin
ProtectHealth	Protecthealth Corporation Sdn Bhd
PSV	Pusat Simpanan Vaksin

RELA	Jabatan Sukarelawan Malaysia
RMCO	Restricted MCO
SUK	Setiausaha Kerajaan (Negeri)
TNB	Tenaga Nasional Berhad
UK	United Kingdom
UNHCR	United Nations High Commission for Refugees
USA	United States of America
VMS	Vaccine Management System
WHO	World Health Organization



CASE 1

USER ACCEPTANCE OF FIRST ROLL-OUT OF COVID-19 VACCINATION IN MALAYSIA

1 USER ACCEPTANCE OF FIRST ROLL-OUT OF COVID-19 VACCINATION IN MALAYSIA

1.1 INTRODUCTION

1.1.1 Background of Study

In the wake of the deadly 2019 novel, coronavirus in Wuhan, China, 2,549,743 deaths in 213 countries and territories have been reported globally. The United States has reported the highest number of fatalities at 29,314,254, followed closely by Brazil and India at 11,124,527 and 10,598,608, respectively. The outbreak has also significantly disrupted societies worldwide. Many countries have started to impose a nationwide lockdown and social distancing policies to reduce the spread of the outbreak. However, these prolonged periods of lockdown and the lack of human contact outside the immediate family have an unprecedented impact on the community's mental health. Additionally, many countries have also imposed travel restrictions and closed their international border to foreign travellers. Economically, consumers are also now less inclined to spend to make up for their lost income due to the pandemic, and as a result, many business activities have remained sluggish. With the unemployment rate projected to increase in 2022, many organisations have to re-strategize themselves to cope with this global pandemic. Like many other countries, the Malaysian government has also introduced several measures and response strategies to overcome these challenges. For example, the movement control order was imposed from 18 March to 28 April 2020 and again from 13 January to 5 March 2021 to flatten the curve of new cases.

Prohibition of movement and mass assembly in business, education, religion, and sports were also introduced. Other restrictions measures were also introduced whereby only one household family was allowed to leave the house at one time within 10 km of residence. Currently, antiviral treatment for COVID-19 such as vaccination is the only best hope for controlling this pandemic. As such, many countries worldwide had accelerated the research and development of COVID-19 vaccines with several roll-outs. Among them includes Pfizer-BioNTech (USA), AstraZeneca (UK), Sinovac (China), CanSino Biological (China), Sputnik V (Russia), etc. Malaysia received its first batch of vaccines from Pfizer-BioNTech in February 2021 and subsequently the Sinovac vaccine a week thereafter. The first phase of immunisation occurred involving all frontline staff starting on 26th February 2021. The second (e.g., 9.4 million people targeting high-risk groups such as the elderly and those with chronic conditions) and third phase (e.g., adults aged 18 and above) occurred from April and August 2021 and May to February 2021, respectively. While much planning has been done, there are still uncertainties about Malaysia's acceptance of COVID-19 vaccination, especially during the first roll-out. Past studies using protection motivation theory and the health belief model have shown that many factors influence the acceptance or uptake of vaccination. They include the vaccination attitude, perception of response cost, perceived efficacy of the vaccine, past vaccination history, social demographic characteristics, vaccination convenience, etc. (Ling, Kothe, Mullan, 2019). As vaccination acceptance reflects the general population's overall perception, there is a need to understand these acceptance factors.

1.1.2 The Gap

The coronavirus is expected to impose a severe burden of morbidity and mortality globally. According to World Health Organisation (WHO), vaccination is the best hope to end this pandemic and as such several vaccines have been rolled out in numerous countries. As vaccinations are essential to stop death and prevent patients from becoming severely ill, 67% of Malaysians were reported to accept the vaccination (The Star, 2021a) willingly. However, the vaccine registration remains low at only 6.1% (1,468,137 Malaysians) out of the 80% target planned for the entire country (The Star, 2021b) despite the moderate acceptance rate. The discrepancy was supported by a study by Wang et al. (2020) whereby the scholars point out that there is a gap between the uptake rate of vaccines compared to vaccination intention. Similar sentiments were echoed by researchers around the world such as in the United Kingdom (Eberhardt & Ling, 2021), China (Wang et al., 2021), Thailand (Kitro et al., 2021), United States and Australia (Trent et al., 2022), etc.

1.1.3 Research Questions and Objectives

Based on the statement of needs, the overall research question is "What are the factors influencing the acceptance of vaccination among Malaysians?". Specifically, are there demographic and geographical disparities in vaccine acceptance? Therefore, in line with the above research question, the objectives of this research are to identify the factors influencing the acceptance of vaccination among Malaysians and whether there are differences in terms of geographical and demographic disparities.

1.1.4 Significant of the Study

As the Malaysian community is continuously exposed to rumours, false conspiracy theories, and misinformation, there is a need to understand the possible factors influencing the Malaysian public acceptance of this vaccination, especially their stumbling obstacles. The eventual success in overcoming this pandemic relies on vaccine coverage and community participation. Therefore, with the adequate knowledge received, the Malaysian government can plan an appropriate strategy to enhance the level of trust and acceptance of the vaccine roll-out for the masses in Malaysia. Additionally, the study can help to reduce the psychological concerns of Malaysians when making COVID-19 vaccine-related decisions and provide additional insights.

1.1.5 Scope of the Study

The study focuses on the initial roll-out of the COVID-19 vaccine in Malaysia and specifically on Malaysians.

1.1.6 Organization of the Report

The following section is the structure of the report. The study begins by providing the past studies related to COVID-19 studies as part of the literature review. This is followed by the research design, findings and lesson learned (guidelines). Then we present the recommendation, limitation and conclusion.

1.2 LITERATURE REVIEW

There are many studies that have been conducted on vaccination studies around the world. Eberhardt and Ling (2021) conducted studies on the COVID-19 vaccine update using the Protection Motivation Theory on 382 individuals in the United Kingdom via an online survey. The result revealed that severity, susceptibility, maladaptive response costs and self-efficacy are crucial factors in predicting intention to the vaccine. Kitro et al. (2021) conducted a study in Thailand to understand the initial phase of the vaccination programme using 959 responses from adults above 18 years old. Interestingly, the result indicated that the acceptance rate was higher for expatriates than local communities, with the acceptance rate increasing up to 89-91.3% if a vaccine brand can be chosen and 80.7-83.2% if health care professionals recommend them. Trent et al. (2022) conducted a study on the acceptance of the COVID-19 vaccine in the United States, United Kingdom and Australia using a cross-sectional survey from Dynata's research panel from July to September 2020. The analysis using Poisson regression revealed that the acceptance rate ranges around 70 % in London, New York City, Sydney, Phoenix and Melbourne. There were mixed findings related to the confidence level towards the current government in which greater confidence towards the current government has a high association with the willingness to receive the vaccine. Wang et al. (2021) conducted a study on the update intention among overseas and domestic university students in China using the Health Belief Model. Results showed online using a cross-sectional survey of 370 overseas university students and 463 domestic university students indicate a similar update intention between domestic (64.6%) and overseas (64.1%) students. Perceived barriers, perceived benefits, and cues to actions were found to be significant predictors to accept COVID-19 vaccine.

Zheng, Jiang and Wu (2022) conducted a study using 800 respondents recruited from an online panel in the United States to investigate the factors influencing COVID-19 vaccination usage. Perceived severity interestingly is not significant with COVID-19 vaccination intention. In addition, perceived susceptibility to vaccine side effects has a negative relationship with vaccination intention. Knowledge of vaccines has no direct relationship with vaccination intention but has a negative relationship with perceived susceptibility to vaccine side effects and perceived severity of vaccine side effects. Some of the additional literatures were identified that highlight on the relevant constructs in the study of COVID-19 vaccination studies (Li et al., 2019; Arshad & Khurram, 2020; Zheng, Luo & Ritchie, 2021; Mohamed et al., 2021, Wang et al., 2021, Trent et al., 2022, Zheng, Jiang & Wu, 2022; Yuan, Tan & Ooi, 2022).

There are many reasons for the low intake around the world Zheng, Luo and Ritchie (2021) concluded that infection susceptibility refers to people's sense of vulnerability towards a particular threat and has an influence, especially during a pandemic like COVID-19. Liang et al. (2011) concluded that people who are under health stress tend to seek informational support. Thus, information support refers to advice, knowledge, and recommendations on the internet that could help solve a problem. Cheng et al. (2012) opined that perceived critical mass leads to usage intention and is therefore, crucial in influencing behaviour from a social psychological viewpoint. Critical mass is the degree to which an individual believes that critical mass is perceived in vaccination intake (Cheng et al., 2012) and Li et al. (2019) defined privacy concern as the degree of control by a user over their personal identifiable information and concluded that it is one of the

most significant factors in technology adoption, such as MySejahtera platform, due to the fear that their private information could be hacked and misused for negative reasons. Yuan, Tan and Ooi (2022) in their studies in Malaysia during COVID-19 context concluded that users are likely to be fearful and will avoid face-to-face contact to protect themselves from being infected and their degree to the usage of vaccine will depend on their ability to avoid face-to-face. Trent et al. (2022) on the other hand argued that the confidence in government authorities has a role in vaccine decision making among the publics. Arshad and Khurram (2020) on the other hand concluded that government social media information quality and trust in government social media agencies can stimulate citizen's participation. The concept of risk has also an influential role in preventing vaccination intake. Zheng, Jiang and Wu (2022) stressed infection severity, vaccine infection severity, vaccine perceived susceptibility. In the study by Wang et al. (2021) they concluded that cues to action would reduce the barrier associated with the vaccination uptake. The health belief models also indicated that the decision of users are affected by weighing the differences between perceived barriers and benefits (Mohamed et al., 2021). Self-efficiency of pandemic prevention refers to the belief that personal action can control or eliminate the threat, while response efficiency of protection refers to the perceived effectiveness of taking action to prevent a threat and have been found to motivate compliance to protection such as vaccination intake (Zheng, Luo & Ritchie, 2021)

1.3 RESEARCH DESIGN

1.3.1 Introduction and Research Design

In order to answer the research question, a mixed-method approach will be adopted. In the first phase, a focus group session was employed as a qualitative research tool. The group consisted of 7 participants from various age groups, religions, ethnicities, and education levels. Each participant's demographical details will be kept anonymous to safeguard their privacy. In qualitative research, the aim is not statistical representativeness, but representativeness in the sense of gaining access to the full range of views, themes, or possibilities in the population. Therefore, the representation of the number is based on data saturation. The participants were asked to share their acceptance/barriers/motivations of vaccination through an open-ended questionnaire led by a moderator. The focus group lasted about 45-60 minutes and was held during the weekend at UCSI University. Qualitative research is essential to gain better insights into the issues and perceptions of vaccination among the population in Malaysia. Additionally, the findings will serve as input for the quantitative research in the second phase via a questionnaire survey of all the constructs. About 2,500 questionnaires based on a mixture of judgmental and quota sampling were distributed throughout Malaysia. Prior to the distribution of the questionnaire, a pre-test was conducted with experts specializing in public health research. The pre-test is necessary to reduce the misinterpretation, double-barrel issue, and fuzziness of the questionnaire design and to ensure that the questionnaire is clear and understandable. The questionnaire was also translated into the Malay language by a professional translator through forward-backward translation. In view of the diverse geographical areas, 16 experience enumerators were hired to distribute and collect the questionnaires via face-to-face and telephone surveys. The availability of enumerators is also essential to help if a person had difficulty understanding any question. While an email survey was even a possibility, it will not be adopted given time constraints, and previous studies have recorded low response rates

for this method. Before the fieldwork, all enumerators will undergo two-day intensive training. This includes a briefing on the objective of research, good interview techniques, interview role-play, etc.

1.3.2 Research Instrument

The survey instrument is divided into two sections (refer to Appendix 1.1). The demographic profile is presented in Section A while section B measures the perception of the constructs. The study follows the existing literature of past studies on the measurement items and adaptations were made wherever necessary. The study adopted the seven-point Likert scale with scores ranging from 1 'Strongly Disagree' to 7 'Strongly Agree' and is shown in Table 1.1.

Table 1.1 Constructs and Sources of Questionnaire Items

Research Constructs	Measurement Items and Descriptions		Sources
Government social media information quality (IQ)	IQ1	"I feel that the Malaysian government agency provides sufficient contents of news & information to me in order to understand and get necessary facts".	Arshad and Khurram (2020)
	IQ2	"The Malaysian government agency provides accurate information to me in order to understand the government & policy news correctly on the vaccination".	
	IQ3	"The Malaysian agency provides diverse and various information to me regarding the vaccination".	
	IQ4	"The Malaysian government agency provides the news & information timely regarding the vaccination".	
Trust in government social media agency (TSM)	TSM1	"I have confidence in the Malaysian agency and its service regarding the vaccination".	Arshad and Khurram (2020)
	TSM2	"I have confidence in the contents that the Malaysian agency provides on its social media regarding the vaccination".	
	TSM3	"I feel that the Malaysian agency's social media provides better government services to contacting citizens regarding the vaccination".	
	TSM4	"The Malaysia agency's social media promoted me to have positive outlook towards government authorities regarding the vaccination".	
Informational support (IS)	IS1	"On my favourite social commerce site, some people would offer suggestions when I needed help regarding the vaccination".	Liang et al., (2011)
	IS2	"When I encountered a problem, some people on my favourite social commerce site	

		would give me information to help me overcome the problem regarding the vaccination".	
	IS3	"When faced with difficulties, some people on my favourite social commerce site would help me discover the cause and provide me with suggestions regarding the vaccination".	
Confidence in Government (CIG)	CIG1	"I have confidence in my national government"	Trent et al., (2022)
	CIG2	"I have confidence in my state government".	
	CIG3	"My level of trust regarding the information about COVID-19 from my national government is high".	
	CIG4	"I trust the governmental approval process to ensure the COVID-19 vaccine is safe for the public".	
Perceived Critical Mass (PCM)	PCM1	"Most people in my group have received the vaccination".	Cheng et al., (2012)
	PCM2	"Most people in my virtual community have received the vaccination".	
	PCM3	"Most people in my class/office have received the vaccination".	
Privacy Concern (PC)	PC1	"I am not concerned that the information I submit to MySejahtera platform could be misused".	Li et al., (2019)
	PC2	"I am not concerned that others can find private information about me from MySejahtera platform".	
	PC3	"I am not concerned about providing personal information to MySejahtera platform, because of what others might do with it".	
	PC4	"I am not concerned about providing personal information to MySejahtera platform, because it could be used in a way I did not foresee".	
Infection Severity (ISE)	ISE1	"I believe that the consequence of COVID-19 infection is severe".	Zheng, Jiang and Wu (2022)
	ISE2	"I believe that COVID-19 is a health threat to people in crowded public area".	
	ISE3	"I believe that COVID-19 will impact people's life if infected".	
Infection Susceptibility (ISU)	ISU1	"I believe that the risk of being infected by COVID-19 is high in crowded public area".	Zheng, Luo, Ritchie (2021)
	ISU2	"I believe that the possibility of contact with infected people in crowded public area is high".	

	ISU3	"I believe that people will be more susceptible to COVID-19 if they travel to crowded public area".	
Vaccine Infection Severity (VISE)	VISE1	"The negative impact of COVID-19 vaccine is very high".	Zheng, Jiang and Wu (2022)
	VISE2	"The negative impact of COVID-19 vaccine can be life-threatening".	
	VISE3	"The negative impact of COVID-19 vaccine is a serious threat for someone like me".	
Vaccine Perceived Susceptibility (VPS)	VPS1	"I think I am likely to get the side effects of COVID-19 vaccine".	Zheng, Jiang and Wu (2022)
	VPS2	"I am at risk of catching the side effects of COVID-19 vaccine".	
	VPS3	"I am vulnerable to contracting the side effects of COVID-19 vaccine in given circumstances".	
Self-efficiency of Pandemic Prevention (SEPP)	SEPP1	"I believe that I am able to take measures to prevent COVID-19".	Zheng, Luo, Ritchie (2021)
	SEPP2	"I believe that I have the necessary knowledge and equipment to protect myself from being affected by COVID-19".	
	SEPP3	"I could learn to perform preventive measures to protect myself from being infected by COVID-19".	
	SEPP4	"For me, taking actions to protect myself from COVID-19 is easy".	
Response Efficiency of Protection (REP)	REP1	"I think the efforts to keep safe from COVID-19 threats are effective".	Zheng, Luo, Ritchie (2021)
	REP2	"I think the available measures to protect myself from being infected by COVID-19 are effective".	
	REP3	"Measures that can be taken to stop people being infected by COVID-19 are adequate".	
	REP4	"I feel less likely to be exposed to the COVID-19 threat if performing the preventive measures".	
Face to Face Avoidance (FFA)	FFA1	"I will try to avoid face to face service contact during and after COVID-19 period".	Yuan, Tan and Ooi (2022)
	FFA2	"I would like to delay making decisions about having face to face financial service during and after COVID-19 period".	
Perceived Benefits (PBEN)	PBEN1	"I believe that COVID-19 vaccine will have high efficacy in preventing significant suffering and complications of the disease".	Mohamed et al., (2021)
	PBEN2	"I believe that if I get vaccinated against COVID-19 the risk of getting infected with the disease or infecting others will decrease".	
	PBEN3	"After vaccination, I can lead a normal lifestyle".	

	PBEN4	"Vaccine also protects other people who are not vaccinated ".	
Perceived Barriers (PBBA)	PBA1	"Getting vaccinated is expensive, requires time and effort".	Mohamed et al., (2021)
	PBA2	"Getting vaccinated is a tedious process that requires time and effort".	
	PBA3	"I am worried that the possible side effects of the COVID-19 vaccination would interfere with my usual activities".	
	PBA4	"I am concern that I may receive faulty/fake COVID-19 vaccine".	
	PBA5	"It concerns me that the development of a COVID-19 vaccine is too rushed to test its safety properly".	
	PBA6	"I am concern about the long-term side effects of the COVID-19 vaccination".	
Cues to Action (CA)	CA	"The chances of me getting vaccinated against COVID-19 will increase if opinion leaders on social media express support for the benefit of the vaccine".	Wang et al., (2021)
	CA2	"The chances of me getting vaccinated against COVID-19 will increase if friends and family express support for the benefit of the vaccine".	
	CA3	"The chances of me getting vaccinated against COVID-19 will increase if official guidelines from the MOH are published".	
	CA4	"The chances of me getting vaccinated against COVID-19 will increase if my GP recommends me".	
	CA5	"If my workplace takes care of vaccinating the workers against COVID-19, I will vaccinate".	
Behavioural Intention (BI)	BI1	"If a vaccine against COVID-19 infection is available in the market, I would take it".	Zheng, Jiang and Wu (2022)
	BI2	"I intend to get vaccinated against COVID-19".	
	BI3	"I will get vaccinated against COVID- 19 even if I must pay for the vaccine".	
	BI4	"I am willing to put my name on the MySejahtera list to get vaccinated against COVID-19".	

1.3.3 Sampling

A focus group has been identified for this phase. The group consists of about 7 participants from various age groups, religions, ethnicities, and education levels. The composition of focus group discussion members will consist of public members according to (for example) income group, 20% T20, 40% M40, and B40 respectively, ethnicities as per the race ratio of Malaysians, people living in rural, semi-urban and urban areas according to the population density ratio and other socio-economic demographics. This was followed by distributing 2,500 survey questionnaires targeting Malaysians using different demographic profiles (e.g., state of residence, gender, race, age group, education level, income level, etc) based on the diverse geographical areas in Malaysia. The survey questionnaires will be allocated to different states in Malaysia based on the population ratios as shown in Table 1.2 below. The sample sizes identified by states will be further stratified according to gender with a ratio of 105.69 males per 100 females. The same samples will also be stratified according to the race ratio of the country, Bumiputera (67.4%), Chinese (24.6%), Indian (7.3%), and Others (0.7%).

Table 1.2 Population in Malaysia

State	Population ('000)	Percentage	Sample size
Selangor	6,555	20.08	402
Sabah	3,833	11.74	235
Johor	3,794	11.62	232
Sarawak	2,822	8.64	173
Perak	2,501	7.66	153
Kedah	2,194	6.72	134
Kelantan	1,929	5.91	118
Pulau Pinang	1,774	5.43	109
WP Kuala Lumpur	1,747	5.35	107
Pahang	1,685	5.16	103
Terengganu	1,275	3.91	78
Negeri Sembilan	1,129	3.46	69
Melaka	938	2.87	57
Perlis	255	0.78	16
WP Putrajaya	116	0.36	7
WP Labuan	100	0.31	6
Total	32,647	100.00	2000

Source: Statista (2021)[1]

([1]https://www.statista.com/statistics/1040670/malaysia-population-distribution-by-state/, viewed on August 27, 2021).

The information shows the population numbers in Malaysia as of the second quarter of 2021 and the sample size for the survey by state. The statistics are sourced from Statistica. Using the 10 times rules based on "ten times the largest number of structural paths directed at a given construct in the structural model" (Hair, et al., 2017, p.448), the study only requires about 130 samples as the minimum sample size. In addition, using G*Power software, the study only requires a minimum of 131 samples given the presence of 13 exogenous constructs, a significance level of 0.05, and statistical power of 80%. Thus, the sample size of 2,000 initial proposed in this study is sufficient for this study. Additionally, the minimum sample based on Krejcie and Morgan (1970) indicates that

384 samples are needed for a population of less than 100,000,000.

1.3.4 Data Collection

While it would be possible to obtain the sampling frame from the Ministry of Science and Technology, this would not be feasible in our data collection method in view of the large sample size. As such the study will adopt judgmental and quota sampling from all the respective states in Malaysia. As judgmental and quota sampling was used to ensure that the sample distribution (i.e., state of residence, gender, ethnicity, age groups) is in line with the national profile of the country, the sample can be generalized as a good representation of the population of Malaysia. Finally, the proposed sample is also comparable to studies on vaccination acceptance in the UK (1,500 samples) and the US (800 samples) (Susan et al., 2021; Zheng, Jiang & Wu, 2021). About 2,500 data was distributed and after removing partial responses, 2,336 respondents were adopted for the final analysis.

1.3.5 Data Analysis

1.3.5.1 Statistical Analysis

The study adopted SmartPLS 3 (a variance-based Structural Equation Modelling) software to check on the conceptual model in view of the non-normality of data. The Mardia's multivariate skewness (β=31.776) and kurtosis (β=474.900) have p-value less than 0.001 using the Web Power online tool, confirming the non-normality of this data set (Wong et al., 2022a; Wong et al., 2022b). The study adopted a 2336 sample size, and the number is higher than the required threshold of 160 sample size using the "ten times rules (Hair et al., 2017). Using G*Power software, the study only requires a minimum of 143 samples given the presence of 16 exogenous constructs, a significance level of 0.05, and statistical power of 80% (Faul et al., 2009). Thus, the sample size of 2,336 is sufficient for this study.

1.3.5.2 Assessing the Outer Measurement Model

The analysis begins with the checking of the measurement model. First the study checks for reliability via Composite reliability (CR) and Dijkstra and Henseler's rho (pA) (Loh et al., 2022a; Lee et al., 2022; Hoh et al., 2022). As shown in Table 3, all the values were larger than the recommended threshold of 0.70. This means that internal consistency is acceptable (Loh et al., 2022; Ng et al., 2022). The analysis proceeded with a validity test by means of convergent (CV) and discriminant validity (DV). Accordingly, CV is established if the factor loadings are larger than 0.70 and the average variance extracted (AVE) surpasses 0.50 (Wan et al., 2021; Loh et al., 2022a; Wang et al., 2022). Factor loadings between 0.40 and 0.70 can be accepted according to Tan and Ooi (2018) provided that the indicator can explain 50 percent of the AVE. Table 1.3 showed that a CV has been established. In order to check for DV, HTMT inference was adopted and results in Table 1.4 indicated that none of the lower and upper bounds of 2.5 and 97.5 percent achieve the required value of 1. Thus, DV has been confirmed in this study (Loh et al., 2020; Ooi et al., 2021). Details of the analysis are described in Appendix 1.2 and 1.3.

1.3.5.3 Inspecting the Inner Structural Model

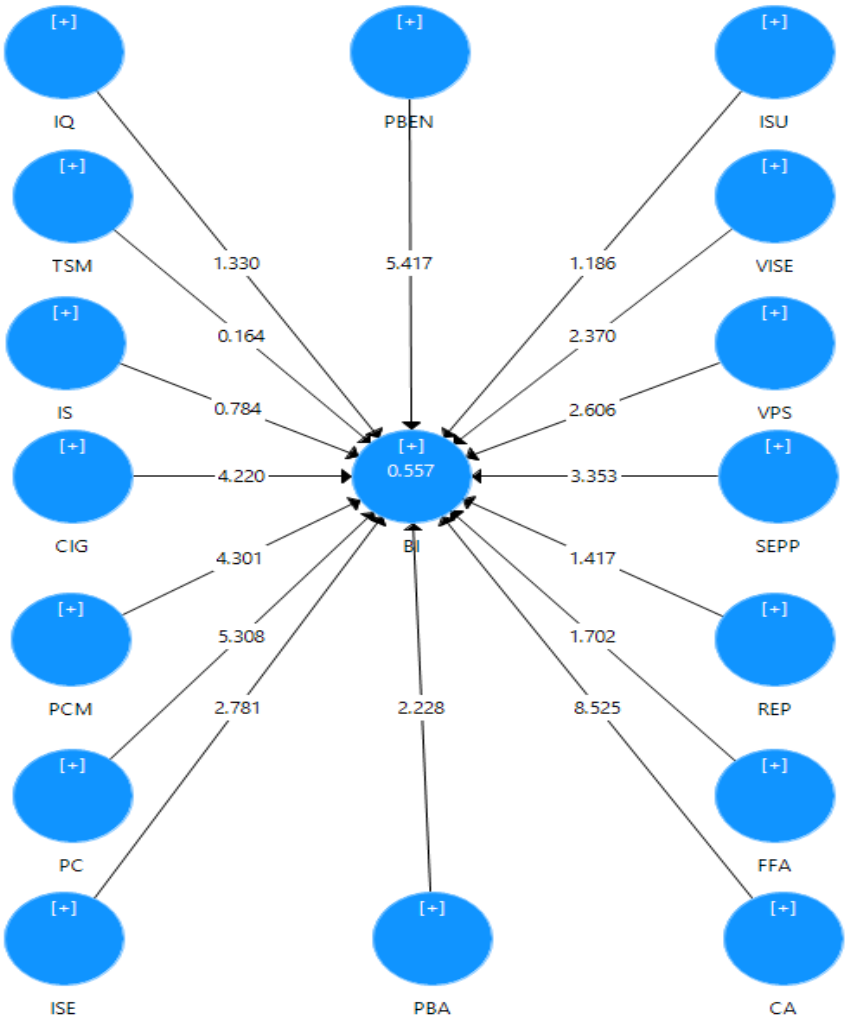
In order to check for the statistical significance of the conceptual model, a bootstrapping procedure was performed using 5,000 sub-samples (Wan et al., 2021; Wang et al., 2022). The inner variance inflation factor (VIF) values in Appendix 1.4 show that all values are below 5 and as such collinearity is absent from this study (Yuan et al., 2021; Tew et al., 2022). On the fitness of the model, as the value is 0.043 for both the estimated and saturated model for Standardized Root Mean Square Residual (SRMR), this means that the model has a good fit (Tan & Ooi, 2018; Loh et al., 2022b). All the hypotheses in Table 1.3 and Figure 1.1 were supported except for FFA and BI (β = 0.051, p > 0.05), IQ and BI (β = 0.043, p > 0.05), IS and BI (β = 0.021, p > 0.05), ISU and BI (β = 0.033, p > 0.05), REP and BI (β = 0.046, p > 0.05) and TSM and BI (β = 0.006, p > 0.05), which were not supported. For the further results please refer to Appendix 1.7.

Table 1.3 Outcome of the Structural Model Examination

PLS Path	Remarks
CA -> BI	Hypothesis supported
CIG -> BI	Hypothesis supported
FFA -> BI	Hypothesis unsupported
IQ -> BI	Hypothesis unsupported
IS -> BI	Hypothesis unsupported
ISE -> BI	Hypothesis supported
ISU -> BI	Hypothesis unsupported
PBA -> BI	Hypothesis supported
PBEN -> BI	Hypothesis supported
PC -> BI	Hypothesis supported
PCM -> BI	Hypothesis supported
REP -> BI	Hypothesis unsupported
SEPP -> BI	Hypothesis supported
TSM -> BI	Hypothesis unsupported
VISE -> BI	Hypothesis supported
VPS -> BI	Hypothesis supported

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Figure 1. 1 Results of Hypotheses Testing



1.3.5.4 The Predictive Relevance and Effect Size

The coefficient of determination (R2 values) of BI is 55.7, which can be described as moderate (Hair et al., 2021). The effect size (f2) ranges from 0.000 to 0.055 indicating no effect to small effect (Cohen, 1992; Tan and Ooi, 2018) as shown in Appendix 1.5. The result in Appendix 1.6 indicates that the estimate Stone-Geisser's Q2 values are greater than zero using an omission distance of 7 thereby confirming that the mode has predictive relevance (Lew et al., 2020; Yan et al., 2021).

1.4 FINDINGS

1.4.1 Focus group

A focus group session was conducted on 12 May 2022 with a group consisting of 7 participants from various age groups, religions, ethnicities, and education levels. The details of the participants are shown in Table 1.4.

Table 1.4 Participants' Demographic Profile

No.	Name	Gender	Age	Race
1	X1	Female	46	Kadazan
2	X2	Female	26	Chinese
3	X3	Female	26	Punjabi
4	X4	Male	23	Chinese
5	X5	Female	23	Iban
6	X6	Female	45	Malay
7	X7	Male	30	Chinese

In qualitative research, the aim is not statistical representativeness but representativeness in the sense of gaining access to the full range of views, themes, or possibilities in the population. As such, there is no firm guideline to determine the sample size for interviews and therefore, information received from the 7 participants has led to data saturation (Wong et al., 2022). The brief descriptions and study background were sent to the interviewees approximately a week in advance. The semi-structured interviews lasted about 1.5 hours and were moderated by 2 employees from UCSI Research Poll Centre (https://www.ucsipoll.org.my/about-us), a subsidiary of UCSI University, namely Mr Choy Kah Yung and Mr Cao Jia Nan. The UCSI Research Poll Centre has expertise in survey research and gathering public opinion. The interviews were audio recorded. During the interviews, participants were asked to share their acceptance/barriers/motivations of vaccination through the Malaysian government's first roll-out of COVID-19 vaccination. Concerns were raised regarding the confidence level of the Malaysian government and the quality of information disseminated. Interviewees also added that, while they have concerns, they agreed to the vaccination due to the high death cases in Malaysia. Based on the comments provided, the questionnaire was subsequently confirmed and pre-tested with academicians from the Faculty of Medicine and Health Science, UCSI University. The pre-test is necessary to reduce the misinterpretation, double-barrel issue, and fuzziness of the questionnaire design and to ensure that the questionnaire is clear and understandable. The final instrument used is shown in Appendix 1.1.

1.4.2 Pilot Study

A pilot test was further performed in June 2022 through online surveys to check the internal consistency reliability. The analysis was conducted using the Partial Least Square-Structural Equation Modelling approach to detect the linear relationship. A total of 35 participants were invited and Composite Reliability (see Table 1.5) for all values was above 0.7 except for VISE. Since the Average Value Extracted (AVE) value for VISE is above 0.5, the study is good for further study (Ooi & Tan, 2018).

Table 1.5 Reliability

Constructs	Composite Reliability
BI	0.828
CA	0.827
CIG	0.839
FFA	0.796
IQ	0.778
ISE	0.798
ISI	0.806
ISU	0.834
PBA	0.886
PBEN	0.763
PC	0.877
PCM	0.878
REP	0.801
SEPP	0.766
TSM	0.908
VISE	0.513
VPS	0.848

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI).

1.4.3 Characteristics of Respondents

The demographic profile of 2,336 respondents for this study is shown in Table 1.6 and Figures 1.2 to 1.9.

Table 1.6 Sociodemographic Characteristics of the Respondents

Sociodemographic Characteristics	Number of Respondents	Percentage (%)
Gender		
Female	1,320	56.5%
Male	1,016	43.5%
Age		
Below 20 years old	226	9.7%
20 – 24 years old	667	28.6%
25 – 29 years old	351	15.0%
30 – 34 years old	302	12.9%
35 – 39 years old	215	9.2%
40 – 44 years old	216	9.2%
45 – 49 years old	118	5.1%
50 – 54 years old	99	4.2%
55 – 59 years old	75	3.2%
60 – 64 years old	37	1.6%
65 – 69 years old	21	0.9%
70 years old and above	9	0.4%
Marital Status		
Single	929	39.8%
Married	1,407	60.2%
Ethnicity		
Malay	1,806	77.3%
Chinese	386	16.5%
Indian	132	5.7%
Others	12	0.5%
Residence		
Johor	240	10.3%
Kedah	136	5.8%
Kelantan	135	5.8%
Melaka	177	7.6%
Negeri Sembilan	136	5.8%
Pahang	109	4.7%
Perak	155	6.6%
Perlis	20	0.9%
Pulau Pinang	110	4.7%
Sabah	243	10.4%
Sarawak	180	7.7%
Selangor	458	19.6%
Terengganu	82	3.5%
WP Kuala Lumpur	136	5.8%

WP Labuan	9	0.4%
WP Putrajaya	10	0.4%
Highest Level of Academic Qualification		
No College Degree	592	25.3%
Diploma/Advanced Diploma	819	35.1%
Bachelor's Degree/Professional Qualification	787	33.7%
Master's/Ph.D. Degree	138	5.9%
Industry working in		
Banking	116	5.0%
Finance	228	9.8%
Information Technology	187	8.0%
Manufacturing	171	7.3%
Retail	237	10.1%
Telecommunication	133	5.7%
Tourism	71	3.0%
Education	318	13.6%
Unemployed	396	17.0%
Others	274	11.7%
Household income		
Less than RM2,500	936	40.1%
RM2,500 – RM3,169	338	14.5%
RM3,170 – RM3,969	243	10.4%
RM3,970 – RM4,849	169	7.2%
RM4,850 – RM5,879	212	9.1%
RM5,880 – RM7,099	171	7.3%
RM7,100 – RM8,699	120	5.1%
RM8,700 – RM10,959	77	3.3%
RM10,960 – RM15,039	40	1.7%
More than RM15,039	30	1.3%

Figure 1. 2 What Is Your Gender?

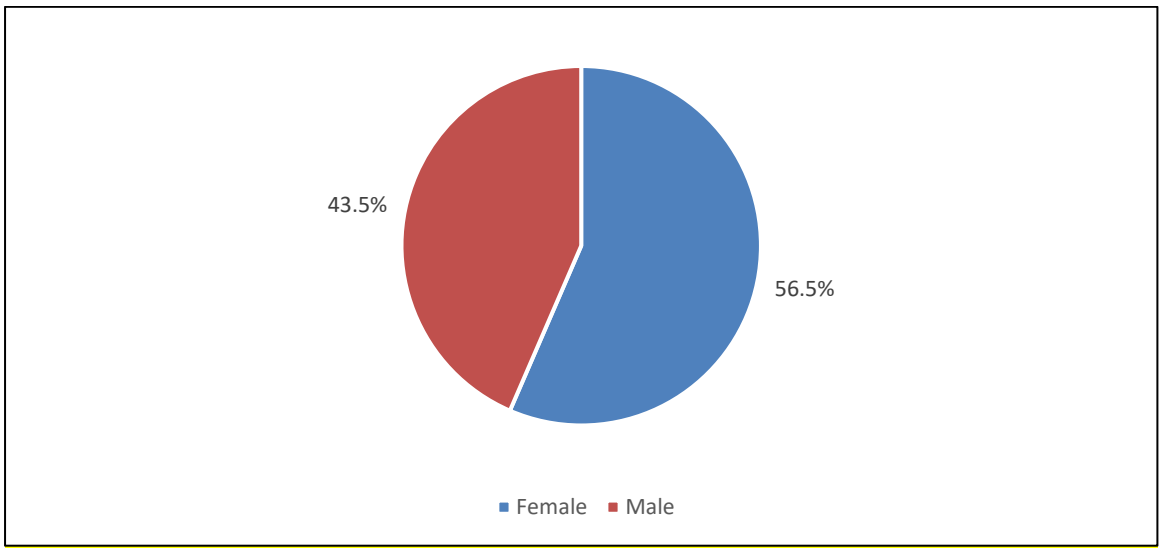
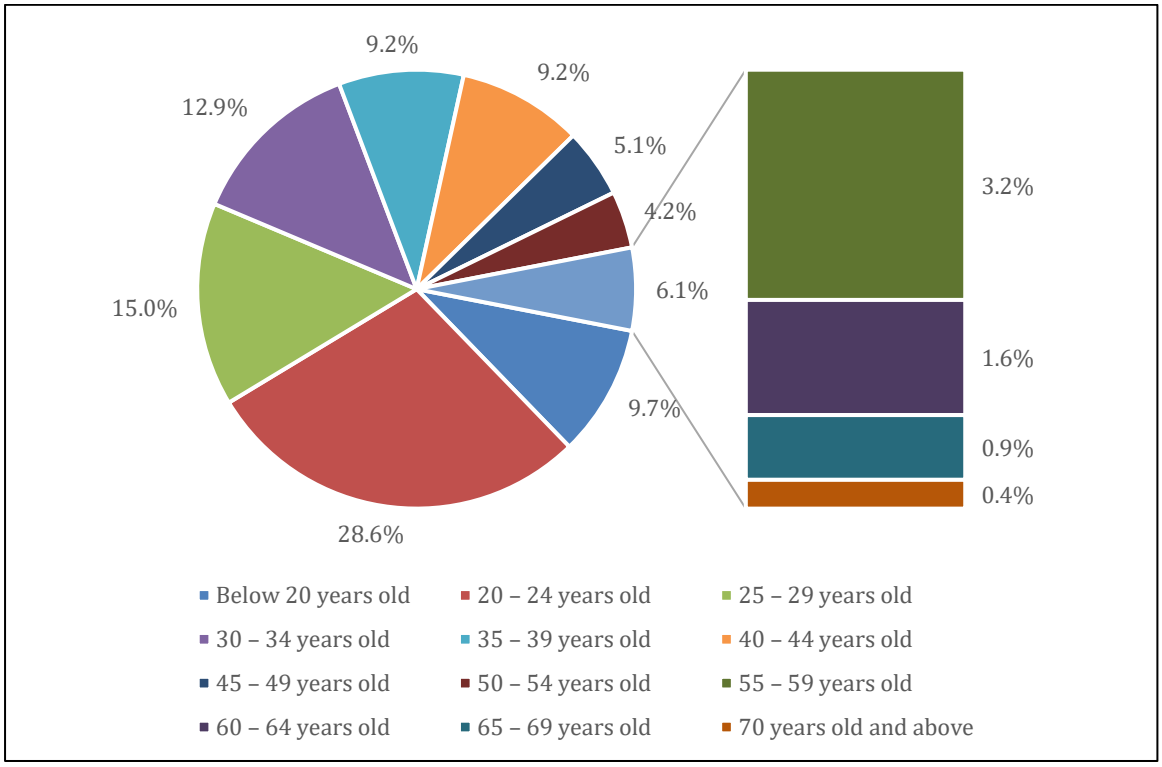


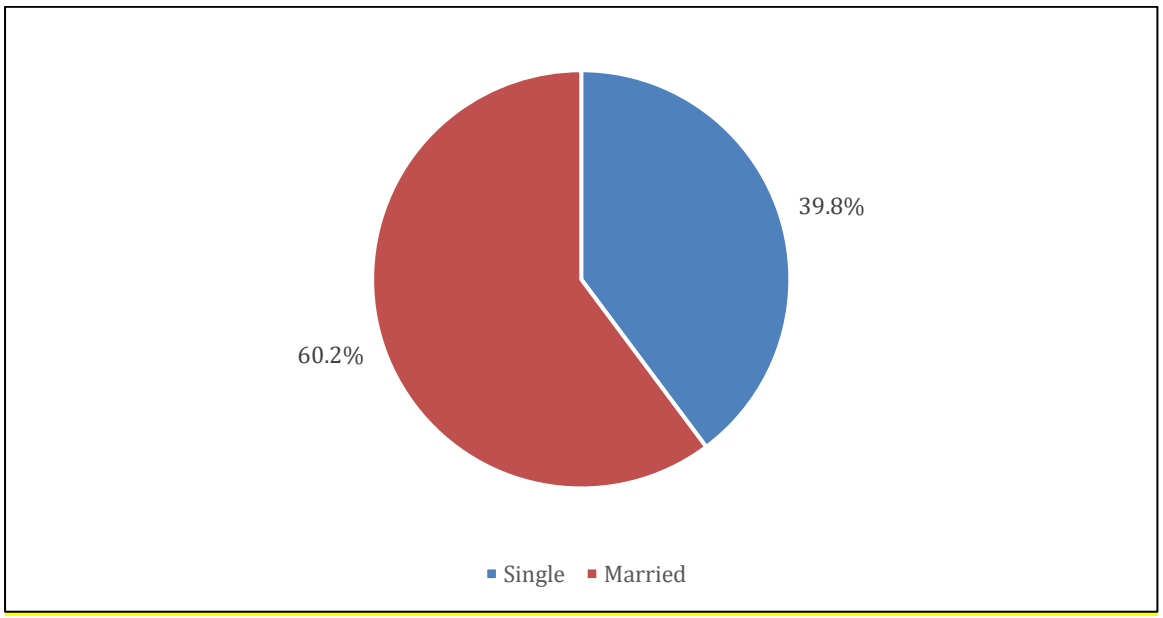
Figure 1.2, it can be seen that 56.5% of the sample are women and 43.5% are men.

Figure 1. 3 How Old Are You?



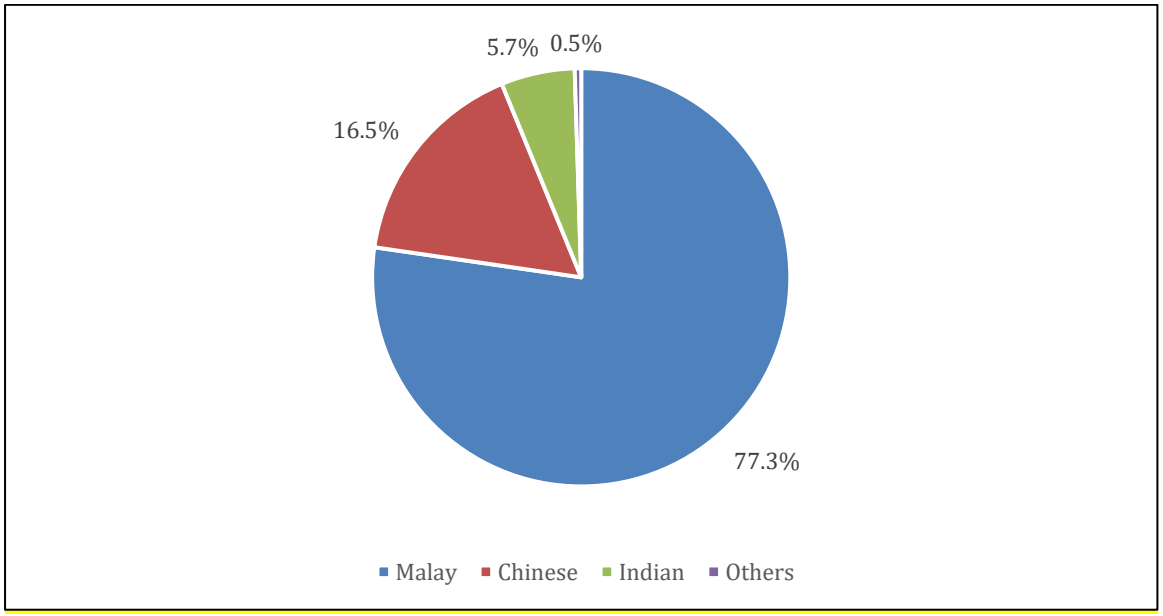
Young adults between the ages of 20 and 29 hold the largest sample share, totalling up to 43.6%; in particular, 28.6% fall into the 20-year-old to 24-year-old age bracket, followed by 15% in the 25-year-old to 29-year-old age bracket. The age bracket of 30-year-old to 34-year-old accounts for 12.9% of the sample whereas the age groups of 35-year-old to 39-year-old and 40-year-old to 44-year-old each make up 9.2%. 9.3% of the sample is between the ages of 45 and 54, and those over 55 years old make up 6.1% of the sample (Table 1.6 and Figure 1.3).

Figure 1. 4 What Is Your Marital Status?



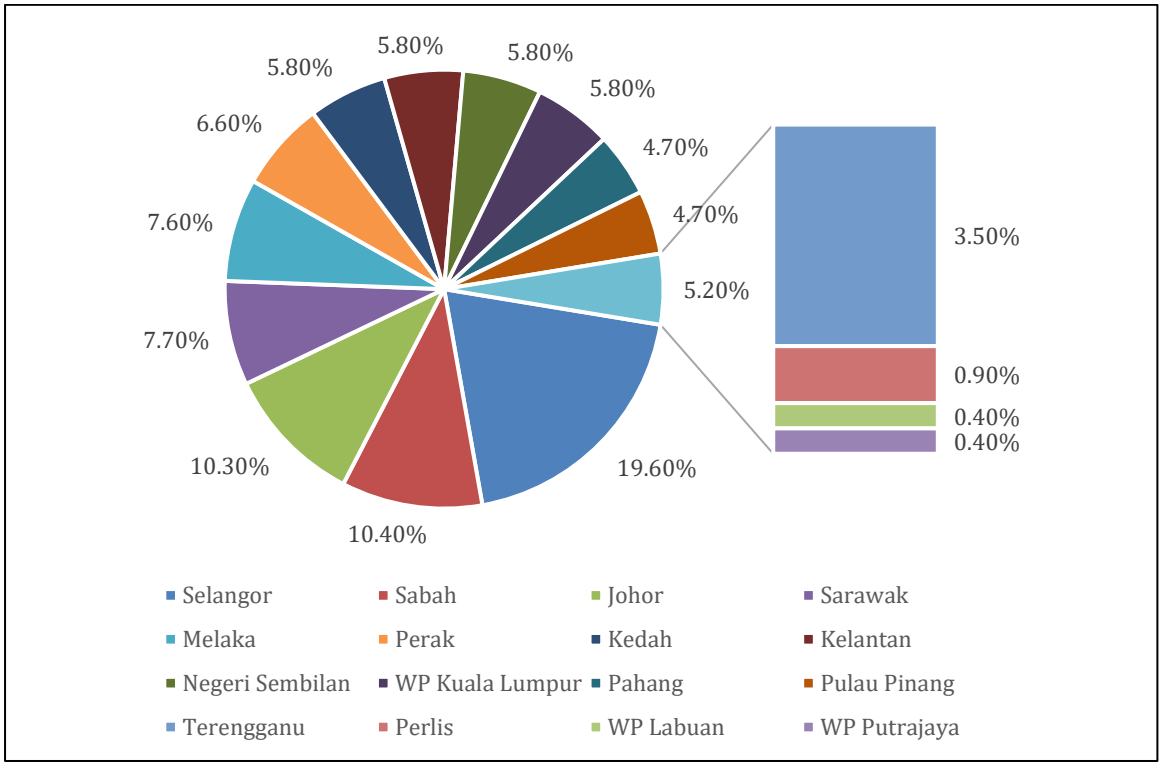
From Table 1.6 and Figure 1.4, it can be observed that 60.2% of the sample are married, and the remaining 39.8% are still unmarried.

Figure 1. 5 What Is Your Ethnicity?



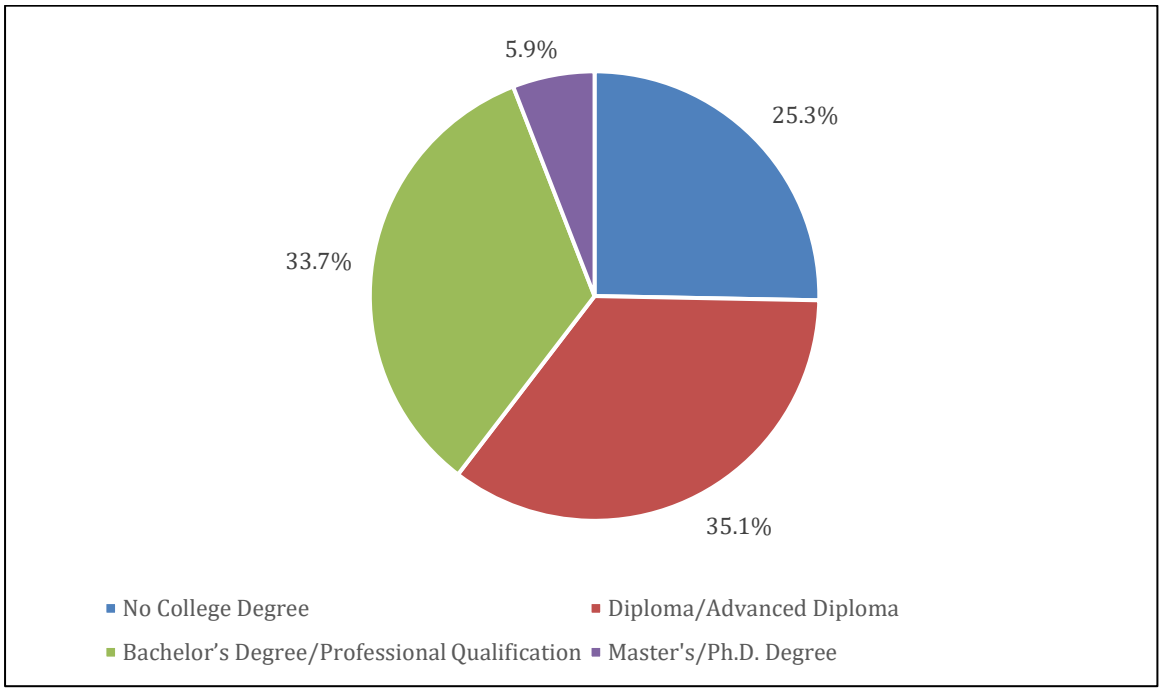
Malay people make up the bulk of the sample (77.3%), followed by Chinese people (16.5%), and Indian people (5.7%). People of other ethnicities make up the remaining 0.5% of the sample (Table 1.6 and Figure 1.5).

Figure 1. 6 Which State Do You Reside In?



In terms of residency, it was observed from Table 1.6 and Figure 1.6, Selangorians hold the largest sample share with 19.6%, followed by Sabahans (10.4%) and Johorians (10.3%). Malaccans make up 7.6% of the sample, while Sarawakians make up 7.7%. 18% of the sample reside in the northern region of Peninsular Malaysia, which includes Perak (6.6%), Kedah (5.8%), Penang (4.7%), and Perlis (0.9%). Moreover, the Federal Territories of Malaysia, notably WP Kuala Lumpur (5.8%), WP Labuan (0.4%), and WP Putrajaya (0.4%), are home to 6.6% of the sample. Terengganu and Pahang have sample shares of 3.5% and 4.7%, respectively, while Kelantan and Negeri Sembilan each hold a sample share of 5.8%.

Figure 1. 7 What Is Your Highest Level of Academic Qualification?



The majority of the sample holds a college degree; specifically, 35.1% have a diploma or advanced diploma, 33.7% have a bachelor's degree or a comparable professional qualification, and 5.9% have a master's or Ph.D. degree, totalling up to 74.7% of the respondents. The remaining 25.3% of the sample consists of non-college graduates (Table 1.6 and Figure 1.7).

Figure 1. 8 Which Industry Do You Currently Work In?

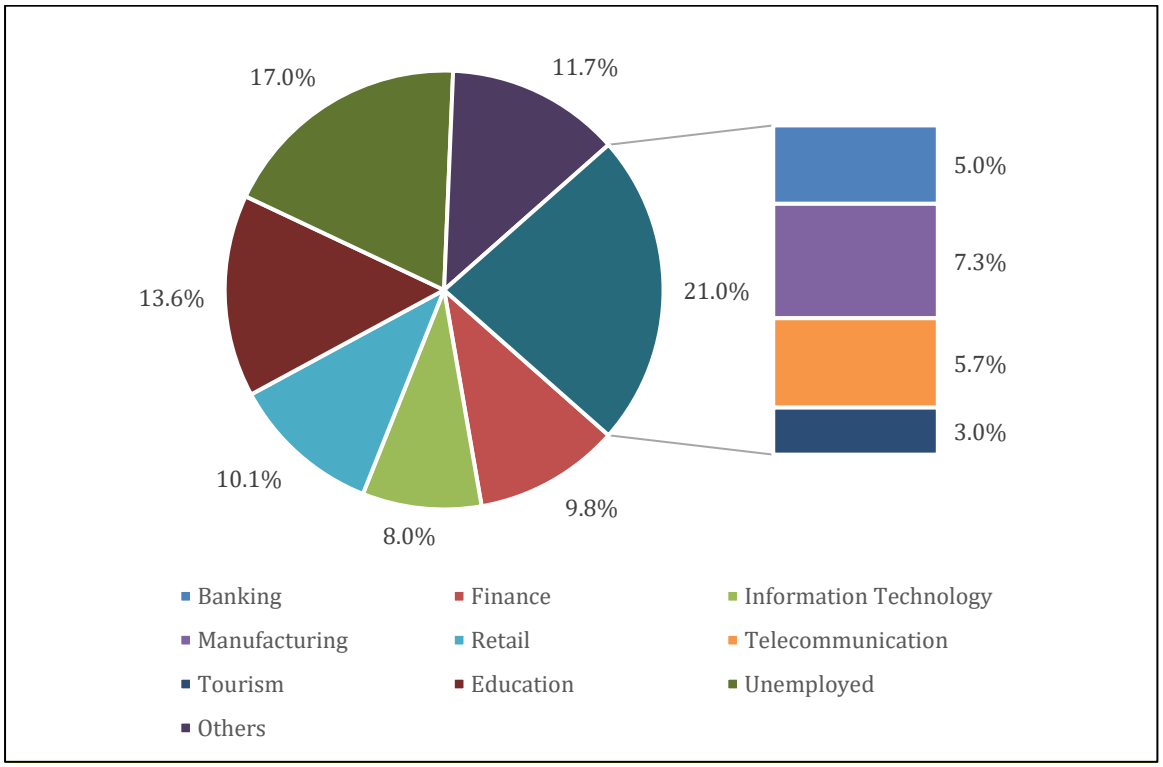
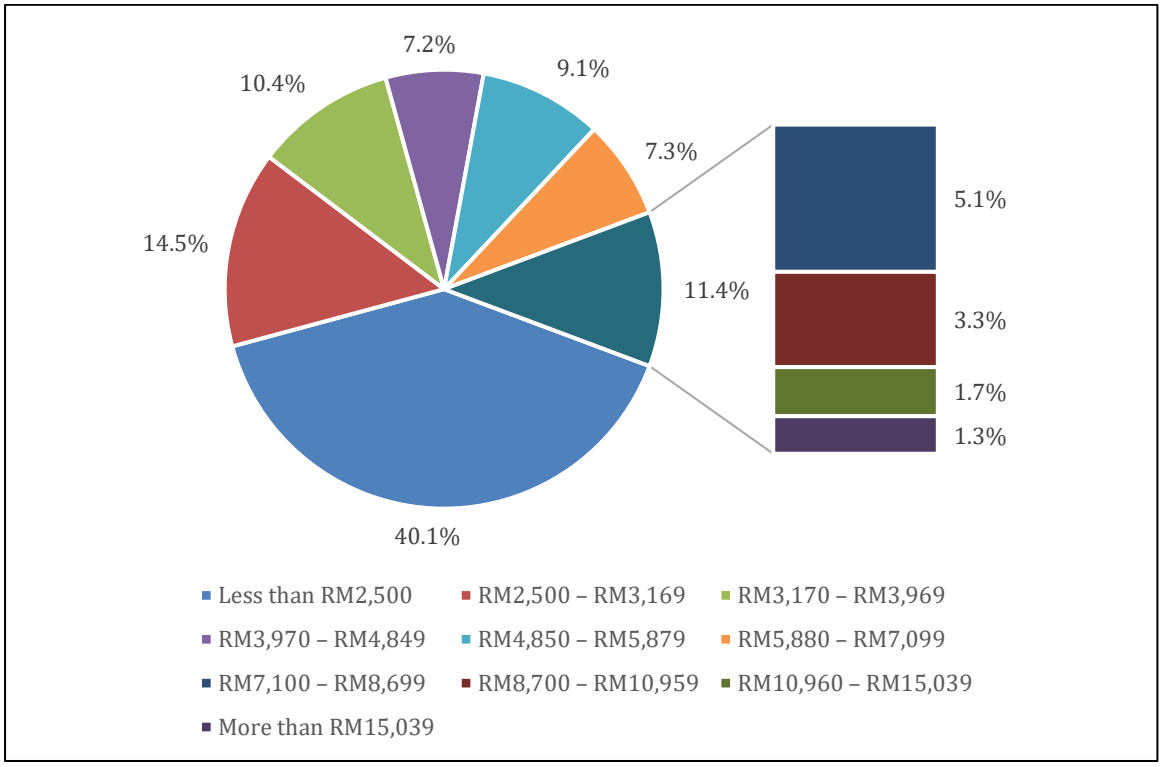


Table 1.6 and Figure 1.8 illustrated that education is the industry with the highest sample share (13.6%), followed by retail (10.1%) and finance (9.8%). 8.0% of the respondents have a job in fields related to information technology, and another 7.3% have a job in the manufacturing sector. Meanwhile, telecommunication, banking, and tourism each have a sample share of 5.7%, 3.0%, and 5.0%, respectively. The remaining 28.7% of the sample are either jobless (17%) or are employed in other industries that were not specified in the selections (11.7%).

Figure 1. 9 How Much Is Your Household Income Per Month?



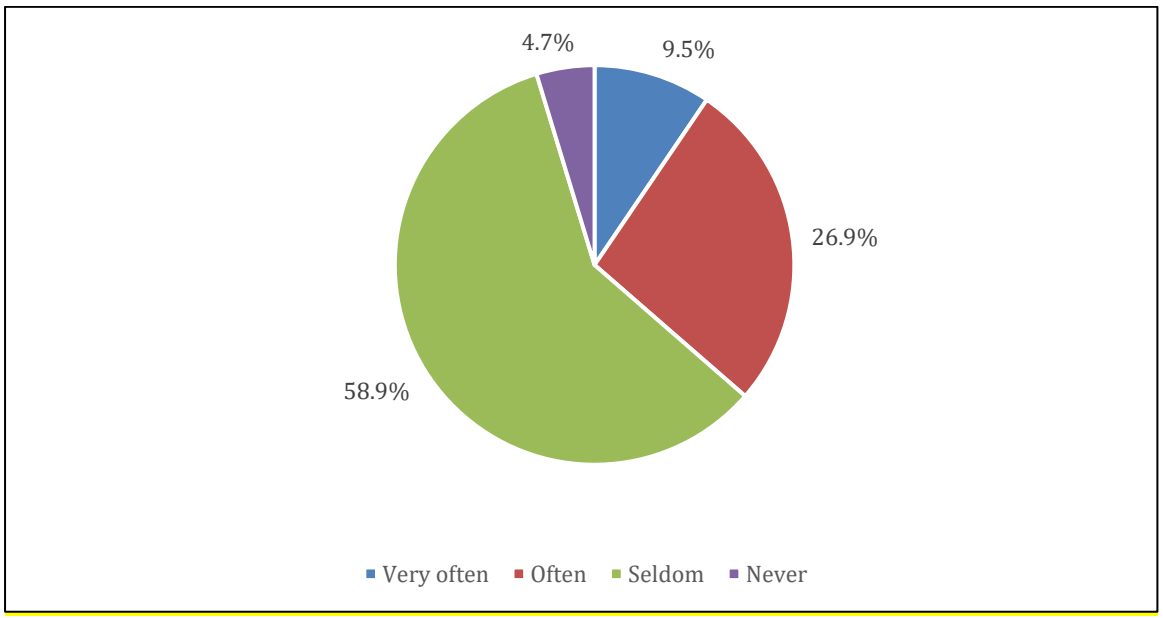
Nearly half of the sample (40.1%) have a household income of less than RM2,500 per month. 24.9% of the sample earn between RM2,500 and RM3,969 each month, and 7.2% earn between RM3,970 and RM4,849. While 7.3% of the sample's households fall into the RM5,880 to RM7,099 income range, 9.1% of the sample's households earn between RM4,850 and RM5,879 in monthly income. Finally, just 11.4% of the sample have a monthly household income exceeding RM7,100, of which only 1.3% of them make more than RM15,039 per month (Table 1.6 and Figure 1.9).

Behaviour towards MySejahtera, COVID-19

When asked how frequently they check the MySejahtera application for updates regarding the COVID-19 pandemic (Figure 1.10), 58.9% of the respondents said that they hardly ever do so. On the other hand, 36.4% of the sample routinely check their MySejahtera application for COVID-19 pandemic updates. Of the 2,336 respondents surveyed, only 4.7% of them reportedly never used the MySejahtera application to retrieve any COVID-19 pandemic-related information.

How Often Do You Check Your MySejahtera Application for Updates (E.G., Hotspot, Digital Health) About The COVID-19 Pandemic?		
Very often	223	9.5%
Often	629	26.9%
Seldom	1,375	58.9%
Never	109	4.7%

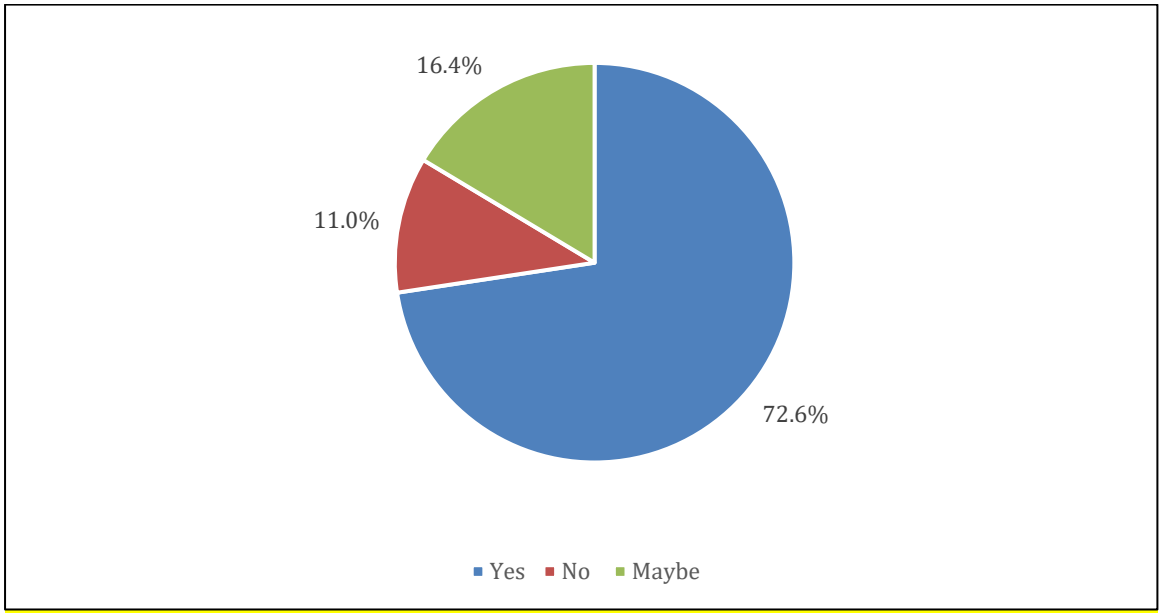
Figure 1. 10 How Often Do You Check Your MySejahtera Application for Updates (e.g., Hotspot, Digital Health) About The COVID-19 Pandemic?



The act of taking the COVID-19 Self-Test is regarded as a societal obligation by 72.6% of the sample, while only 11% disagree. Meanwhile, 16.4% of respondents were unsure whether taking the COVID-19 Self-Test is a social responsibility (Figure 1.11).

Do You Agree That Taking COVID-19 Self-Test Is a Social Responsibility?		
Yes	1696	72.6%
No	258	11.0%
Maybe	382	16.4%

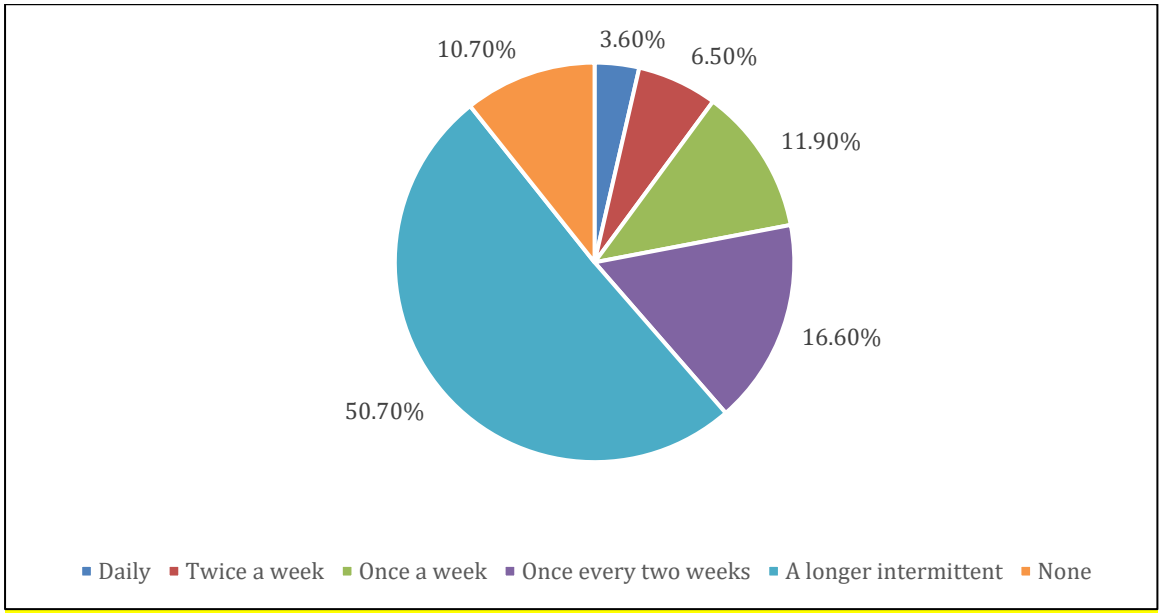
Figure 1. 11 Do You Agree That Taking COVID-19 Self-Test Is a Social Responsibility?



From Figure 1.12, it can be seen that it is unusual for 61.4% of the sample to take the COVID-19 Self-Test; specifically, 50.7% take it sometimes, and 10.7% had never taken one before. 16.6% of the sample take a COVID-19 Self-Test once every two weeks. 11.9% do it once a week while 6.5% do it twice a week. Meanwhile, only 3.6% of the respondents take the COVID-19 Self-Test every day.

How Often Do You Take COVID-19 Self-Test?		
Daily	84	3.6%
Twice a week	152	6.5%
Once a week	278	11.9%
Once every two weeks	388	16.6%
A longer intermittent	1,185	50.7%
None	249	10.7%

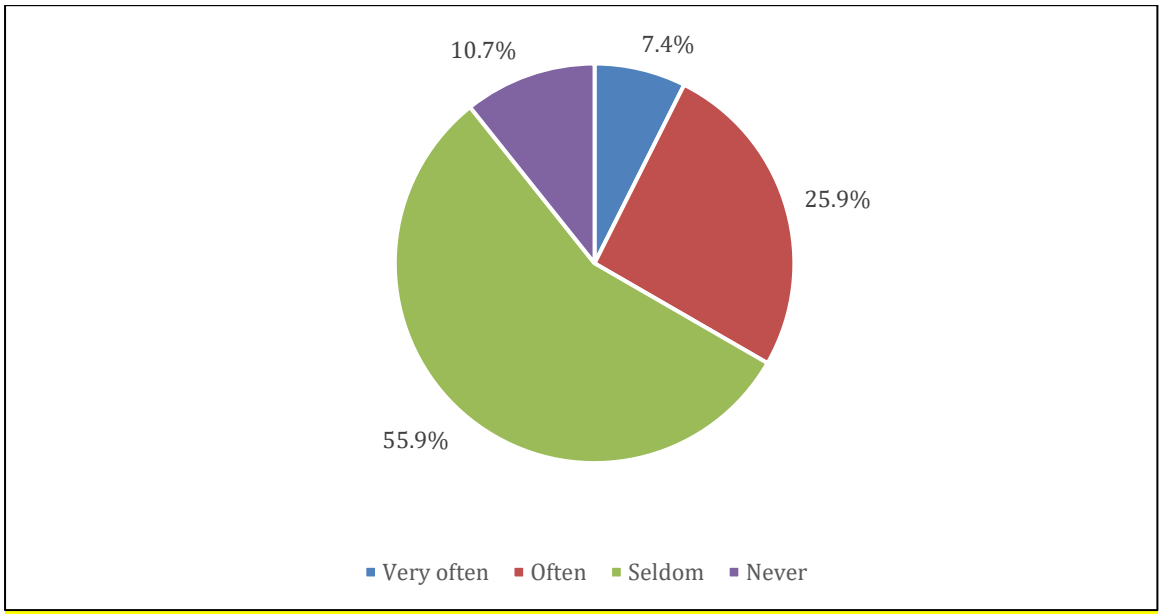
Figure 1. 12 How Often Do You Take COVID-19 Self-Test?



55.9% of the sample rarely update their COVID-19 Self-Test results in their MySejahtera application. On the contrary, 7.4% of the sample regularly update their results for contact tracing. Meanwhile, 10.7% of the sample had never updated their COVID-19 Self-Test results in their MySejahtera application (Figure 1.13).

How often do you update your COVID-19 Self-Test results in your MySejahtera application for contact tracing?		
Very often	174	7.4%
Often	606	25.9%
Seldom	1306	55.9%
Never	250	10.7%

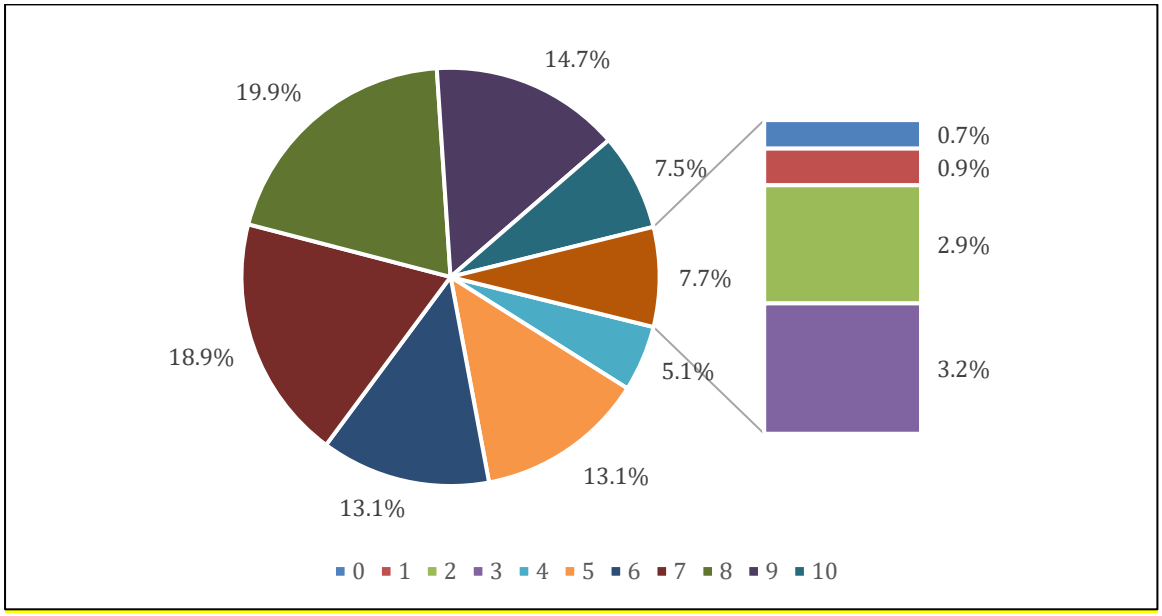
Figure 1. 13 How Often Do You Take COVID-19 Self-Test?



From Figure 1.14 it is illustrated that in overall, 87.2% of the sample gave the MySejahtera application a score of 5 or higher on a usefulness scale of 1 to 10, with 7.5% giving the application a score of 10 out of 10 for its usefulness. 12.8% of the sample gave the MySejahtera application a usefulness score of 4 or lower out of 10, with only 0.7% not recognising its value at all.

From the scale of 0 – 10, how do you rate the usefulness of the MySejahtera application?		
0	16	0.7%
1	22	0.9%
2	67	2.9%
3	75	3.2%
4	119	5.1%
5	306	13.1%
6	305	13.1%
7	442	18.9%
8	465	19.9%
9	343	14.7%
10	176	7.5%

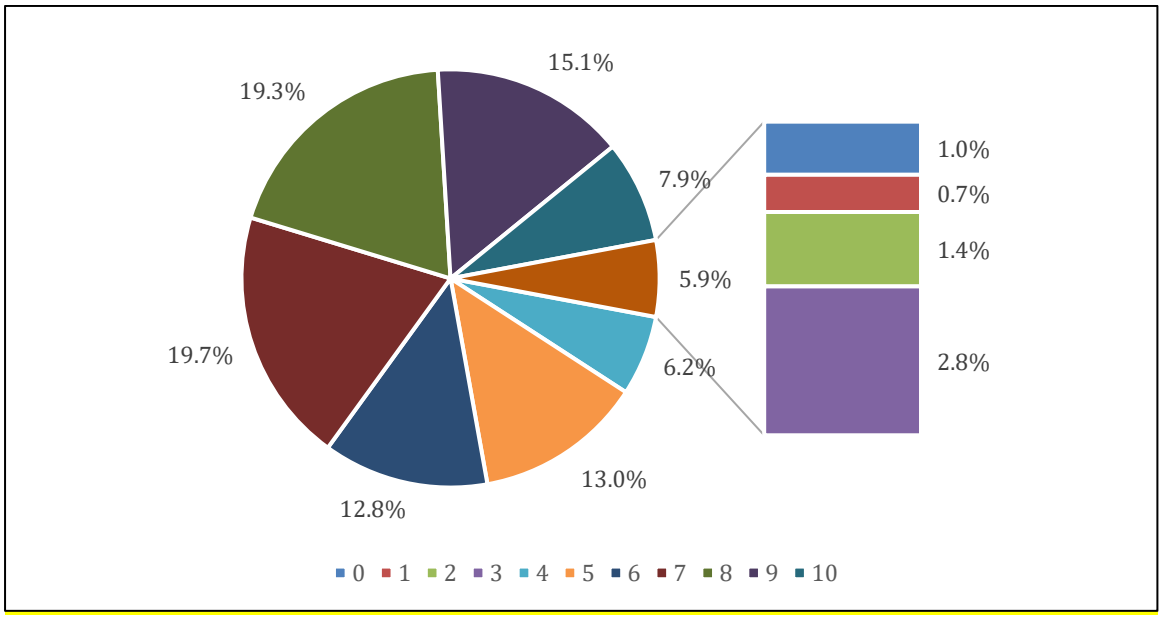
Figure 1. 14 How Do You Rate the Usefulness of the MySejahtera Application?



Most respondents agreed that the MySejahtera application is trustworthy; in fact, 87.8% of respondents gave the MySejahtera application a score of 5 or higher on a trust scale of 1 to 10. Meanwhile, 7.9% have complete faith in the MySejahtera app, giving it a score of 10 out of 10. 12.1% gave the application a trust rating of 4 or lower, while only 1.0% of the respondents have zero faith in the MySejahtera application, rating a score of 0 out of 10 (Figure 1.15).

From the Scale Of 0 – 10, How Do You Rate Your Trust Towards the MySejahtera Application?		
0	24	1.0%
1	16	0.7%
2	33	1.4%
3	65	2.8%
4	144	6.2%
5	303	13.0%
6	300	12.8%
7	461	19.7%
8	452	19.3%
9	353	15.1%
10	185	7.9%

Figure 1. 15 How Do You Rate Your Trust Towards the MySejahtera application?



The study has also segregated the data into regions such as Northern Region (Perlis, Kedah, Penang, Perak), East Coast Region (Kelantan, Terengganu, Pahang), Central Region (Selangor, Kuala Lumpur and Putrajaya), Southern Region (Negeri Sembilan, Melaka and Johor) and East Malaysia (Sabah, Sarawak and Wilayah Persekutuan Labuan (Table 1.7). 53.91%, 47.24%, 33.94%, 43.22%, 38.19%, gave a trust rating of 8 and above for Northern, East Coast, Central, Southern Region and East Malaysia respectively.

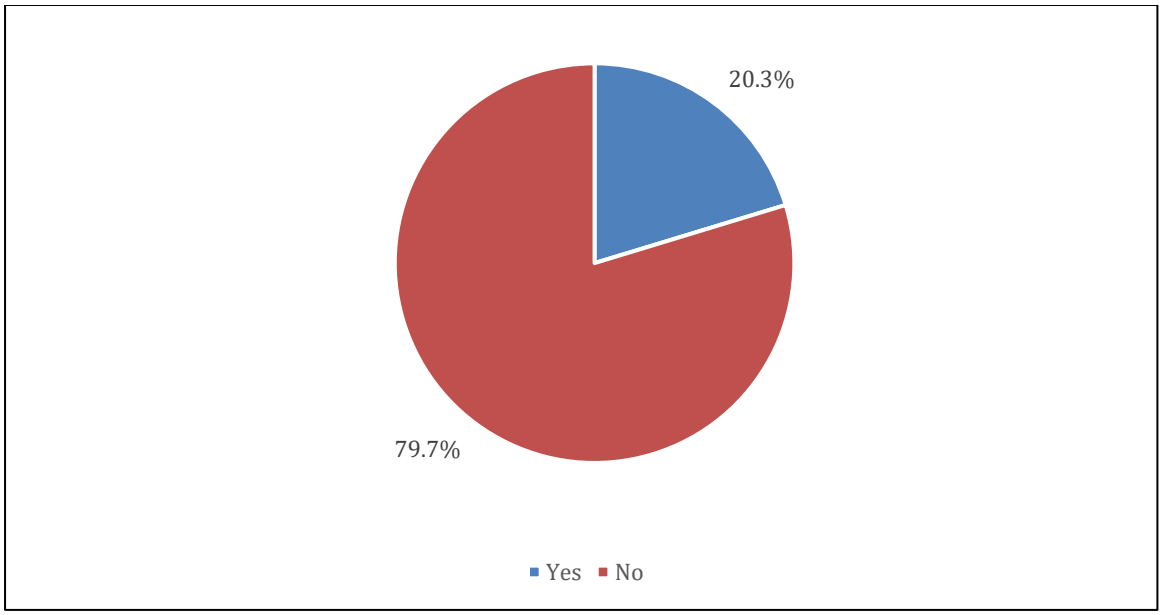
Table 1.7 Trust Towards MySejahtera Application by Region

From the scale of 0 – 10, how do you rate your trust towards the MySejahtera application?					
	Northern Region	**East Coast Region**	**Central Region**	**Southern Region**	**East Malaysia**
0	4	2	9	4	5
1	4	2	6	4	0
2	4	4	12	7	6
3	13	12	26	6	8
4	16	14	54	26	34
5	36	34	86	77	70
6	43	50	71	78	58
7	74	54	135	112	86
8	89	74	94	128	67
9	101	61	63	73	55
10	37	19	48	38	43

79.7% of the sample are free of any chronic disease or long-term condition that the other 20.3% reportedly have (Figure 1.16).

Do you have any chronic disease/long term-condition?		
Yes	474	20.3%
No	1,862	79.7%

Figure 1. 16 Do You Have Any Chronic Disease/Long Term-Condition?



1.4.4 Outcome of the Main Result

In order to answer the first research question, "What are the factors influencing the acceptance of vaccination among Malaysians?" the study focuses on the relationships of all the factors with COVID-19 vaccination acceptance. The study indicated that the relationship between CA, CIG, ISE, PBA, PBEN, PC, PCM, SEPP, VISE and VPS are supported in this study. However, the relationship between FFA, IQ, IS, ISU, REP and TSM are not supported (Table 1.8).

Table 1.8 Outcome of the Result

PLS Path	Remarks
CA -> BI	Supported
CIG -> BI	Supported
FFA -> BI	Unsupported
IQ -> BI	Unsupported
IS -> BI	Unsupported
ISE -> BI	Supported
ISU -> BI	Unsupported
PBA -> BI	Supported
PBEN -> BI	Supported
PC -> BI	Supported
PCM -> BI	Supported
REP -> BI	Unsupported
SEPP -> BI	Supported
TSM -> BI	Unsupported
VISE -> BI	Supported
VPS -> BI	Supported

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

1.4.5 Outcome of the Demographic Differences

In order to answer the second research question, "Are there demographic and geographical disparities in vaccine acceptance?", the study focus on gender and ethics differences.

1.4.5.1 Gender Differences

The study indicated that there are no differences in gender apart from the relationship between PBEN, VISE and VPS with BI using the permutation analysis. The results are shown in Table 1.9.

Table 1.9 Outcome of the Permutation Analysis

	Path Coefficients Original (Gender QA1(Female))	Path Coefficients Original (Gender QA2(Male))	Path Coefficients Original Difference (Gender QA1(Female) - Gender QA2(Male))	Path Coefficients Permutation Mean Difference (Gender QA1(Female) - Gender QA2(Male))	2.50%	97.50%	Permutation p-Values
CA -> BI	0.254	0.252	0.003	0.001	-0.123	0.127	0.960
CIG -> BI	0.111	0.094	0.017	0.004	-0.098	0.101	0.800
FFA -> BI	0.013	0.095	-0.081	0.002	-0.118	0.114	0.148
IQ -> BI	-0.002	0.119	-0.121	-0.001	-0.143	0.134	0.082
IS -> BI	-0.005	0.067	-0.071	0.002	-0.112	0.103	0.208
ISE -> BI	-0.070	-0.093	0.023	-0.002	-0.116	0.106	0.670
ISU -> BI	0.075	-0.011	0.085	0.006	-0.098	0.13	0.148
PBA -> BI	-0.048	-0.014	-0.034	-0.001	-0.086	0.08	0.394
PBEN -> BI	0.239	0.094	0.145	0.003	-0.121	0.127	0.016
PC -> BI	0.115	0.099	0.016	-0.002	-0.085	0.078	0.674
PCM -> BI	0.105	0.103	0.003	-0.004	-0.106	0.088	0.966
REP -> BI	0.065	0.006	0.059	-0.004	-0.134	0.127	0.382
SEPP -> BI	0.078	0.118	-0.041	-0.001	-0.122	0.12	0.520
TSM -> BI	0.014	0.005	0.01	-0.001	-0.148	0.134	0.888
VISE -> BI	0.103	-0.012	0.115	-0.004	-0.096	0.079	0.008
VPS -> BI	-0.104	0.007	-0.111	0.001	-0.087	0.090	0.010

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

1.4.5.2 Ethnic Differences

The results indicated the differences between Malay, Chinese and Indian in their decision marking. The results are shown in Table 1.10, 1.11 and 1.12. The results however need to be taken with cautious due to the differences in sampling percentage.

Table 1.10 Outcome of the Result (Malay)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Remarks	Results
CA -> BI	0.227	0.227	0.034	6.763	0.000	Supported	Similar
CIG -> BI	0.116	0.115	0.027	4.384	0.000	Supported	Similar
FFA -> BI	0.040	0.038	0.032	1.260	0.208	Unsupported	Similar
IQ -> BI	0.035	0.036	0.037	0.957	0.339	Unsupported	Similar
IS -> BI	0.021	0.021	0.031	0.676	0.499	Unsupported	Similar
ISE -> BI	-0.096	-0.096	0.029	3.328	0.001	Supported	Similar
ISU -> BI	0.023	0.023	0.029	0.765	0.444	Unsupported	Similar
PBA -> BI	-0.058	-0.054	0.022	2.623	0.009	Supported	Similar
PBEN -> BI	0.186	0.189	0.036	5.237	0.000	Supported	Similar
PC -> BI	0.119	0.117	0.023	5.235	0.000	Supported	Similar
PCM -> BI	0.102	0.103	0.027	3.797	0.000	Supported	Similar
REP -> BI	0.042	0.042	0.034	1.217	0.224	Unsupported	Similar
SEPP -> BI	0.098	0.097	0.034	2.866	0.004	Supported	Similar
TSM -> BI	0.035	0.035	0.039	0.900	0.368	Unsupported	Similar
VISE -> BI	0.081	0.082	0.025	3.217	0.001	Supported	Similar
VPS -> BI	-0.035	-0.037	0.025	1.439	0.15	Unsupported	Not similar

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Table 1.11 Outcome of the Result (Chinese)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Remarks	Results
CA -> BI	0.443	0.437	0.078	5.704	0.000	Supported	Similar
CIG -> BI	0.196	0.192	0.084	2.320	0.021	Supported	Similar
FFA -> BI	0.024	0.021	0.069	0.341	0.733	Unsupported	Similar
IQ -> BI	0.094	0.092	0.082	1.146	0.252	Unsupported	Similar
IS -> BI	-0.02	-0.023	0.071	0.275	0.783	Unsupported	Similar
ISE -> BI	-0.023	-0.015	0.082	0.274	0.784	Unsupported	Similar
ISU -> BI	0.174	0.167	0.079	2.217	0.027	Supported	Not similar
PBA -> BI	-0.011	-0.004	0.055	0.204	0.838	Unsupported	Not similar
PBEN -> BI	0.095	0.103	0.078	1.210	0.227	Unsupported	Not similar
PC -> BI	-0.039	-0.041	0.043	0.909	0.364	Unsupported	Not similar
PCM -> BI	0.077	0.078	0.056	1.389	0.165	Unsupported	Not similar
REP -> BI	-0.044	-0.045	0.091	0.484	0.629	Unsupported	Not similar
SEPP -> BI	0.083	0.086	0.079	1.044	0.297	Unsupported	Not similar
TSM -> BI	-0.07	-0.065	0.094	0.747	0.456	Unsupported	Similar
VISE -> BI	0.017	0.014	0.054	0.322	0.748	Unsupported	Not similar
VPS -> BI	-0.086	-0.084	0.054	1.598	0.111	Unsupported	Not similar

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Table 1.12 Outcome of the Result (Indian)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Remarks	Results
CA -> BI	0.474	0.436	0.152	3.125	0.002	Supported	Similar
CIG -> BI	-0.157	-0.161	0.168	0.934	0.351	Unsupported	Not similar
FFA -> BI	0.04	0.032	0.13	0.308	0.758	Unsupported	Not similar
IQ -> BI	0.005	-0.002	0.136	0.037	0.971	Unsupported	Not similar
IS -> BI	0.134	0.115	0.133	1.006	0.315	Unsupported	Not similar
ISE -> BI	0.091	0.099	0.134	0.674	0.501	Unsupported	Not similar
ISU -> BI	-0.1	-0.091	0.165	0.604	0.546	Unsupported	Not similar
PBA -> BI	-0.166	-0.136	0.143	1.162	0.246	Unsupported	Not similar
PBEN -> BI	0.201	0.21	0.16	1.26	0.208	Unsupported	Not similar
PC -> BI	0.189	0.188	0.148	1.274	0.203	Unsupported	Not similar
PCM -> BI	0.004	0.009	0.123	0.033	0.974	Unsupported	Not similar
REP -> BI	0.275	0.232	0.156	1.762	0.079	Unsupported	Not similar
SEPP -> BI	-0.002	0.038	0.166	0.014	0.989	Unsupported	Not similar
TSM -> BI	0.027	0.06	0.161	0.168	0.867	Unsupported	Not similar
VISE -> BI	0.013	0.012	0.128	0.101	0.92	Unsupported	Not similar
VPS -> BI	-0.135	-0.141	0.151	0.898	0.37	Unsupported	Not similar

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

1.5 LESSON LEARNED (GUIDELINE) AND RECOMMENDATION

The finding indicated that IQ is not associated with BI. Active participation by government social media agencies should be encouraged so that it gives rise to more sufficient content of news and information for social media users on COVID-19 vaccination. A proper social media strategy should be crafted.

The study also indicated that there is no effect of TSM on BI. The finding is not surprising given that there is a rise of mistrust in government institutions over the last few years where the government's social media platforms were generally used to raise 'voice' and not positive feedback when everything was well (Arshad & Khurram, 2020). All government agencies should continue to make full use of their presence on social media platforms to alleviate this problem.

Likewise, the relationship between IS and BI is not supported in this study. Liang et al. (2011) stressed that users normally look for IS such as advice, knowledge and recommendation on social media websites when under health stress. A decision on how to facilitate the use of IS is critical in providing a supportive environment for social media platform providers.

There is strong support between CIG and BI in which higher trust in government leads to a high confidence level to accept vaccination. Additionally, VISE and CA are related to BI. This is surprising given that many public health measures around the world appear to have been politicised (Trent et al., 2022). The government in power should continue to use a spokesperson to convey the information and alleviate misinformation. Official guidelines from the MOH should also be published using different channels (e.g., traditional methods such as via television, radio, newspaper, etc) and social media.

Given that PCM influences BI, this means that Malaysians are dominated by other users' behaviours which will eventually lead to the formation of acceptance. The perception of PCM can be extended to the use of social media advertisement to strengthen the belief and lower the perception of risk. PC was found to be associated with BI. As 'MySejahtera' application is the only platform available to register for vaccination, many Malaysians are not concerned with privacy or information collected.

ISE is associated with BI. The result implied that the respondents are aware of the severity of COVID-19 infection, and this could have resulted from the news shared online and offline. This could be credited to the widespread coverage of news all over the world. VPS is associated with BI. This implies that Malaysians in general are concerned about the side effect of the COVID-19 vaccine and view themselves as susceptible to some undesirable vaccine-related negative effects. Government social media agencies should continue to provide information to provide more knowledge to the masses.

SEPP and BI were found to be related. Interestingly Malaysian belief that their personal action can help to reduce the threat of the COVID-19 virus. This could be credited to the 'MySejahtera' application which can provide real-time social distancing information (e.g., number of hot spots, information) and protective instruction messages (Zheng, Luo & Ritchie, 2022). FFA, ISU and REP were found to be unsupported with BI. Likewise, a decision on how to support the use of new and traditional mass media are important to

encourage BI. PBA and PBEN are associated with BI. The government should continue to provide more information related to the benefits of vaccination and try to reduce the barriers. For example, the government has arranged for the vaccination to be held at private clinics, and mega centres during office and non-office hours.

In terms of gender differences, there are no differences apart from the relationship between PBEN, VISE and VPS with BI using the permutation analysis. Finally, on ethic differences, it is interesting that different ethnics in Malaysia have other thoughts when accepting the vaccination. While this may be true, the uptake percentage went up subsequently in the following phases because of the high death rates. The study would like to be cautious that the differences in decisions were based on the first roll-out; therefore, future studies should include longitudinal studies to check on the differences. (Figure 1.17 summarises the recommendations).

Figure 1. 17 Infographic for Recommendations



1.6 LIMITATION

Like all research findings, this study has limitations. First, the study adopted a cross-sectional design to verify the proposed model. However, behaviour of consumers may change over time. Future studies may adopt longitudinal designs or experimental to test the casual assumptions of this model. Second, the study adopted specific constructs such as IQ, TSM, IS, CIG, PCM, PC, ISE, ISU, VISE, VPS, SEPP, REP, FFA, PBEN, PBBA, CA to study the BI to accept the vaccine whereas there are also other factors that may be influential in the acceptance of the COVID-19 vaccine. For example, vaccine, doctor to patient communication (Zheng, Jiang & Wu, 2022). Given the complexity of this study, future research can adopt additional variables and theories to better investigate the underlying mechanism leading to vaccination intention. Third, the study is collected from the viewpoint of an emerging country like Malaysia and thus may limit the generalizability of the findings. Future scholars could explore the intention to accept the COVID-19 vaccine by comparing other countries or other stages of the COVID-19 pandemic (e.g., post COVID-19). Finally, the study adopted a non-probability sampling in view of the missing sampling frame. While judgmental and quota sampling was used to ensure that the sample distribution (i.e., state of residence, gender, ethnicity, age groups) is in line with the national profile of the country, the sample can be generalized as a good representation of the population of Malaysia, the study may have sampling bias. Random sampling can be adopted to enhance the external validity of the findings for future studies.

1.7 SUMMARY

Low vaccination acceptance can pose a major huddle to achieving herd immunity and preventing the spread of COVID-19 infection in Malaysia. The study has shown that all the proposed hypotheses are supported apart from the relationship between FFA and BI, IQ and BI, IS and BI, ISU and BI, REP and BI, and TSM and BI. Like all major strategies, there is no single intervention that is likely to be effective and thus a combination of different approaches is important. In addition, effective marketing campaigns with sufficient information are important in alleviating the concerns of Malaysians and boosting public trust.



CASE 2

THRIVING FOR AGILITY AND RESILIENCE IN THE ROLL-OUT VACCINATION PROGRAMME OF COVID-19

2 THRIVING FOR AGILITY AND RESILIENCE IN THE ROLL-OUT VACCINATION PROGRAMME OF COVID-19

2.1 INTRODUCTION

The emergence of COVID-19 virus has been declared as a public health emergency worldwide by the World Health Organization (WHO). The virus has caused millions of deaths around the world as well as lasting health problems in some who have survived the illness. Countries around the world have accelerated the process of securing a vaccine as a resort to combat the pandemic. In managing the pandemic, countries explore and experiment various strategies, processes and protocols to ensure implementation, control and success toward population immunity. Each country thrived on different streaks of strategies and tactics based on the uniqueness of its institutional, cultural and geo-political lens. This study focuses on the Malaysian strategic and tactical plans of COVID-19 preparedness for the country. We focus on the processes and protocols in developing maximum immunity across Malaysia in the context of the vaccination programme. It is also important to understand the trajectory and challenges of capacity building across all stakeholders during the immunisation process. We address this crucial aspect as there is a need to understand how Malaysia develops and musters resources, skills, abilities and insights from its granular, pocket stakeholders during a crisis. In the final analysis, it is significant to document the strategic, tactical actions as well as capacity building before, during and after the PICK programme in order to enhance our national readiness in encountering future possible crises. In capturing such detail nuance through multiple lenses and trajectories would enrich our national resilience, agility and teamwork.

2.1.1 Research Objectives and Research Questions

The objectives of this study include the following:

- To develop an understanding of Malaysia's strategic and tactical plans of preparedness in addressing the COVID-19 pandemic throughout its different waves.
- To depict the project management, processes, protocols, and approaches in developing maximum population immunity across Malaysia in the context of the COVID-19 pandemic.
- To explore capacity building across all stakeholders/actors in Malaysia's ecosystem to address COVID-19 through PICK.

Subsequently, this study answers the following research questions:

- What are Malaysia's strategic and tactical plans of preparedness in addressing the COVID-19 pandemic throughout its different waves?
- How Malaysia canvass/depict the project management, processes, protocols, and approaches in developing maximum population immunity across Malaysia in the context of the COVID-19 pandemic?
- What type of capacity building has been implemented across all stakeholders/actors in Malaysia's ecosystem to address COVID-19 through PICK?

2.1.2 Significance of the Study

This study is significant to stakeholders and policy makers. First, stakeholders can learn from the effectiveness of Malaysia's primary care practitioners in delivering vaccine doses to the general population. The strategy adopted by the government in allocating financing, provision, distribution, and administration of vaccines, including strategy in encouraging COVID-19 vaccination to all populations should be taken as exemplary of crisis management strategy in any other context. Thus,stakeholders can adopt the similar tactics and strategy in managing the crisis at different levels of management.

Second, policy makers in the similar industry are able to understand the necessary actions to be taken in order to face future similar pandemics. The COVID-19 pandemic not only affects theeconomy, but also businesses and communities. Border closures, trade restrictions, physical and mental well-being of people worldwide are all affected and cause serious and negative implications. Therefore, policy makers can learn and understand the necessary actions to be taken should similarpandemics happen in the future.

Third, this study suggests that the specific style of leadership, such as adaptive leadership and independent thinking will prove to be decisive factors, important and necessary to excel in crisis management. Leaders and managers play an extremely important role during a crisis. Respondingto the challenges and preventing them from occurring in the future is one of the important agenda in crisis management. Therefore, specific types of leadership and management style is important in managing the crisis. This project provides on how important the role of a leader and the effective traits a leader should have is in dealing with a crisis.

2.1.3 Scope of the Study

This case contextually focuses on elucidating how Malaysia, as a nation develops its strategies, tactics and mechanism to ensure maximum population immunity to fight against COVID-19. Hence, it approaches the objectives of the study through the lens of decision makers as well as key stakeholders who were directly involved in the process of the vaccination programme, known as National Covid-19 Immunisation Programme (PICK). Due to such a focus, we applied qualitative methodology, predominantly using Interviews, document analysis (CITF minutes of meetings) and focus group discussion (FGD) sessions with selected 'elite' samples from the period of July to November 2022. The study adopted semi-structured interviews and FGD questions. The questionswere designed to address the three research objectives. In terms of location, the entire fieldwork activities focus on Kuala Lumpur and Putrajaya. The data were collected and transcribed. Content analysis technique was used to analyse the data and verbatim texts were applied in discussing the emergent themes. Data were analysed using qualitative data analysis software, NVivo.

2.1.4 The Organization of the Report

Case 2 has eight sections. Upon Introduction in the first section, the latter is a review of literature, offering a brief overview of how Malaysia and other countries perform immunisation programmes in facing the pandemic. The third section explains the

research design, followed by a presentation of the findings and discussion of the results in the fourth section. The fifth and sixth section describe the significant lesson learnt and recommendation from the study while the seventh section outlines the limitation. We conclude all aspects of the study in the eighth section.

2.2 LITERATURE REVIEW

In traversing issues of crisis management and preparedness, any events that lie outside fundamental patterns of routine expectations, as none in the past can convincingly point to its possibility and predictability yet have the capacity of generating extreme impacts are conceptualized as "*black swans"* (Taleb, 2007). The zoonotic virus of COVID-19 that inherently sprung within the nuances of regular seafood wet market at Huanan, Hubei China. Gralinski and Menachery (2020); Li et al. (2020) can be classified as a black swan event. Experts who are against such a perspective, purported that the major pandemic has been anticipated. In earlier platforms of discussions, quests and suggestions for improved strategic crisis and risk management systems, procedures and specific measures at the country level have been called for. Yet, the timing, impact, magnitude, and severity of the COVID-19 pandemic undoubtedly surprised many governments as the sudden virus sprang in the wake of other multiple contextual immediate issues within their settings. Hence, nations grappled with the effective and efficient model to survive and thrive over such a fatal virus, particularly during thefirst wave of COVID-19.

The ongoing global pandemic of coronavirus disease 2019 (COVID-19) had a negative impact on economic growth. According to Statista (2022) the world's collective gross domestic product (GDP) fell by 3.4 percent during the pandemic. In addition, global employment increased to 5.9% and global trade goods volume declined to -11.6% (Statista, 2022). The economic consequences of the COVID-19 pandemic call for urgent policy responses to support households and firms alike.

Different countries apply different strategic and tactical plans in addressing the COVID-19 pandemic.In the United States for instance, the Advisory Committee on Immunisation Practices (ACIP) consisting of a panel of specialists, was formed to provide directives regarding the use and administration of vaccines in the country (Amara et al., 2021). In India, the National Expert Group on Vaccine Administration for COVID-19 (NEGVAC) was developed to guide all aspects of COVID-19 vaccine administration in the country. This includes the strategy for quick and effective distributionof the COVID-19 vaccine (Kumar et al., 2021). New Zealand implemented a minimization and protection strategy to prevent the COVID-19 pandemic from spreading and achieve maximum population immunity (Blair et al., 2022). The minimization and protection strategy aims to keep the spread of COVID-19 as low as possible by identifying and treating the most at risk of severe disease/outcomes (New Zealand Government, 2022). On the other hand, specific countries, such as Thailand and Qatar, relied on a suppression strategy for pandemic control, using non- pharmaceutical interventions to reduce cases, hospital admissions, and deaths (Han et al., 2021).

Managing the outbreak is challenging. Policymakers have adopted various approaches to developing maximum population immunity. Among the approaches are vaccine supply chain management and prioritisation of specific target groups (Amara et al., 2021). A shortfall of vaccines due to failure of the vaccine supply chain management negatively

impacts the community. Australia, for example, is one country that ensures there are no cold chain breaches of vaccine supply (Bozorgi & Fahimnia, 2021). Other countries also developed and strategically planned their purchase schedule for vaccines and related medical products. A strategic approach was implemented by mobilising specific target groups by allocating COVID-19 vaccines based on a particular group of people. In the United States, priority was given to the number of people 18 years or older in the jurisdiction to the entire population (Amara et al., 2021). On the other hand, other countries used the oldest-first approach, whereby the vaccine is prioritised for individuals aged 60 years and above (Jentsch et al., 2021).

Various hurdles exist in achieving herd immunity, including community acceptance of the COVID-19 vaccine. Policymakers worldwide faced the slight issue of maximizing vaccine uptake while recognizing many communities' distrusts of government-led medical programmes (Mondal, 2021). Furthermore, it was documented that vaccine hesitancy was influenced by many sociodemographic factors such as race, gender, employment, and place of residence (Amara et al., 2021). In addition, other factors such as historical mistrust of healthcare, lower levels of awareness, pre-existing vaccine hesitancy, and politicization of COVID-19 also affect vaccine hesitancy among world populations. For instance, during a study conducted in Australia and the United States, only 59% of the adults were ready to receive a COVID-19 vaccine. The rest of the population, on the other hand, was in doubt due to potential vaccine side effects (Bertrand & Pereira, 2020; Chow et al., 2022).

According to Klotz (2022), leadership communication is an effective weapon to change the beliefs of unvaccinated citizens and overcome COVID-19 vaccination hesitancy. Studies have shown that in France, a televised speech by France's President has increased French citizens' willingness to vaccinate by roughly 5% (Klotz, 2022). In achieving maximum population immunity, factors including geography, demography, politics, and economics affect the effectiveness of the implementation plans (Duijzer et al., 2018; Mohamadi et al., 2021). For instance, being dispersed over vast geography poses acute challenges in vaccine distribution to Canada's population (Marchildon, 2021).

Project management, processes, and protocols must be strategically planned to combat a pandemic. High-level coordination at national, state and district levels were also crucial for effective cooperation and collaboration among the key departments involved in COVID-19 vaccination. In addition to that, capacity building across all stakeholders needs to be strengthened. Institutional development, financial and human resource development, and effective programmes should be employed and monitored. The capacity-building activities had to be tailored based on geographical location, infrastructure and resource centralization levels, and network access to other institutions (Ariza-Vioque et al., 2022). According to Ariza-Vioque et al., (2022) capacity-building initiatives cover various aspects, including mentorship from experienced countries or institutions, infrastructure renovation, equipment purchasing, developing standard operating procedures, reinforcing quality assurance and promoting staff training. Enhancing capacity building is crucial because it encourages the leadership of a country or an institution to evaluate their abilities to perform not only in addressing COVID-19 but also in future similar pandemics.

For Malaysia, the pandemic calls for a holistic and encompassing power to identify, implement and control the whole national ecosystem, particularly when the corona was evolutionary in the beginning and made a surprise turn of waves before the country ruled it as a pandemic. While epidemic and pandemic are not uncommon for Malaysia as it has experiences in handling strategic preparedness and management of the swine flu (H1N1) and avian flu (H5N1) outbreaks, COVID-19 push authorities to re-galvanize new strategies as the zoonotic virus mutated radical uncertainty in all spheres and sectors of practical life.

From a more critical angle in comparison with other nations, Malaysia has its unique nuances and contextual settings which makes any effort to imitate the strategies or framework of other nations may create a further dilemma. Each nation seems to encounter different phases of the pandemic upsurge and these instances precipitate further spectrums of heterogeneity in creating asynchronized or coordinated process of safety across nations and regions. In simpler words, what works in New Zealand or Finland might not be fitting in Malaysia when it comes to delineating the model, process flows, strategies, and tactics of handling the pandemic. One size fits a model that generalizes solutions in all aspects of weathering this pandemic storm may face a bottleneck because each context/country has its own dynamics in terms of the socio-political economy, technological innovations, culture, and institutional practices. While other countries relied specifically on the Ministry of Health (MOH) to address the pandemic, Malaysia took a different tweak in which a concerted effort across ministries, agencies, and also non-governmental associations systematically bottom-up with the Ministry of Science, Technology, and Innovation (MOSTI) helming the lead in managing the vaccine roll-out. A recent report by the World Health Organization (WHO, 2020) even commended Malaysia for its concerted effort to fight the pandemic. According to the report, Malaysia has made enormous progress in strengthening capacities in addressing health emergencies and disasters. Therefore, Malaysia's trajectory that veins from a step-by step strategy toward amalgamating health security, synchronized control and coordination mechanisms, a multisectoral and collaborative approach, and a robust national surveillance system need to be documented in order to foster insights for other nations.

Against such a background, decision-makers in Malaysia in an evolving manner build its architectural eco-system to set the importance and urgency in addressing COVID-19 based on the suitability and sustainability of its context and dynamism. Such an agile yet resilient framework of pandemic preparedness might later pave a new understanding and readiness to face future black swans in the form of an unexplored pandemic. Hence, it is timely that Case 2 explores and explains the processes that spiral across the various waves/turns of COVID-19 since February 2020. This case study stands as an insight as well as a reflection to effectively communicate the basis for assessment of accurate actions and predictions, development of technical competence and public trust as well as foresight for future necessary capital and personnel in facing another pandemic. A knowledge base in the form of a case study is a necessity. As we learn to address in advance any unpredictable high-impact events, yet low in frequency, we shall muster the readiness to create measures and thus dwarf any negative ultimate impacts from any *black swans.*

2.3 RESEARCH DESIGN

After an in-depth secondary search to understand the dynamic phenomenon of the pandemic, the researchers set for qualitative field work. Interviews with relevant decision makers, policy makers, and policy implementers in MOSTI and other related ministries was conducted. The Focus Group Discussion (FGD) was also conducted with relevant stakeholders to understand the process of capacity building in generating a resilient and agile eco-system that focuses on creating beyond- herd immunity through the roll-out vaccination programme. A qualitative approach is deemed effective in developing this case study as we aim to gain insights into "why" and "how" the strategies and processes are created and implemented. This methodology also enables researchers in discovering unique nuances of certain actors and actions that determine the projections of viable solutions for the country. Figure 2.1 depicts the overall approach of this study.

Figure 2. 1 The Study Approach

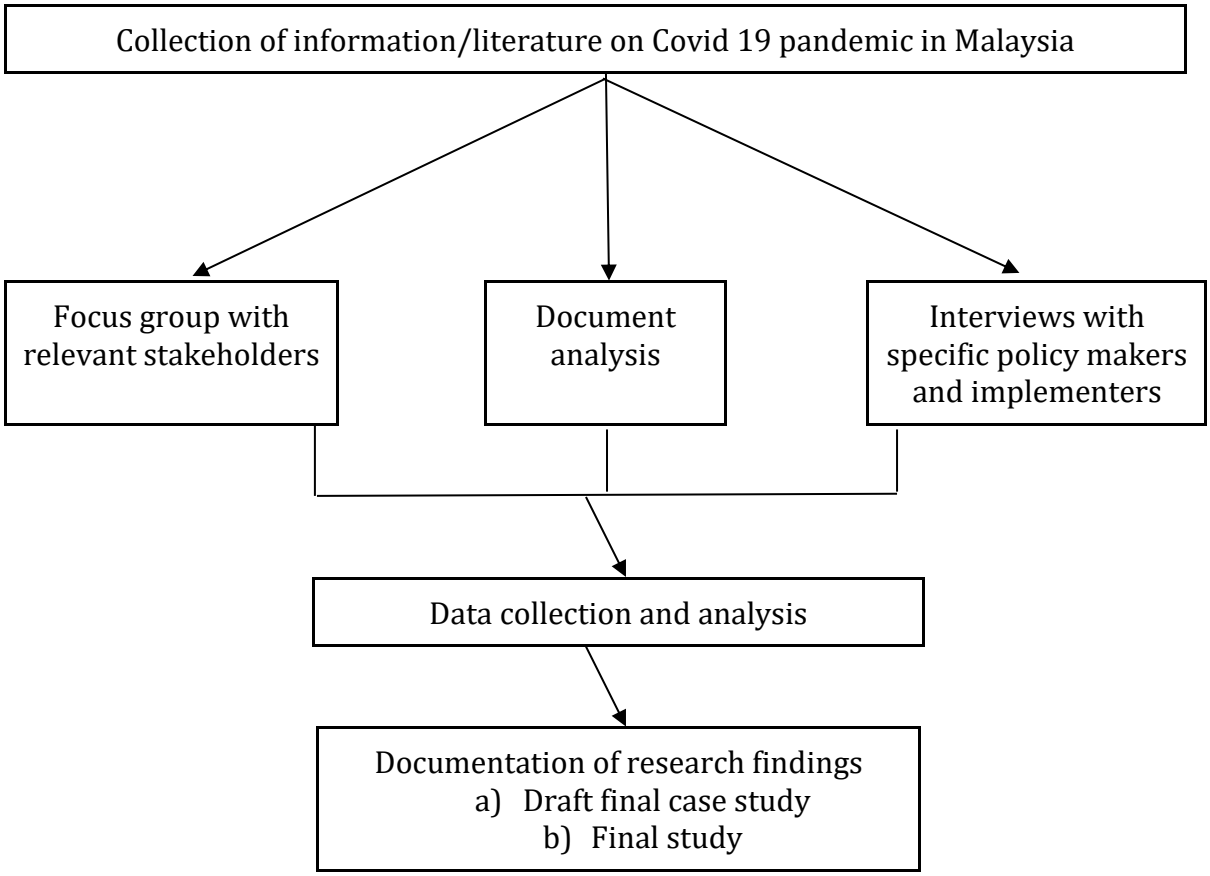


Table 2.1 depicts the information gathered for the qualitative approach and its utilisation. These information areas are in accordance with the study's research questions and research objectives.

Table 2.1 Key Information Areas and Usage of Information

Information Areas	Usage of Information
Strategic and tactical plans of preparedness in addressing the roll-out vaccination programme for COVID-19.	Understanding the approaches taken for a) The planning, monitoring, and intervention strategies and tactics in terms of technology usage, management, and communication for PICK throughput completion. Some specific scope to consider are: i. Organization ii. Coordination iii. Communication iv. Technology v. Logistics and scheduling vi. Execution and utilisation of resources in the form of PPV variations vii. Data management and analytics b) Understanding the supply and demand management of the vaccine, and the interventive scheduling to ensure throughput. The field work would include identifying factors contributing to the speed and successful completion of PICK at various localities (e.g., local residents' willingness, facilities availability, geographical locations, and management efficiency).
Project management, processes, protocols, and approaches during the roll-out vaccination programme	To understand the various deliberation process which relevant actors consider in identifying the ways to achieve effectiveness and efficiencies in the stages of planning, implementing, and controlling the PICK programme. This would also include exploring the purposes and rational behind each stage of the processes, protocols, and approaches.
Capacity building across all stakeholders/actors in Malaysia's ecosystem to enhance agility and resilience in the context of the COVID-19 pandemic.	To clarify and delineate functions, roles, responsibilities, and voluntarism of each actor in building the ecosystem that is bullet-proof resilient, and sustainable toward future waves of COVID-19, plus any similar pandemic.

2.3.1 Research Instrument

The interview and FGD instrument contained three guided questions. These questions aim to:

- Sought an understanding of Malaysia's strategic and tactical plans of preparedness in addressing the roll-out vaccination programme for COVID-19.
- Discover the project management, processes, protocols, and approaches in planning, implementing, and controlling the completion of the COVID-19 vaccination programme.
- Explore capacity building across all stakeholders/actors in Malaysia's ecosystem in addressing vaccination programme and future similar pandemics.

All these questions were open-ended in nature. They were designed to allow the interviewees and the participants to express themselves about what the study intended to find out in a relaxed manner. In anonymity, all the interviewees and the participants were assured that their information will only be used for the study and remain strictly confidential. After the interviewsand FGD session, the team listened to and transcribed the audio-recorded materials. Content analysis was used to analyse the data. The analysis consists of two different steps. Firstly, the process of comparing the interviewee's and FGD responses. Secondly, a sequentially followed by summarizing each question with each interviewee and respondent's points of view.

Appendix 2.1 describes the interview and FGD questions, which were used during the fieldwork activities. The key information areas identified earlier during the secondary desk research determine the areas and scope of the questions. We also set several probing questions in order to extract further in-depth information from the participants. For the interviews with the Secretary General (KSU), ministers, and special advisor, all three areas were asked. For the focus groups that involve Sections Head (i.e., Leader of all sections of CITF groups), only the third area was asked. The time indicated in Appendix 2.1 provides estimates for the questioning sessions.

2.3.2 Sampling

The study employed 'elite sampling' (McCluskey et al., 2010; Richards, 1996; Dexter, 2006). Elite sampling is a well-known sampling approach in studies that involve policies, and political and social sciences. Elite sampling shares some commonalities and differences with expert sampling (Littig, 2009). Elite samples can either have the expert know-why or know- how in the respective area. Whether the term 'elite' or 'expert' sampling frame is chosen depends on the aim of the research. In general, elite sampling is utilised when the samples possess certain characteristics, i.e., privileged status, significant decision-making power, difficult to access, part of a special personal network, and considerable tacit knowledge. The term 'elite' is probably more appropriate if the samples possess considerable interpretative power to decide the decision- making process in a particular situation. Based on the nature of this study, the term 'elite sampling' was used as it is believed to be more appropriate given the involvement of political power and privileged subtleties in the strategic decision-making and implementation of the COVID-19 vaccination programme in Malaysia. For this study, elite samples refer to individuals who occupy the highest senior management position, have decision-making power, assume influential status, and possess the know-how and know-

why behind the whole strategic direction of the CITF operation in Malaysia.

2.3.3 Data Collection

Despite challenges in rooting the elite participant interviewees, the Universiti Teknologi Malaysia (UTM) study team managed to conduct few interviews and a focus group discussion. The interviews were conducted between July to November 2022. The first interview was accomplished in early July with the former secretary general of MOSTI, Prof. Datuk Ir. Ts. Dr. Siti Hamisah Tapsir. This specific interview was meaningful as it provided a preliminary bird's eye view and reality of how the COVID-19 pandemic started, the emergence of strategies and tactical actions as well as the continuous improvement of the vaccination programme. This first interview also drove the researchers in gaining succeeding contacts for interviews based on snowball sampling of the elite participants. Nonetheless, it was not easy to gain a session with the elite participants due to their tight schedule. Toward the final week of the report submission, with the support of MOSTI, we achieved two significant interview sessions, namely with Mejar Jeneral Datuk Abdul Aziz Samsi and YB Khairy Jamaluddin.

The focus group discussion (FGD) was conducted on 14 September 2022. The purpose of the FGD is to gain an in-depth understanding of the issues under investigation. We selected group of individuals as a representative sample. Table 2.2 below depicts the schedule for interviews and focus group sessions:

Table 2.2 Elite Participants for Interviews and Focus Group Sessions

No	Data collection	Participant	Date
1.	Interview	Prof. Datuk Ir. Ts. Dr. Siti Hamisah Tapsir (SHT)	7 July 2022
2.		Mejar Jeneral Datuk Abdul Aziz bin Samsi@Hj. Shamsudin (AA)	17 Sept. 2022
3.		Dr. Muhammad Firdaus Ujang	13 Oct. 2022
4.		Puan Ruziah Shafei	21 Oct. 2022
5.		Mr. Khairy Jamaluddin Abu Bakar	1 Nov. 2022
6.	Focus group discussion	Dr. Nazrila Hairizan Nasir	14 Sept. 2022
7.		Puan Ruziah Shafei	
8.		Ts Mohd Amirul B. Ramlan	
9.		Dr. Maheshwara Rao A/L Appannan	
10.		Mr. Nik Adi Sukiman Nik Ahmad Fauzi	

Besides elite interviewing and focus group discussions, the team performed documents analysis. We went through all the Federal CITF minutes of meetings. There were 62 minutes of meetings and we assessed the documents in accordance with the objectives of

the study. We went through all the documents electronically. The documents were reviewed and evaluated accordingly, without any interventions from the researchers. In totality, the document analysis which we gained from the CITF minutes of meeting as well as the focus group session complemented the data which was concurrently built through the in-depth interviews. The triadic approach of qualitative data collection supported our process to achieve optimal theoretical saturation. As we triangulated data from all the four sources (including the review of literature), we achieved requisite and relevant information for the next process, which was analysis.

2.3.4 Data Analysis

Data analysis for this field work employs the process of exploring and analysing the views, perspectives, perceptions, and experiences of the senior officials who are involved in COVID-19 Immunisation Task Force (CITF). The meaning (i.e., subjective meaning) from the interviewees and FGD is diverse and numerous. This entails researchers observing the complexity of views rather than constricting meanings into a few categories or ideas.

In this project, thematic analysis using Qualitative Data Analysis Software- NVivo was utilised in assisting researchers to analyse the data. NVivo is computer software and another software to be used is Computer Assisted Qualitative Data Analysis Software (CAQDAS) available for analysing qualitative data. Analysis of qualitative data with CAQDAS will still involve the intellectual task of the researchers because the software itself could not function on its own unless instructed (Hwang, 2008; Konopasek, 2008).

Basically, the transcribed interviews and the memos on thoughts developed throughout the elite interviewing process served as the documents. These documents have to be assigned in a single platform known as the 'Project'. After the documents have been assigned to the project, the next step is to extract segments of the documents into pieces of information, known as 'quotation', whichwere deemed important and relevant to the topic under investigation. In NVivo, the process to extract segments (i.e., quotations) is called coding. This project employed inductive coding (i.e.,open coding) where it started from scratch and created codes based on the qualitative data itself.All codes arose directly from the participants' responses. Furthermore, in NVivo, the researcher would be able to extract all the codes (i.e., categories or themes) with all the quotations assigned to each code. Also, the quotations are linked to assigned memos and comments. In addition, NVivo could process the codes to produce other output such as mind maps, matrix coding query, word query (i.e., Word Cloud), and output using visualization tools. Also, the data analysis process is continued by advancing the descriptions and themes in the form of narrative passages and interpreting and giving meaning to the data manually.

Any biases in reporting the results from qualitative interviews was eliminated. The reporting was controlled by standardizing the stimulus (i.e., probing phrase). In this case, any variations seen in the responses will be a true measure, rather than an object of personal methods (Mason 2002, 2017). The interview session needs to be done with an understanding of the complexities of social interactions and not merely just performing the interview (Mason, 1996).

2.4 FINDINGS

2.4.1 Research Objective 1

To develop an understanding of Malaysia's strategic and tactical plans of preparedness in addressing the COVID-19 pandemic throughout its different waves.

Results from the interviews and focus group clearly indicated that both strategy and tactics during the PICK programme were **emergent and agile** in nature. The creation and establishment of Standard Operating Procedures, processes and related systems arose early during the first phase of pandemic. Nonetheless, these mechanisms were continuously revisited, reviewed, tweaked and adjusted according to changes in scenarios as well as expansion of stakeholders' involvement. The dynamics of the PICK programme lies in the openness of the upper echelon leadership of the countryto allow a bottom-up approach in strategy formulation, implementation as well as control of the whole scenario.

Research findings of Case 2 vividly confirmed that Malaysia's way of addressing the COVID-19 pandemic can be drawn into different stages. Each stage was thrived using different strategies and tactics which were defined by evidence-based management, audacious decision making and strategic pivoting.

Based on the principle of thematic analysis, we differentiate the different phases of the pandemic and the emergent strategies orchestrated within each singular phase into five (5) waves, namely:

Wave 1: *Drought and darkness;*
Wave 2: *Vaccine drops;*
Wave 3: *Vaccine flood;*
Wave 4: *Rainbow; and*
Wave 5: *Green growth.*

We map Malaysia's strategic and tactical plans of preparedness in addressing the pandemic across these five (5) waves and relate them to the specific 5 phases of the national immunisation programme. The 5 phases of the immunisation programme of the country are:

Phase 1: Healthcare workers and frontlines
Phase 2: High-risk groups
Phase 3: Adult citizens aged 18 years old and above
Phase 4: Workers in critical industries
Phase 5: Adolescents aged 12 to 17 years old

Phase 1 and 2 were carried out during the *Vaccine Drops* wave; while Phase 3 and 4 were leveraged in Wave 3 (*Vaccine Flood*) and 4 (*Rainbow)*; and lastly, Phase 5 was implemented during the *Green Growth* wave. Along with the national immunisation roll-out journey across various waves, numerous unexpected issues have emerged and posed new challenges to the programme implementation.. From both the interviews and focus group session, we posit that significant leadership qualities that focus on agility and

resilience, visionary, empowerment, strategic management, integrity and governance, self-motivation, communication, negotiation, problem-solving, decision-making, active listening, critical thinking and stress management to be among the important factors in ensuring the programme is successful.

2.4.1.1 Wave 1: Drought and Darkness

This wave featured the onset of the pandemic. Infrastructure constraint has been chaotic to the government in coping with the COVID-19 pandemic at this wave. For instance, there were challenges in adopting new technologies to facilitate the coordination between managing the pandemic and limited capacity in performing COVID-19 testing. The testing capacity of the MOH at that juncture was approximately 200 to 300 tests per day. The Ministry of Science, Technology and Innovation (MOSTI) detected this issue, and stood up to support MOH in expanding the testing capacity. This was confirmed by Prof. Datuk Ir. Ts. Dr. Siti Hamisah Tapsir in the interview session. As a result of the joint effort by multiple key stakeholders, our country has successfully enhanced its testing capability significantly. Benchmarked on the best practice by South Korea, MOSTI obtained between RM8 million to RM9 million from the Malaysian National Security Council (Majlis Keselamatan Negara Malaysia or MKN) in setting up a booth whereby people can perform mobile testing.

During the *Drought and Darkness* wave, there was no vaccine available for the COVID-19. Nevertheless, MOSTI continued to approach various experts and even reached out to the Centre for Policy Research (CEPR). At the same time, there were various voices, opinions and concerns on the country's journey in procuring vaccination, but no consensus was reached until the former Prime Minister Tan Sri Muhyiddin Yassin assumed the leadership role. In fact, there was no vaccine being tested at that point of time, although CEPR introduced the vaccines pillar of the Access to COVID-19 Tools (ACT) Accelerator (COVAX), which is co-led by the Coalition for Epidemic PreparednessInnovations (CEPI) and the World Health Organization (WHO). Tan Sri Muhyiddin Yassin then requested MOSTI to work with MOH, whereby MOSTI was tasked on vaccine preparation,access and procurement, while MOH handles healthcare related issues given the increasing death cases.

The initial vaccine negotiation by MOSTI was represented by Prof. Datuk Ir. Ts. Dr. Siti Hamisah Tapsir, and later replaced by its minister, YB Khairy Jamaluddin in the subsequent negotiations which became more complex. Concerns over the vaccine price was brought up, in which a developing country like Malaysia was charged the same as a developed country. The vaccine procurement process involved complicated conditions and considerations, whereby a committed country was required to commence payment obligations during the vaccine's development and testing stages with no guarantee these vaccines will work. However, the government agreed to proceed with the terms and would consider such a payment as a donation from Malaysia towards the research of vaccines if such an undesirable situation happened. Meanwhile, the anti-vax group emerged during the national vaccination roll-out programme. Through the strategic and tactical plans rolled out in this wave, it reflected remarkable leadership qualities as project management, agility and resilience, active listening, decision-making, empowerment, and visionary in managing a crisis at the national level.

2.4.1.2 Wave 2: Vaccine Drops

Under a joint effort of the MOH and the Special Committee for Ensuring Access to COVID-19 VaccineSupply (JKJAV), a national vaccination programme titled National COVID-19 Immunisation Programme (NIP) (*Program Imunisasi COVID-19 Kebangsaan or PICK*), which was co-led by Khairy Jamaluddin and Dato' Sri Dr. Adham Baba (the former minister of MOH), was launched on 24 February 2021 as a mechanism to curb the spread of COVID-19. Khairy Jamaluddin was appointed as the coordinating minister for the PICK, whereby approximately 200 to 300 people were involved in the COVID-19 Immunisation Task Force (CITF) meetings.



Source : Berita Harian (2021)

The Formation of CITF

In preparation for the nationwide COVID-19 roll-out programme (PICK) in Malaysia, the CITF was established on 20 January 2021. The key rationale of developing the CITF was that careful and structured planning and coordination were required to ensure a smooth implementation of PICK that involved managing a large and complex supply chain as well as capacity building.

The CITF targeted to achieve three (3) objectives:

- To deal with the COVID-19 pandemic through a country-wide immunisation roll-out programme to the entire community;
- To accelerate the country's economy recovery; and
- To coordinate and provide support services to PICK at the federal and state level.

In addition, the CITF also played key roles which included a) monitoring the

implementation of PICK; b) coordinating strategy and action implementation between the federal, states and private agencies; c) mobilising the government staff and volunteers to handle facilities and vaccination centres (*Pusat Pemberian Vaksin,* PPV); and d) monitoring and coordinating the effectiveness of PICK via geo-data analysis adoption. One of the strategies proposed by the Deputy Director-General of Health (Public Health), Dato, Dr. Chong Chee Kheong was performing daily reporting on the Project Management Team (PMT). In addition, PICK's task was to ensure seamless progress. Figure 2.2 depicts the structure and governance of JKJAV and CITF. The diagram shows that both JKJAVand CITF constitute players from various institutions and backgrounds. Through our observationin attending the online CITF meetings, we identified the camaraderie and dynamic environment among members of the meetings despite their different organizational and political settings. There was a high sense of top management's aspiration (both ministers of MOH and MOSTI) in ensuring the goal to achieve a successful roll-out of the vaccination process in the country happened within the specified duration planned.

Since the formation of CITF, effective interdepartmental/institutional communication and coordination at multiple levels had been critically important in facilitating the strategic and tactical plans developed and implemented in supporting the PICK. During the second meeting of the CITF, the Chairman had instructed MOH to coordinate the programme implementation with states, while he would actively participate in meetings with the chief ministers. In the meantime, the Malaysian National Security Council took care of the facilities management. On the other hand, the vaccine safety and security were the responsibility of Vaccine Storage Centre (*Pusat Penyimpanan Vaksin, PSV*), of which bulk vaccines were stored in the premises of Pharmaniaga.

Eventually, Puan Ruziah Shafei steered CITF's operations as the Chief Secretariat. This secretariat managed and allocated funds received from the Ministry of Finance (MOF) for operational expenses, human management and building infrastructure. Thereafter, various agencies comprising PETRONAS, Bank Negara Malaysia (BNM), MIMOS Berhad, and PricewaterhouseCoopers (PwC) also leveraged on their respective areas of expertise to provide operational support to CITF and PICK. For instance, PETRONAS and PwC supported the project management while BNM sent experts with IT capabilities. In relation to project management, PwC acted as the sounding board for CITF, and provided insights on vaccine supply management and projection, vaccination's Standard Operating Procedures (SOPs), assurance and risk mitigation. Additionally, PwC also suggested the establishment of a Project Management Office (PMO) to coordinate and report the progress of PICK under the collaboration with PICK. PwC helped CITF to manage themselves quite well under such circumstances and contributed vastly in the formulation of strategic and tactical plans.

Emphasis has also been placed on data driven decision making. Professor Dr. Chan Chee Seng from Universiti Malaya was seconded to MOSTI as the Undersecretary for the *Bahagian Data Strategik & Foresight Teknologi,* and he led the Unit 4 of CITF on data tracking. Professor Dr. Chan rendered his expertise in big data analytics, and CITF had also adopted it subsequently. CITF also developed a dashboard with the big data obtained, though people were sceptical about it at the initial stage. In realising an effective management on the vaccines, the Vaccine Management System (VMS) system was set-up, whereby the VMS dashboard system displayed the real time monitoring on vaccine

acceptance and distribution at every Vaccine Storage Centre and the Vaccination Centres. In addition, risk assessment on the PICK was performed by mapping high impact and likelihood areas in the Heatmap of COVID-19 cases in Malaysia, whereby the data provided played a critical role in effective decision making of the CITF.

In relation to big data, databases have been another key focus of the CITF in the vaccination roll-out programme. A mobile application named MySejahtera was developed to facilitate contact tracing efforts in response to the COVID-19 pandemic in Malaysia. The Unit 0, which was Appointment and Analytics, was entrusted to manage the MySejahtera app, with core roles including plan appointments, strategy, supply, demand and data. In other words, Unit 0 served as the front facing people in the CITF. The team's strategies in supporting the top management's aspiration were a) ensuring there was a spokesperson during the weekly CITF meeting; b) practicing high level of transparency on actual scenario of the pandemic; c) to be resilient in supporting the leaders' goals; and d) effective stress and expectation management. During the two and a half year, MySejahtera had 53 mobile builds and more than 500 backend builds. Dr. Maheshwara Rao Appannan credited the contribution to the good developer and vendor who could manage the application and therefore they did not face major technology problems. He added the importance of having an appropriate and well communicated aspiration, to enable stakeholders working collaboratively in achieving the shared vision.

The first batch of vaccine was ready by February 2021, after completing days of testing upon its arrival. At this stage, the general public was doubtful and cynical on the effectiveness of the vaccine. To build public's trust and confidence, the country leaders volunteered to be the pioneers in the country to be injected with the COVID-19 vaccine. For example, a lead-by-example strategy was engaged, whereby Tan Sri Muhyiddin Yassin, the Prime Minister during that time, received the first vaccine in a live broadcast.



Source : New Straits Times (2021)

National Vaccination Roll-Out Programme (PICK)



Source : Reuters (2021)

Malaysia kickstarts its COVID-19 vaccination campaign with the administration of the first shot to Tan Sri Muhyiddin Yassin, the 8th Prime Minister

Additionally, the Division of Pharmacy Enforcement *(Bahagian Penguatkuasaan Farmasi*) supported CITF by managing the pharmaceutical related products that reached the country. CITF worked closely with MOH on the vaccine logistics and facilities as the first batch of Pfizer needed to be kept at -80 degree Celsius. This collaboration was successful as everyone was certain of the main objective. Meanwhile, CITF needed committed and proactive volunteers as they were required to be at the vaccination centre at 7:00am in the morning and there were instances their days only ended at 2.30am the following day due to attending meetings. The Division of Public Service (*Jabatan Perkhidmatan Awam*, JPA) furnished almost 700 volunteers. With that collaborative strength, the CITF managed to set up the logistics part from scratch within a tight time frame.

In terms of the location identification, the CITF liaised with the National Registration Department (*Jabatan Pendaftaran Negara,* JPN) and Google to check population density of the area. However, additional efforts were pursued to avoid data discrepancy. For example, field visits to Sabah to estimate the population density was challenging as the sea nomads living in houseboats (*Rumah Atas Air*) were moving constantly. Hence, weekly CITF meetings were carried out every Tuesday to engage and facilitate the communication among several ministries and key stakeholders.

Furthermore, integrity and governance are crucial when it's related to public fund usage, whereby the CITF minimised some of the basic reserves in order to lower down the costs, as some places provided free basic infrastructure such as electricity supply for the vaccination location. *"I understand that no matter how urgent things are, compliance and*

integrity cannot be compromised", said Prof. Datuk Ir. Ts. Dr. Siti Hamisah Tapsir. She sent out an important message in making sure each vaccination centre practiced transparent management and compliance with all SOPs. Such major concerns were proactive preparation for independent audit by the National Audit Department Malaysia (*Jabatan Audit Negara*).

Important issues such as funding, reports on the vaccine profile, as well as reports by experts to move forward with the notion to vaccinate firstly the children or elderly were discussed in the CITF meeting with MOH. In relation to the herd immunity matter, the initial view was 80% threshold. However, experts disagreed and opined that it needed to be 100%. During the pandemic peak, CITF with the support of a communication expert, designed the *COVID-19 brochures* with the aim to educate the public. In response to the low vaccination registration at Phase 2 and 3, *media promotion* has been deemed as another key strategy implemented to promote the PICK with the ultimate aim of ensuring increased vaccination among the community. *Social media marketing* is key in giving the right information to the right audience effectively. In this regard, the communication team utilised various social media platforms to publish media statements by the government. They also developed and integrated various effective promotional tools such as social media infographics, videos and public service announcements (PSAs) to promote public information awareness, absorption and sharing. In addition, the Strategic Planning and Corporate Communication (StratComms) team has also been empowered to review the strategy to increase the registration for vaccination.

The military and police played an important role in the national vaccination roll-out programme from the logistics perspective. They were deployed as escort riders to safeguard these valuable vaccines during this wave. The presence of the military and police had been an extra force to the CITF when it came to crowd management in the vaccine centre. For example, during the first day of vaccination day at the World Trade Centre Kuala Lumpur (formerly known as Putra World Trade Centre or PWTC), a huge number of people turned up for the vaccines and they were not following instructions from the crowd control team. The presence of the military and police in uniform had been an important mechanism in delivering unspoken messages of compliance with all rules to the crowd. In addition, non-governmental organisations (NGOs) such as the Malaysian Red Crescent Society (*Persatuan Bulan Sabit Merah*) and Communication for Behavioural Impact (COMBI), National Disaster Management Agency (NADMA), private sector players like Bank Rakyat, Bank Simpanan Nasional, government-linked companies comprising Tabung Haji and Permodalan Nasional Berhad (PNB) had made notable contributions to the PICK in various aspects. All these showed the significance of having the expertise in all areas when tackling a mega crisis.

Special attention was given to the on-the-job training, strategic management as well as agility and resilience. The country was racing against time and had to make quick decisions. CITF learnt along the way, like on crowd management, they set up military management in the vaccine centre at Kuala Lumpur Convention Centre and the need to appoint at least one floor manager for each vaccination centre. Every vaccination centre must also have a leader from healthcare and supported by military staff as the floor manager. Says the case of Bukit Jalil Stadium PPV that received an influx of foreigners who do not speak *Bahasa Malaysia*, and therefore faced a significant language barrier and posed huge communication problems that led to chaos at the queuing area. These

secondary vaccination centres were established to ease the burden of government health clinics; as well as the one-dose-one-reserve method was amended to rolling method since the vaccine supply of Pfizer has increased as scheduled. Also, take an example of logistics from Sabah and Sarawak, when there was no plane at that time flying to East Malaysia due to the Movement Control Order. Therefore, the military planes were utilised to go to Sabah and Sarawak.

At the state level, leadership and commitment from the respective leaders demonstrated significant correlation with the progression of the vaccination roll-out programme. Committed leaders such as the State Minister of Health Sarawak who always attended the weekly meeting, and this contributed to the Sarawak state efficiency in managing the issue of the increased COVID-19 positive cases. Indeed, a synergy with the federal governments and nine (9) states had been created beyond political agenda. After a meeting with the Prime Minister, a ramp up programme was rolled out in that area in May, whereby people from different parties worked together. Next, looking further into diplomatic relationships at the international level, the CITF's strategy included calling up all embassies for possibilities of vaccine donations whenever there was a depletion of vaccine stockpile. In this regard, the country received vaccine donations from Japan (one million doses of Pfizer), China (500,000 doses of Sinovac) and Singapore (20,000 doses of Sinovac). There were some counties that indicated their intention to donate only in 2022.

Resulting from the joint-cooperation between the country with China, Malaysia received the first batch of Sinovac vaccines on 27 February 2021. In supporting this, Pharmaniaga Berhad, Malaysia's leading pharmaceutical company, signed a partnership agreement with Sinovac in January 2021 in supplying 12 million doses of the Sinovac COVID-19 Fill and Finish vaccines to the country, whereby this contract obliged the company to supply the vaccines within seven (7) months from May to November 2021. (Pharmaniaga Berhad, 2021). However, Pharmaniaga Berhad managed to complete the vaccine delivery 4.5 months ahead of the initial contract schedule. At Phase 1 of the PICK, the country has received around 1 million doses of the Pfizer vaccine and 200,000 doses of the Sinovac vaccine. Both vaccines reported high efficacy rate. Sinovac vaccines were mainly utilised during Phase 2 as the first focus PICK was senior citizens and as well as the high-risk groups. It is a strategy to curb mortality rate. During the Dark and Drought period, 80 percent of the COVID-19 mortality in the country were senior citizens. The implementation of Phase 2 involved the participation from health and non-health premises, private clinics and hospitals, whereby they synergised the timetable for the distribution of Sinovac vaccines, vaccine administration, as well as the operations of PPV.

2.4.1.3 Wave 3: Vaccine Flood

During the *Vaccine Flood* stage, General Practitioners (GPs) clinics were identified as private vaccination centres beginning 4th May 2021, while private hospitals came into play effective June 2021. This was the strategy to accelerate the vaccination capacity. In addition, though there were some initial unfavourable public's perceptions on the effectiveness and uncertainties of the AstraZeneca vaccine, there were overwhelming responses in the voluntary opt-in vaccination mechanism by urban citizens in Kuala Lumpur and Selangor. As suggested by the Major General, Dato' Abdul Aziz bin Samsi, this initiative was subsequently expanded to states outside the Klang Valley such as Johor and

Pulau Pinang which also received encouraging take-up rate. The registered citizens were successfully inoculated with the AstraZeneca vaccine.

In addition, the government also introduced the Operation Surge Capacity, which added a new challenge to the implementation of Phase 3, whereby this initiative aimed to ensure every adult resident in the Klang Valley area will receive their first dose of vaccine by 1st August 2021 with an expected utilisation rate of 93% in October 2021. In order to realise this objective, the government had increased the capacity and vaccine supply throughout Kuala Lumpur and Selangor. YB Khairy Jamaluddin also made special remarks on 'adult residents', whereby it included those who live in Kuala Lumpur and Selangor but are not accounted for by the Department of Statistics Malaysia. He also added that after the completion of the Operation Surge Capacity, all vaccination centres in the Klang Valley will allow 'walk-in' for anyone who has not received the first dose, including undocumented migrants and those without any valid supporting documents.

Amongst the efforts in enhancing the vaccination capacity to the rural areas, outreach vaccination service has been introduced with the support of a mobile outreach team which involved MOH, Department of *Orang Asli* Development (*Jabatan Kemajuan Orang Asli,* JAKOA), as well as NGOs. In addition, the industry vaccination centre had also started its operations at the Putrajaya International Convention Centre on 7 July 2022 to support factory workers in the Klang Valley area. This was designed to support the Phase 4 vaccination programme, which gave specific attention to the workers in critical industries such as food, manufacturing, construction, retail, plantation and hospitality.

On top of that, a joint-effort initiative that promotes the collaboration between the public and private sectors titled the *Program Imunisasi Industry COVID-19 Kerjasama Awam-Swasta* (PIKAS) was launched on 16 June 2021. PIKAS was carried out with on-site vaccinations at designated factories and industrial locations. Priority was given to enterprises in important manufacturing sub-sectors such as food processing, electrical and electronics, medical devices, iron and steel, oil and gas, personal protective equipment and rubber products, which are critical sectors in supporting the supply chain of essential products and services. As continued effort and commitment in combating the pandemic, the government has also increased the budget allocation on vaccine purchases from surge capacity 120% to 130% that was worth RM400 million, in which RM150 million was used to support the PIKAS.

There were special highlights on the vaccine supply. About half of the 16 million doses of the Sinovac vaccine had been distributed and the rest to be used to cover the second doses. MOH announced on 15 July 2022 that the country will stop administering the Sinovac vaccine once its supplies end. Pharmaniaga has fully delivered all its contractual supply of vaccines to the federal government. With this regard, the Pfizer vaccine anchored the country's inoculation drive. The government has secured about 45 million doses of this vaccine to cover 70 percent of its population (The Diplomat, 2021). Nevertheless, the central administration had agreed to continue the use of the Sinovac vaccine in supporting the state-run and private inoculation programmes.

Tactical communication had also been carried out to combat the fake news in relation to the PICK and vaccines. For this, PICK collaborated with the Malaysian Communications and Multimedia Commission (MCMC). Strategies had also been developed to address

legal issues raised regarding the newly added features for MySejahtera in addressing queries related to vaccination needs for pregnant ladies, appointment cancellation features or hotline for cancellation, spreading fake news in media, virtual card as vaccination evidence, and vaccination consent form.

Though the number of vaccinations has increased, the vaccination rate remained low. As a result, MOH has mandated the CITF to enhance coordination on vaccine allocation and distribution for a more effective arrangement. Apart from that, a new strategy on seven (7) days working week vaccination centres' operations had also been introduced to optimise the vaccination exercise and reduce the stockpile at the vaccine storage centre. Another strategy implemented by the CITF in pushing the vaccination programme was the deadline adjustment based on its vaccination capacity.

Next, emphasis was also given on 'breaking the differences', whereby Khairy Jamaluddin had also ensured a close cooperation between the federal and state governments by appointing the Member of Parliament for Bangi, Ong Kian Ming as the Coordinator for the Selangor state government, whereby people are working together regardless of political party. This value was also relatable when it came to vaccination for foreign workers, who have helped to build the country as well as refugees. Though there were concerns raised on this aspect, CITF always believed in achieving the common cause and there are leaders who understand human rights and have faith that they are doing the right thing.

2.4.1.4 Wave 4: Rainbow

The government's strategic move in improving and strengthening the vaccination capacity to the mass community (including laggards such as the anti-vax group) has been effective and productive, which was reflected in the figures on number of COVID-19 cases as well as ICU bed utilisation. Grounded by strong statement of getting 80% of the population to be vaccinated by February 2022 and supported by an effective strategy to vaccinate the population within different phases, the PICK programme hit the target 5 months prior to the deadline. This success canvasses the strong and committed team of stakeholders as well as data management on geographical population and demographic patterns.

Along with the positive and motivating progress shown in the PICK, a National Recovery Plan (NRP)was also announced by the Prime Minister. It was a comprehensive policy to guide the country in moving out from the COVID-19 pandemic, with specific efforts concentrated on the public health service and reopening the social and economic sectors. Malaysia made timely and consistent adjustments based on the indicators related to the threshold value in moving to the recovery phase. NRP has also been a successful mechanism in accelerating the PICK. To illustrate, RM300 incentive was given to the vulnerable groups to cover their freight cost in taking a taxi or e-hailing service. Moreover, states that have reached 3 threshold values as stipulated in the NRP were allowed to evolve into the next recovery phase stipulated in the NRP. To further elaborate, Perlis, Perak, Kelantan, Terengganu and Pahang successfully moved to the second phase of NRP on 5 July 2021. These states had met the threshold values set as well as recorded above 10% of complete vaccination and a satisfactory ICU bed capacity. Another best practice was associated with the announcement of inter-state travel for those who have completed two (2) doses of the vaccine, which had significantly increased

the surge in demand for the second dose of vaccine. For better management and monitoring of people mobility based on the vaccination status, system integration was performed on MySejahtera and SelVax (a vaccination system available for the Selangor community) to make sure that only one standardized digital vaccination certificate is issued upon the completion of 2 vaccine doses.

Likewise, with the aim of strengthening the mobile outreach programme in speeding up the PICK, the Federal CITF also entrusted the state CITF to decide on the geographical area coverage and target vaccine recipients through this programme. Another remarkable strategic plan along the PICK was on the booster or the third dose roll-out, in response to the data presented in internationalreports that have proved the effectiveness of the third dose in increasing the antibody rate and serving as an additional protection to the vaccine recipients, as proposed by JKJAV.



Source : The Edge Market (2021)

COVID-19 Vaccine Booster or Third-Dose Roll-Out

2.4.1.5 Wave 5: Green Growth

Moving forward to the *Green Growth* wave, the implementation of the vaccination programme for the adolescents (age group between 12 to 17 years old) has received wide attention from the public. This phase of the immunisation programme first focuses on adolescents with chronic disease and higher risk of being infected with the COVID-19 virus. Subsequently, the COVID-19 Immunisation Task Force-Adolescent (CITF-A) was formed on 15th September 2021 under MOH, with a clear target of achieving full vaccination for 80% of Malaysians in this group, before the reopening of schools (The Edge Market, 2021). CITF-A was tasked to oversee the National COVID-19 Immunisation

Programme for Adolescent (PICK Adolescent), an initiative on scheduled walk-in process that covered students in the public and private education, adolescents in the protection and rehabilitation programmes, as well as the homeless, refugees and non-citizen groups in Malaysia.

In addition, various discussion and strategies have also been carried out to fasten the vaccination process and its coverage. With this, the government has decided to allow vaccine purchases by the private sector and state governments, whereby MOH revised the guidelines of the Grant Implementation Policy (*Polisi Pelaksanaan Pemberian)*. Besides, it also involved utilisation of second dose storage at the state level, reviewed the scheduling of second dose, as well as revisit the strategy in vaccinating the group who has not registered for vaccine. The coverage of the mobile vaccination centre initiative has also been expanded to the community at the People HousingProjects (*Projek Perumahan Rakyat*, PPR). Aside from that, CITF strengthened its communication strategy, which was performing media hype to remind the general public for the second dose of vaccine as well as carried out aggressive communication that target the anti-vaccination group with the utilisation of emotive elements such as the death case of a popular singer named Siti Sarah Raisuddin. On top of that, live agent function via WhatsApp has been activated under the service rendered by TM One to facilitate the public's enquiry on vaccination matters. The Helpdesk feature of the MySejahtera has also been strengthened with the digital certification related queries.

Another prime strategy in this wave was the adoption of the **Whole-of-Government approach** that aims in promoting the collaboration between the federal and state CITFs, ministries and government agencies, state governments, NGOs, the private sectors as well as the community to ensure the PICK achieves its target by October 2021. Several strategies have been designed and implemented, whereby this effort comprised of:

a) Kelantan, Terengganu, Pahang and Johor must expedite the vaccination progress to avoid the monsoon season;
b) the state CITF must ensure that adequate vaccine supply allocations are given to the industry vaccination centres under the PIKAS;
c) prioritisation in Sabah to vaccinate its citizens, while industry parties such as plantation companies that employed non-citizen employees were required to make their own vaccine purchases.

The MOH has also directed the National Pharmaceutical Regulatory Agency (NPRA) and MySejahtera team to release data on adverse events following immunisation (AEFIs) into the GitHub portal. NPRA was committed to ensuring the safety of COVID-19 vaccines through a closed monitoring on AEFI cases. Besides, the TRIS (Test, Report, Isolate, Seek) strategy has been developed, and subsequently the National COVID-19 Testing Strategy was also released as part of the TRIS protocol with the objective to assist in the implementation of contact tracing system that will be developed, which will help in the reopening of economic sectors and transition to the endemic. The National COVID-19 Testing Strategy outlines the testing requirements activities related to workplace, education sector, mass gathering, targeted groups and inbound travellers.

Apart from that, grounded by a sustainable long-term vision in relation to the country's independent capability and capacity in vaccine development, JKJAV has approved the establishment of the Malaysia Genome and Vaccine Institute (MGVI). MGVI will focus on

research and development of Malaysia as a vaccine producer and enhance local capacity to perform research discovery on vaccines as well as the country's ability to conduct pre-clinical studies.



Source : Utusan Malaysia.

Vaccine Capacity Development

This wave also witnessed an extraordinary landmark on the national vaccination roll-out programme, where CITF officially handed over its duties to MOH by the end of October 2021, and the programme on adolescent's booster will be handled by MOH. As such, the weekly CITF meeting was co-chaired by the Minister of Health from 1st September 2021. In coordinating the duty of MOH and MOSTI on public announcement, MOH was responsible on COVID-19 medical issues related matters, whereas the latter took charge on immunisation affairs like PICK.

With regard to the vaccination programme for kids aged 5 to 12 years old, the vaccine uptake has been relatively low as compared to adults' inoculation rate of 98% with double vaccination, of which 69% has received the booster shot. Only half of the children within this age group have received at least one dose of the vaccine, including 43% who have fully vaccinated (Code Blue, 2022). In moving forward, MOH has begun the procuring exercise for specially formulated vaccines for children aged six (6) months to 5 years old, specifically those immunocompromised, with underlying health issues or with comorbidities.

2.4.2 Research Objective 2

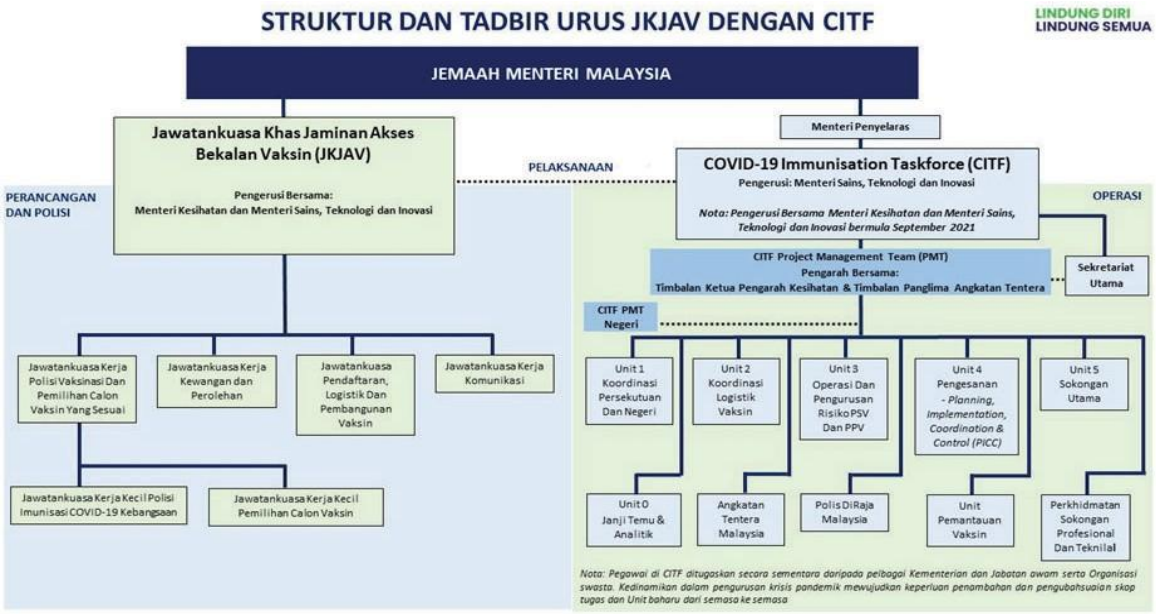
To depict how Malaysia depicts the project management, processes, protocols, and approaches in developing maximum population immunity across Malaysia in the context of the COVID-19 pandemic.

From the findings, we develop four themes in describing the project management, processes, protocols, and approaches in developing maximum population immunity across Malaysia. These mechanisms are featured in this case study through the lens of how the government managed unique and outlier incidents as well as specific population groups. The following describes our thematic analysis.

2.4.2.1 COVID-19 Immunisation Task Force (CITF): Governance matters

The COVID-19 Immunisation Task Force (CITF) was formed on 20 January 2021, as preparation for the nationwide COVID-19 rollout program (PICK) in Malaysia. CITF was responsible for planning, implementing and monitoring the supply and distribution of vaccine, vaccination enrolment, preparation of *Pusat Penyimpanan Vaksin & Pusat Pemberian Vaksin*, vaccine KPI reporting, and risk management. They are also responsible for reporting the development of daily vaccination to CITF Chairman during CITF meetings periodically. The CITF was led by YB Khairy Jamaluddin, the former Minister of MOSTI. Specifically, CITF has three (3) objectives: (1) to deal with the COVID-19 pandemic through a country-wide immunisation; (2) to accelerate the country's economic recovery; and (3) to coordinate and provide support services to PICK at the federal and state level. Figure 2.2 below shows the structure and governance of JKJAV and CITF.

Figure 2. 2 Structure and Governance of JKJAV and CITF



Source : MOSTI (2022)

In terms of CITF's operations, Puan Ruziah Shafei was appointed as the Chief Secretariat of CITF. This included managing and allocating the funds received from the Ministry of

Finance (MOF) for operational expenses, human management and building infrastructure. To ensure the success of PICK, National Security Council (MKN) was committed and responsible for six aspects as follows:

1) Operational and coordination of CITF at the country and state levels;
2) Action integration in the Operations Room (*Bilik Gerakan*) at the federal, state and district levels;
3) Coordination of federal and state administration,
4) System application management,
5) Road geodata (geodata raya) management,
6) CITF command centre management.

MKN led the coordination and monitoring strategies together with the federal agencies and state governments. As for vaccination registration for foreigners, MKN presented the proposal, and several factors were considered including (i) policy, legislation, operation and strategy (ii) classification of foreigners' diplomat, expat and students (category A), foreign workers, immigrants (category B), asylum seeker and refugee (category C), illegal immigrants (category D). A dedicated Project Management Team unit was established under CITF to hold this responsibility, for instance, the Ministry of Women, Family and Community Development *(KPWKM)* also involved as CITF members and considered the role of elderly.



Source : MOSTI

Three Phases of COVID-19 Vaccination

There were five units established in PICK as a basis for their overall modus operandi particularly in Phase 2 of the Vaccination period:

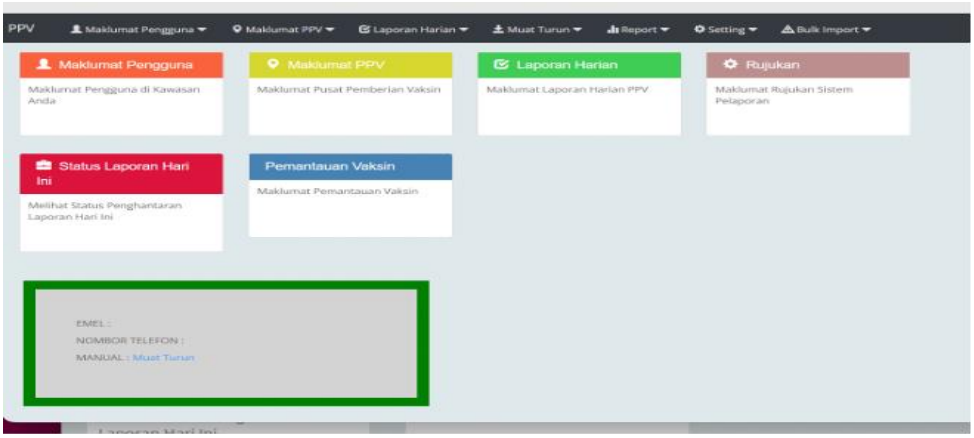
Unit 0- Appointment and Analytics, involving ATM and the Support Services
Unit 1- Coordination of Central and State governments
Unit 2- Logistics of the Vaccines
Unit 3-Risk Management
Unit 4- Planning, Implementation, Coordination and Control

Unit 5- Professional and Technical Support
Constant coordination of the units was the key critical success factor of the overall PICK exercise. For instance, Unit 3 was responsible for the risk assessment of the whole operation. Any incidents that occurred in any PPVs, was under the Unit 3 responsibility. To ensure speed, control and minimal risks, Unit 3 worked closely with Unit 1 as well as other units. together with the state government.

2.4.2.2 Vaccine Distributions

The first batch of vaccine was ready by February 2021, after completing days of testing upon its arrival. At this stage, the general public was doubtful and cynical on the effectiveness of the vaccine. To build public's trust and confidence, the country leaders volunteered to be the pioneers in the country to be injected with the COVID-19 vaccine. For example, a lead-by-example strategy was engaged, whereby Tan Sri Muhyiddin Yassin, the Prime Minister during that time, received the first vaccine in a live broadcast.

The implementation of Operation Surge Capacity for Klang Valley started in July 2021, with 1.3M doses targeted (200K was implemented by the Selangor state government through their SelVAX program). For instance, additional supply of vaccines started in June 2021 increases the utilisation rate from 61% to 90% and above. Therefore, new PPVs were opened, and the operation hour was extended to 12.00am to accommodate the capacity and it reduced congestion. This involved close coordination between CITF and ProtectHealth. Hence, the Federal CITF has developed a PPV daily reporting system which allowed data on the rate of vaccine use, remaining daily vaccines, the presence of vaccine recipients and the data of staff members to be displayed for Federal CITF monitoring for any arising issues and troubleshooting at PPV.



Source: MOSTI(2022)

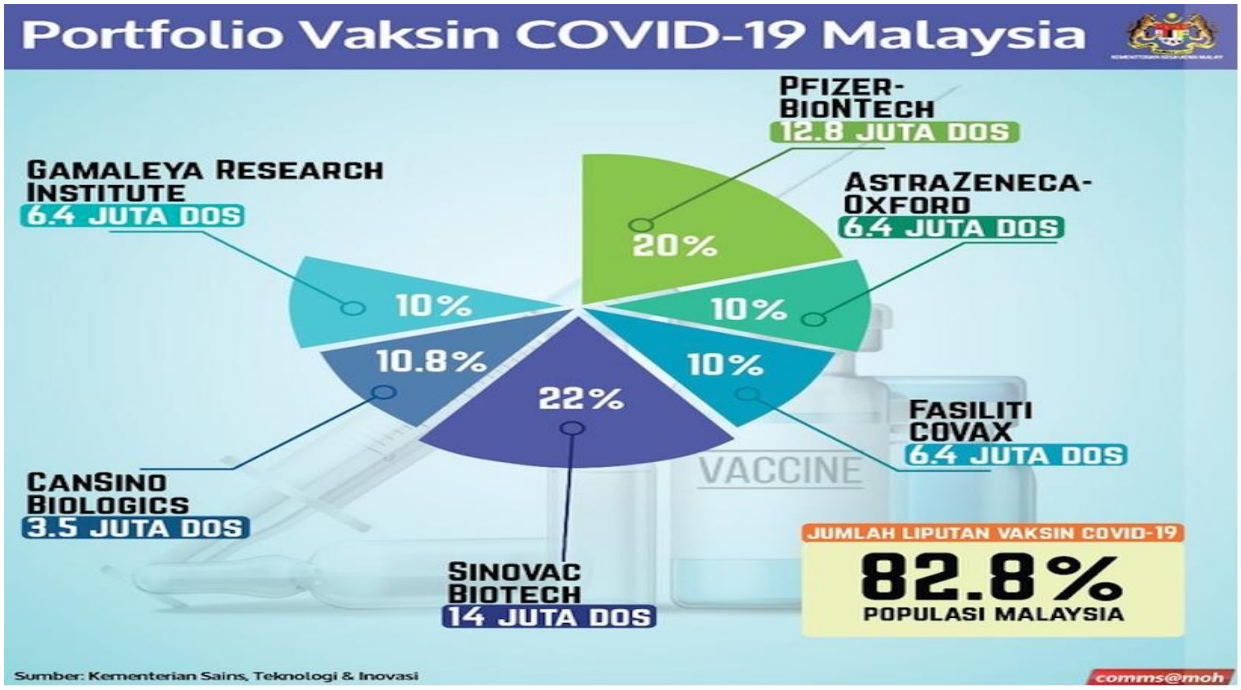
PPV Daily Reporting System

As to address and solve issues related to congestion, lack of infra and inconvenience in small PPVS, the Mega PPV was opened on 27 May 2021 in MITEC and AXIATA. Moreover, the CITF team targeted to achieve 80% of completed doses by October 2021, which was much earlier than the initial plan by the first quarter of 2022.

Beginning 2 August 2021, the focus was on giving the second dose of the vaccine. Thus,

walk-in vaccination operations at PPVs were opened for the Klang Valley according to categories depending on PPVs capacity. The categories involved were: (1) category 1= Malaysian citizen; category 2= non-citizen; category 3= walk-in through external outreach programs implemented on a schedule by NGOs or Government Agencies. In addition, these walk-in operations focused on individuals who have either a) not yet received an appointment, b) have cancelled an appointment or c) who have yet to register even for the first dose. The elderly walk-ins were extended to all PPVs nationwide from August 12, 2021. The state CITF has the authority to coordinate based on PPVs' capacity & vaccine supply (priority was given to the elderly, disabled, comorbidities & those who cannot attend the second dose due to positive covid/ quarantined). Therefore, the walk-ins SOP applied in the Klang Valley was updated for use in other states. The capacity surge operation for the Klang Valley ended in August 2021 with the achievement of 6.1 million individuals who registered on MySejahtera (for WP KL, Putrajaya and Selangor), with 96% of Selangor and KL residents receiving at least one dose.

Between August and September 2021, the focus was on areas that were difficult to access as to achieve the target of 50% of the population receiving 2 doses of the vaccine. The aggressive communication, focused on the anti-vaccine group using emotive elements was applied. For instance, the vaccination process for the rest of the eligible population (aged 18 years and above) who have registered, can get the vaccine at the nearby PPV within a reasonable radius (State CITF determined this reasonable radius). These were carried out by specific PPVs which basically resided either near or within hospitals, government agencies, and private clinics. These tactics were coupled with outreach programs with online approaches to eliminate hassles for the public who were in need of vaccines. In this respect, both local and federal PICK deadline cooperated and synergized closely to achieve the national target for population immunisation, given the effective vaccine supply.



Source : Ministry of Health

Malaysian COVID-19 Vaccines Portfolio

Moreover, CITF has strategically coordinated the vaccine distribution schedule for the month of August so that all states achieved the same performance by Independence Day. Also, the vaccination for teenagers was decided by a special JKJAV meeting. It provided priorities to teenagers at high risk (age 12-17 years) who have comorbidities, obesity and teenagers living with family members at high risk. Simultaneously, the team also focused on dealing with negative sentiment by anti-vax groups since these involved teenagers, although not mandatory. Walk-in for all those aged 18 years and above, including the elderly, disabled, comorbid, individuals who missed the second dose as well as teachers and support staff at educational institutions was carried out in the Klang Valley (all PPVs), non-citizens at Bukit National Stadium Jalil, Sarawak (all PPV) and Perlis (one PPV for those aged 40 and over).

On 21 September 2021, 80% of the adult population completed their vaccination. Still, the mop-out operation continued with an outreach program headed by JKN (*Jabatan Kesihatan Negeri*) with cooperation of ministries, universities and NGOs. Outreach aims to reach those who dropped out from the PICK program (such as those who missed the appointment, bedridden, in the deep- rural areas, including indigenous people).

The effectiveness of Vaccine Distribution and PPVs relies on the following critical key factors shown in both leaders and members (followers) of the PICK program:

1. Unnecessary bureaucracy or protocol was eliminated, as the team was empowered to amend steps of the vaccination processes to ensure smooth operations and PPV gained full authority in decision making.
2. Effective communication (especially with the public).
3. Commitment from all PICK's stakeholders and volunteers with agile, resilient and transparent routine processes.
4. Good followership with respect to understanding the requirements and expectations of the leader, who in return offered constant encouragement.
5. Teamwork that works towards achieving targets with full speed, high engagement and skills.
6. Management of stress and expectation with tenacity in creating solutions and ideas to ensure challenges during the vaccination period could be eliminated.
7. The Mega PPV functioned to improve and solve issues related to congestion, lack of infra and inconvenience in small PPVs

2.4.2.3 Issues with Vaccination

2.4.2.3.1 Illegal Immigrants and Refugees

Illegal immigration is a national issue. Although it may appear as a subtle or distant issue, the immigrants have permeated our granular society. The government took a rational decision when they ruled that due to the pandemic, immigrants were part of '*adult residents*' who needed to be immunised. In this section, we articulate how the CITF has handled the vaccination issues for illegal immigrants and refugees in order to achieve the maximum population immunity.

The government did not have the exact number of the community population, and this has made the effort to identify the needs and allocation of vaccines challenging. In March 2020, Malaysia's defence minister stated that anyone seeking COVID-19 testing or treatment based on their immigration status would not be arrested. However, after a series of raids on apartments and work sites under coronavirus lockdown, the minister announced that the amnesty period had expired. More than 2,000 people were arrested as a result of the crackdown, and COVID-19 outbreaks occurred in immigration detention centres. The incident has caused a trust deficit in the government's vaccination plan for this **vulnerable community**.

The plan to get the illegal immigrants vaccinated was first discussed in the CITF meeting on 11 March 2021, where MKN presented the proposal to give vaccination to all foreigners in Malaysia. Four factors were considered including policy, legislation, operation and strategy. Foreigners are categorised into diplomats, expats and students (category A), foreign workers, immigrants (category B), asylum seekers and refugees (category C), illegal immigrants (category D).

On 13 July 2021, the Project Management Team Meeting decided that a Task Force should be established led by the National Security Council to plan methods and develop SOPs for the vaccination of illegal immigrants, refugees, UNHCR Card holders and those without citizenship in an objective and organised manner. The SOPs or *Garis Panduan* aims to give vaccinations to all Malaysians on the principle of *"no one is safe until everyone is safe"* and the Government's intention is to ensure that all Malaysians and non-Malaysians received the immunisation. This is based on the interview made by YB Khairy Jamaluddin, the former minister of MOSTI, that mentioned:

"[*Undocumented migrants] can come forward freely and they will be confident that the government will vaccinate them and not detain them... We must build trust in these communities so they can come forward willingly and freely so that we can administer the vaccines.*"- *YB KJ, https://www.thestar.com.my/news/nation/2021/07/25/kj-vaccination-guidelines-for-illegal-immigrants-refugees-approved-by-citf*

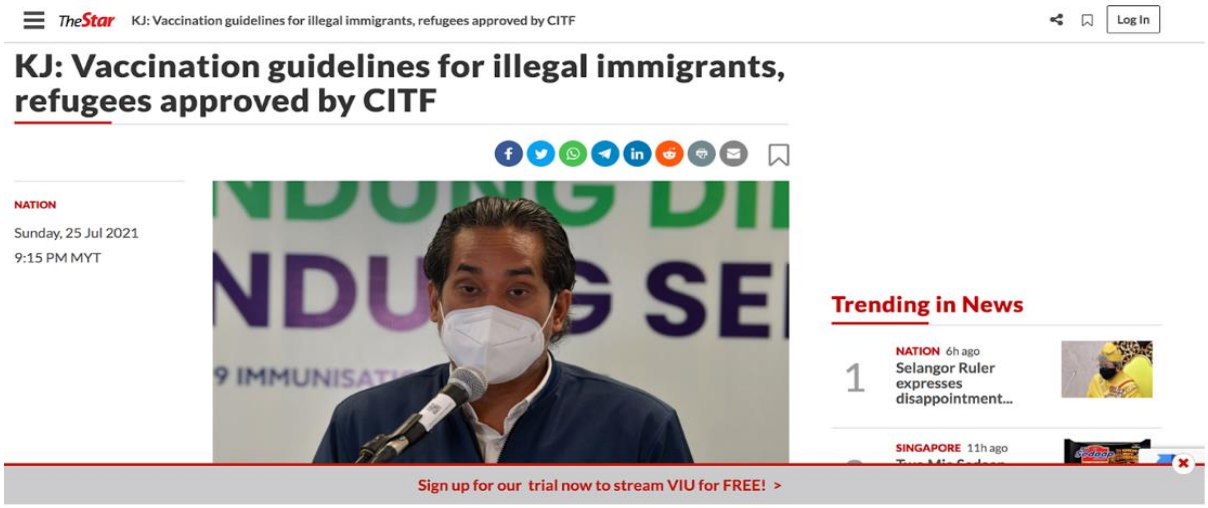


Source : The New Straits Times

Vaccination for Everyone

It will also help to facilitate people's affairs through the practice of no wrong door policy, especially in a pandemic situation that requires immediate action without breaking any rules.

After 1st August 2021, the vaccination programme was opened to illegal immigrants for a walk-in, so that they will get at least one dose of vaccine. In the beginning, the CITF team received opposition from the Ministry of Home Affairs regarding the vaccination of illegal immigrants, but they later opened up about it and did not catch the illegal immigrants. The illegal immigrants did not have documents, so they could not cross the border, and when they came in for vaccinations, the police had to be aware of their lack of documentation and let them in. Such circumstance was one of the difficulties the team encountered. They had to coordinate with the immigration agency to make the plan and process run smoothly.



Source : The Star

Vaccination Guidelines for Illegal Immigrants and Refugees

And to ensure that the vaccination plan for the illegal immigrants and refugees is successful, certain units were deployed. Non-governmental organisations (NGOs) such as the Malaysian Red Crescent Society were involved in the vaccination exercise for refugees and illegal immigrants because they felt more at ease if the PPVs were handled by NGOs that have previously provided health services to these groups. In some states like Penang, the state government collaborated with NGOs, Doctors Without Borders and the United Nations High Commission for Refugees (UNHCR) to vaccinate the undocumented immigrants and refugees in the state.

2.4.2.3.2 Pregnant Mothers

There was a lot of apprehension about vaccination for pregnant mothers where they were not allowed to take vaccines as it was not clear with the side effects of the vaccine. This situation led to the death of pregnant mothers during the initial stage of the corona. The increased toll of death among pregnant mothers and positive coverage of vaccinated pregnant mothers in western developed contexts (such as Europe and the United States) somehow motivated the local ones to get vaccinated. During the *Vaccine Flood (Wave 3)*, Unit 2 (logistics coordination unit) revised the guidelines and SOPs to include pregnant

mothers. This actually involved daily meetings and contacts with the head of services and finally presented in the meetings with the MOH at the executive COVID-19 management level. Once the guidelines had been accepted, it was presented to CITF members. Then, Unit 2 worked with Unit 5 to identify the best ways to present the guidelines to the public using simple and accurate infographics. A campaign called *'Ibunisasi'* was also conducted with other agencies using MySejahtera to retrieve the record of pregnant mothers in Malaysia. By August 12, 2021, the walk-in method for pregnant women was improved. Vaccines were given throughout pregnancy periods for women, except those with complications.

2.4.2.3.3 PPV Co-ordination and Deliberation

A total of 1,400 PPVs have been opened throughout the country, which included PPV Awam, PPV Integrasi, PPV Rumah Ibadat, PPV Pandu Lalu, PPV Mobile and Outreach. For the operation of the PPV, Dr Firdaus Ujang (*Pakar Perubatan Kesihatan Awam*) was assigned as a permanent specialist at Federal CITF on 23 March 2021. As a person in charge for the establishment and implementation of the PPV, his team and himself had to work and engage closely with JKN, SUK and also to have a collective discussion at both levels which were Persekutuan and state. Initially, before Dr Firdaus was transferred to Federal CITF, he was stationed at MOSTI which has been connected with other agencies such as ATM, policies, APM etc. They already established good and close communication with JKN. Thus, this was an advantage for him as he already had a good network with them.

As for the decision whether to open a new PPV, Federal CITF decided on the availability of the vaccines as well as appropriateness of the location and the scale type, since it involved a big number of crowds among the public (for Phase 3). As for Phase 1 and 2, it was handled quite well since they had the data on frontliners, elderly and comorbidity. The decision was quite critical and challenging during phase 3 as it was a first decision on opening the first PPV Awam. At the beginning, Prof. Datuk Ir. Ts Siti asked the team to open the PPV based on the population radius. However, there was an issue if it was based on the population radius, because this approach could not be applied throughout the country. For example, in Rompin, Pahang where the population was scattered thus it was difficult if the population radius-based approach was used. In fact, for the rural area, this approach cannot be applied. Therefore, to address this issue, it required the need of the medical background expertise because health management was totally a different context in managing a situation. In addition, using population radius could not identify the congested areas. Thus, they then decided based on the registered population in MySejahtera. So, they communicated with the MySejahtera team to provide the statistics. Then, each state was asked to provide the proposal (followed the guidelines given) and submit it to Unit 2. Under Unit 2, there were several persons in charge for each state. Next, Federal CITF discussed and decided to approve their proposal (provided they had fulfilled the said criteria), as one of the criteria was based on the number (reached certain quantity) of registered population in MySejahtera.

In term of budget, RM661 million were allocated for a year to develop 500 PPVs (to reach 80% vaccination with the estimation of 26M), the budget was used for various purposes including utility and rental, consumables and supplies, cleaning, waste disposal, mobile

toilets, sanitization, data integration and system, contingency, safety and volunteers. For instance, algorithms for vaccine delivery and vaccine demand at PPV were arranged for logistics and delivery of vaccines. Since the target to achieve herd immunity has been set in December 2021, PPV needs to arrange and manage vaccination injections to 160,000 per day. In order to monitor this, real-time data were displayed via dashboard to monitor the receiving and distribution of vaccine activities in all PSV and PPV.

Demographics, accessibility and population profile determine the setting of PPVs. Specific cases such as the rural areas (*kampung*) were special. It might seem different than the guidelines for the cities. These PPVs were placed depending on observation of the state government on the larger size of the population. Once a PPV was set up, its structure and flow were defined. Then, the number of volunteers and clinical people were determined with consent from the vaccination team. During the early stage, the consent form was conducted manually but later it was digitized through the MySejahtera system. This electronic system reduced waiting time. Furthermore, the system allowed the user to report for side effects of specific vaccination cases. Reports of side effects of the vaccine gained from MySejahtera as well as from the pharmacy department were then analysed and discussed during the CITF meetings with specific actions taken depending on the seriousness of the issues.

PPV coordinators from the public department managed the volunteers such as ATM and RELA. For instance, the pharmacy department played an important role as they are the one that looked after the logistics, allowing the vaccine to enter as they have to check the requirement of the vaccine. When the vaccine reached a certain target of capacity in a state, the PPV coordinators reported it to Unit 1 in order to avoid shortage and late arrival of vaccines. Specifically, the line of command for daily reporting regarding the vaccination performance and issue mitigation was structured as such: PPV reported to district CITF, which in turn reported to state CITF, and ultimately to the Federal CITF. (PPV → district CITF → states CITF → Federal CITF)



Source : Bernama

Improvement of Appointment for Vaccination

Throughout the process, we could learn the various strategic deliberation that add seamless coordination:

1. In order to determine the need to open or increase PPVs capacity, specific teams conducted detailed research to ensure its necessity vis a vis vaccine distribution within the state, district & PPV.
2. The approved financial procedure covering rentals of tools and equipment at PPVs (the purchase of assets is not allowed) were accomplished at an early stage of CITF.
3. JKJAV approved the implementation of digital consent, which improved the vaccination process at PPV. Eligible individuals can verify digital consent before attending a PPV. Medical officers completed the digital consent verification through MyVAS system in PPVs.
4. CITF approved the express route (new process flow) to improve smoothness in PPVs for individuals who used digital consents.
5. Daily reports of vaccine stock were monitored. This includes daily monitoring, use and wastage of vaccines at PPV, latest information on number of vaccines available at PPVs; the daily number of vaccines received by PPVs; the amount of vaccine used for injection; the amount of vaccine wasted, the amount of vaccine returned to the PPVs on the same day; the amount of vaccine distributed to other PPVs, and the amount of the final balance of vaccines per day stored at that PPV (if any).
6. Additional information was made on dashboard data reporting by including vaccine rate chart data compared to ICU bed utilization rate & death rate due to Covid 19.
7. The PPV opening guidelines and equipment are distributed for the understanding of parliament members (this was done by YB Coordinating Operating Surge Capacity Selangor and parliament members of Bangi).
8. Coordination among the police in coordinating interstate travel was strengthened for vaccine taking without a valid reason (i.e., Kedah residents change their address in the MySejahtera system just to get vaccine in Perlis).
9. The Operation Surge Capacity was enhanced by the walk-in operation displaying video on location through CCTV.
10. Vaccine recipients who did not have smartphones could print a digital certificate on the JKJAV website.
11. Purchase & procedure of vaccination by the private markets was in accordance with the Guidelines drawn up by KKM (Covid 19 vaccination procedure & CITF guidelines) as well as data integration in the MySejahtera & VMS system. All vaccinations done through private markets were captured in MySejahtera digital certificates.
12. Quality standards at PPV GP clinics were monitored as they would take over the vaccination program at later stages.
13. The theme song *'Protect yourself, protect everyone'* was released on 9 August 2021 and was used as a promotional campaign while consent forms were made available in various languages.

2.4.2.4 Issues with PPV

2.4.2.4.1 The opening of PPV Integrasi @ World Trade Centre (WTC)

The PPV Integrasi was opened at the World Trade Centre (WTC), Kuala Lumpur. According to the press conference held by YB Khairy Jamaluddin, the facility can accommodate 2,468 appointments in a day. The WTC PPV is one of four which provides AstraZeneca vaccine injections to Malaysians and foreigners living in the country, apart from Universiti Malaya, Universiti Kebangsaan Malaysia and the Ideal Convention Centre (IDCC) in Shah Alam.

On 15 January 2021, the WTC opened its doors to the public for the PICK programme. In this PPV Integrasi, the operation was managed by both MOH and ProtectHealth Corp. The CITF team was so excited and thrilled. It was the first time that they administered such a large number of vaccinations to the public. Meetings and preparation were made, and all teams were well-informed. The public was excited too, because after waiting for so long, this was the first time most of them could get vaccinated through MySejahtera appointment.

However, it did not go smoothly. The place was overcrowded due to many individuals who arrived far earlier than their scheduled vaccination periods as well as those who were not registered for the vaccination but "tried their luck" to get vaccinated. The overcrowded scenes were quickly shared on social media, including Twitter. Some people had to wait for two hours while some were afraid to get infected with the virus from the crowd.



Source : Astro Awani

Overcrowded PPV at WTC

On the CITF side, they did not provide clear guidelines on how to get to the vaccination desk, there was only one entrance offered, which made it overcrowded, and they did not be firm on the appointment time. To make things worse, there was a problem with the queuing system. It was a challenging time for all the members and the top management,

including YB Khairy and Prof. Datuk Ir. Ts. Dr. Siti Hamisah.



The queuing system was down, pushing the team to use manual processes for the operation. At the beginning, this has caused some panics among the members at the scene.

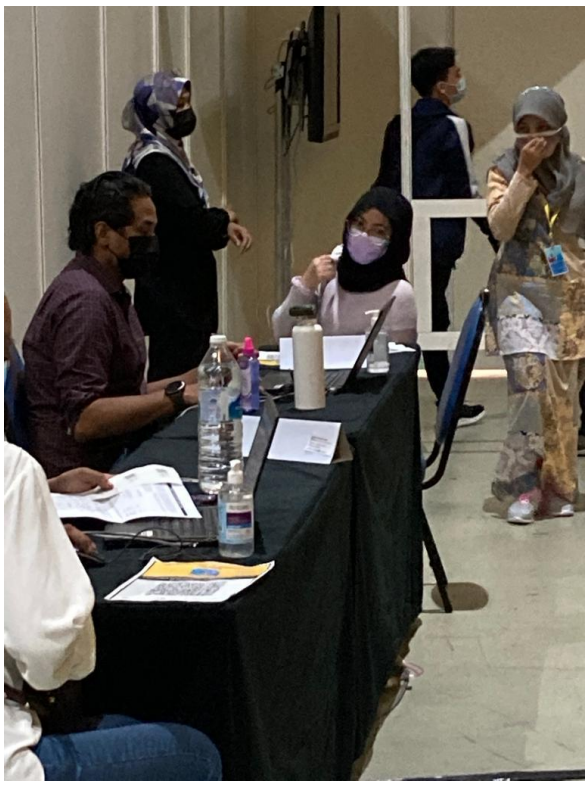
They solved the problems within two hours. They learned from their experience. Fast decisions were made, each member was deployed to their respective units. The one main entrance to the hall has been split into three separate entrances to counter the overcrowding issue. Police were seen to guide the public with the direction. Army and police were also deployed to manage the crowd and to ensure only those who had appointments could enter the premises.

Picture Courtesy: Dr Mohamad Firdaus

Queuing System Down at PPV

According to Dr Firdaus, one of the team members who were at the scene:

"We asked the police to make sure only people with appointments can be here and asked who did not have to leave. Those with the appointments but arrived early were told to leave the area too. They need to come half an hour before their appointment".



During this challenging time, everyone has lent a hand regardless of their status. YB Khairy Jamaluddin for instance, has helped with the manual registration.

It was their first experience in facing such challenges, but with strong teamwork, good guidance and empowerment, the chaos was solved within a short time.

On 16 October 2021, YB Khairy Jamaluddin mentioned in Twitter: *"PPV AZ WTCKL much smoother today. Better crowd control outside. Good learnings for eventual opening of the country's biggest vaccination centre".*

Picture Courtesy: Dr Mohamad Firdaus

Manual Registration at PPV



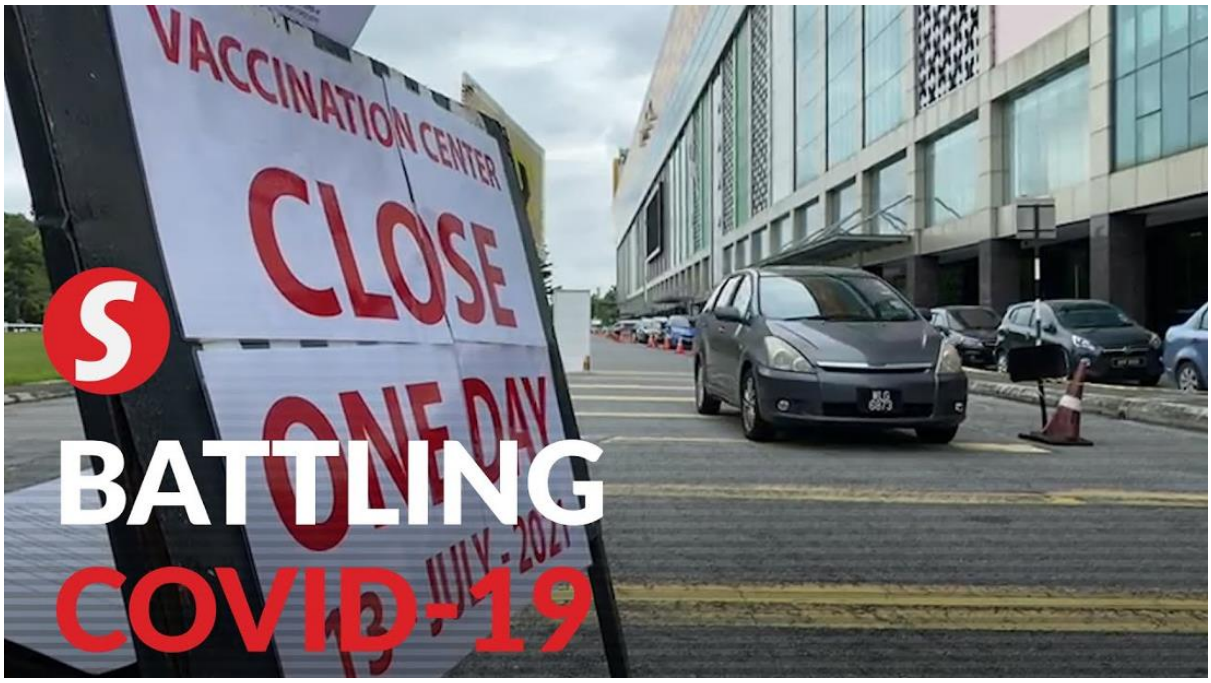
Picture Courtesy: The Malay Mail

People Queuing Outside of the WTC, on 16th October

2.4.2.4.2 COVID-19 Infected 200 volunteers in PPV Integrasi, IDCC Shah Alam

While the vaccination effort was actively implemented, a major incident disrupted the process. The PPV IDCC Shah Alam incident involved 204 volunteers who were infected with COVID-19. It sparked worries and has activated urgent plans to rectify the problem. The discovery of the positive cases came after a mass testing, ordered by the National Covid-19 Immunisation Programme (NIP) Coordinating Minister Khairy Jamaluddin after two volunteers were contracted with COVID-19 earlier. News has spread quickly online and this has caused anxiety to the public about their safety while at the PPV. Some netizens were criticising the government's lack of SOPs in protecting the staff at PPV from contracting the virus.

The situation was challenging, which requires **careful deliberation, firm decision and rapid action**. As an emergency measure to solve the problem, the centre was closed for one day for sanitization. All appointments were rescheduled to another date. The infected volunteers were quarantined at home. Because of this, restructuring of manpower was done. Replacement volunteers were recruited.



Source : The Star

The IDCC PPV was Closed for One Day Due to the Outbreak at the Centre

In order to improve the confidence level of the public, a press conference was held to inform the measures that have been taken to solve the problem. An FAQ about the incident was published on social media for public references. As a precautionary measure, YB Khairy Jamaluddin advised all those who were vaccinated at the centre from 4pm last Friday (July 9) onwards to monitor themselves for 10 days to see if they developed symptoms.

The IDCC incident further enhanced the learning curve of PICK's heroes. They learn to improve effectiveness during unexpected scenario within the larger COVID-19 pandemic

crisis. After the IDCC incident, each CITF state pooled more volunteers to ensure the supply availability of staff is sustained should a crisis similar to IDCC recur at different other vaccination centres.

2.4.2.4.3 Reaching the Unreached

To ensure every citizen in Malaysia received the vaccination, plans were made to reach people living in the rural areas, especially the Orang Asli. The outreach programme in the interior of Gua Musang, Kelantan, was an example of a success story.



Puan Ruziah Shafie, Head of the CITF Secretariat, shared about the vaccination process there, which is adapted to local conditions. Coordination between the CITF headquarters, CITF states, NGOs, ATM, MOH, the Fire Rescue Department, and the Department of Orang Asli Development has helped the mission to succeed. Companies like Tenaga Nasional Berhad (TNB) also played a role in providing logistic assistance for the vaccines. The leader tribe of the Orang Asli also played an important role in influencing the members to accept vaccination.

Some Orang Asli settlements in the remote areas of Gua Musang such as Pos Belatim, Pos Balar, Pos Bihai, Pos Hau and Pos Simpor are hard to reach via normal transportation. Thus, air transportation is used to reach the community. A helicopter was also used to ensure the vaccine cold chain was secured. One of the vaccination programmes in Gua Musang has involved a team that consists of CITF members, Jabatan Kesihatan Kelantan, and Director General MOH, Tan Sri Dr Noor Hisham Abdullah. The team which carried some Covid-19 vaccines with them was transported to the Orang Asli settlement via a helicopter on November, 7, 2021.

In other parts of Malaysia, the outreach programmes continued with strong collaboration between government and other stakeholders. Awareness programmes and mobile vaccination are some activities that were implemented. This includes collaboration between Hospital Orang Asli Gombak, University Malaya Medical Centre and Malaysia Rapid Transit. Many parties have come forward to assist in the vaccination programme. The outreach program to reach the unreachable is an epitome of selfless commitment, localised treatment, strategic coordination and implementation.

2.4.3 Research Objective 3

To explore capacity building across all stakeholders/actors in Malaysia's ecosystem to address COVID-19 through PICK.

The in-depth analysis of the qualitative data reveals how capacity building of all actors in addressing COVID-19 through PICK. In totality, capacity building of PICK features **dynamic proactiveness**. We detail such proactive capacity from the following perspectives:

2.4.3.1 Financial Management

As of 2021, the government has allocated RM32.4 billion to the MOH for operating and development expenditure (Ministry of Finance, 2021). During the pandemic, requests for a budget for immunisation within MOH facilities were made by the secretariat of CITF through Malaysian National Security Council (MNSC). The MNSC is a federal agency under the Prime Minister's Department that is responsible for managing and coordinating the implementation of policies related to the security of Malaysia.

Immunisation implementation outside of MOH facilities that require budgets require permission and discussion. The government mostly implemented budget sharing to conduct immunisation processes outside of MOH facilities. For example, in building an industry vaccination centre, the cost is financed by the industry, although the vaccine is supplied by the government.

To ensure that Malaysia achieved maximum population immunity, several revisions to the budget allocations have been done to increase the immunisation capacity. For instance, as of 18 March 2021, budget allocation has been increased from RM3 billion to RM5 billion to accelerate the target group immunisation.

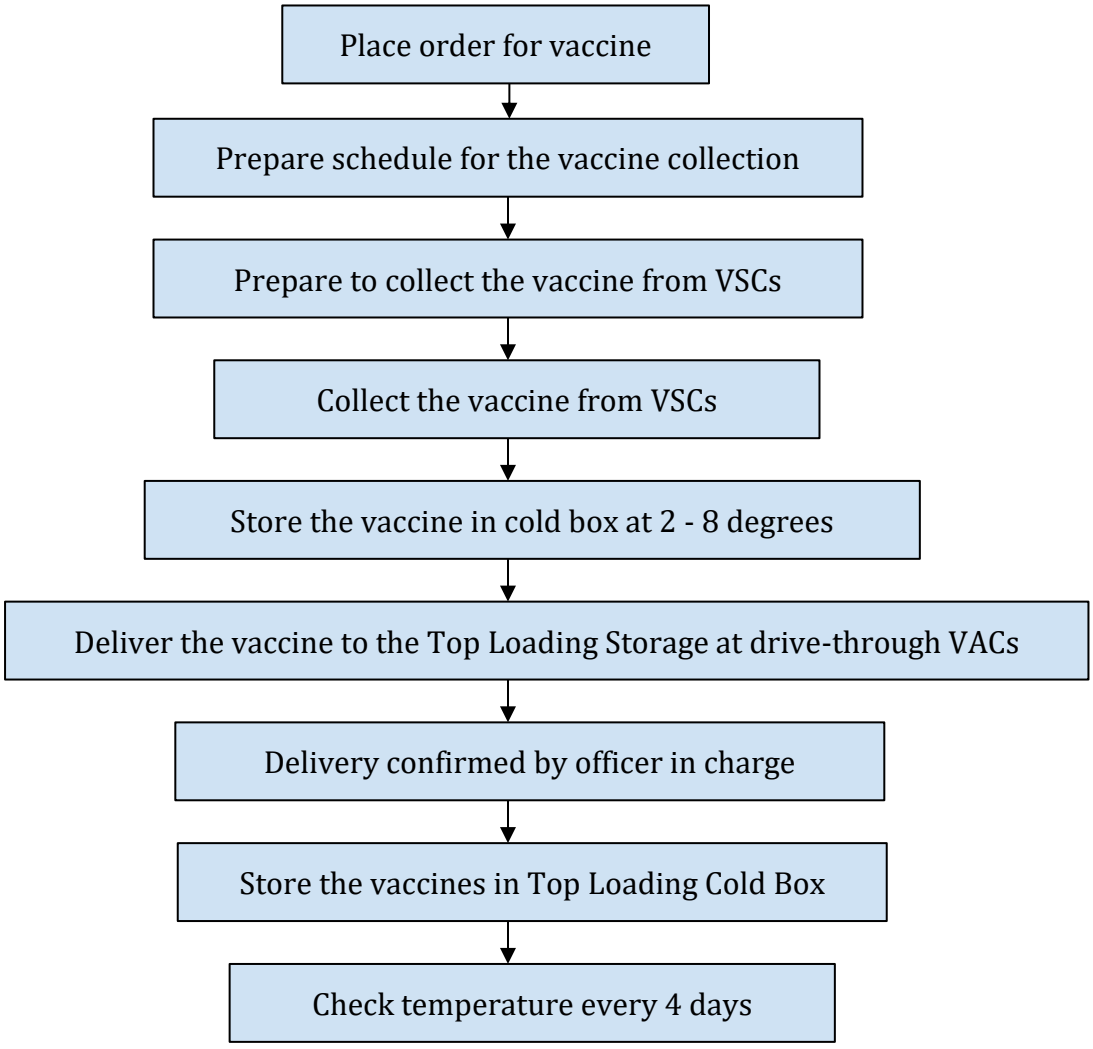
2.4.3.2 Facilities Management

Facility management during COVID-19 boils down to three major focuses: a) storage and logistic, b) facility cleanliness, including waste disposal, and c) safety of employees. On 28 February 2021, there were a total of 300 thousand confirmed cases of COVID-19 in Malaysia, while there were only 600 vaccination centres under MOH facilities and 473 vaccination centres under non-MOH facilities. In addition, it was recorded that Selangor only has a vaccination centre under MOH facilities. Therefore, MNSC worked with MOH to ensure that additional facilities for non-MOH could be jointly utilised.

Regarding vaccine storage, vaccine temperature was monitored daily using a temperature monitoring device. A sufficient amount of ice packs was ensured to maintain the stability of the vaccine. Each dose of the vaccine was stored at a temperature of 2 to 8 degrees. On-site vaccine storage was also not taken lightly, whereby portable freezers and refrigerated cold storage units were ensured to comply with the specification. A power supply backup with generators was also provided in case of power failure. A proper ventilation system was also ensured for the vaccine storage area. Also, the separation of the vaccine according to its type was also practiced to avoid injection errors. The government appointed Pharmaniaga Logistics Sdn Bhd to manage the logistics and

distribution of vaccines to government facilities. It is pivotal to ensure safety and security were not jeopardised. The company was selected because it has the infrastructure, facilities and capabilities with more than 26 years of proven track record in handling vaccines. In addition, a process flow for delivering vaccines from the vaccine storage centres to the drive-through VAC was also established. Figure 2.3 shows the process flow.

Figure 2. 3 The Process Flow of Transporting Vaccine from the Vaccine Centre



Source : MOH

Proper clinical waste disposal was one of the practices to ensure facility cleanliness. The percentage of vaccine waste allowed was only 15%. Clinical waste, such as swabs and gloves, were disposed into the yellow biohazard bag while used, empty and mixed vials, including opened vials, syringes and needles, were disposed into the sharp bin. These practices, in addition to ensuring that waste disposal is appropriately managed, were also practiced to ensure that employees' safety is not compromised.

Facilities management includes access to the internet connection. Therefore, several discussions with telco providers were conducted to increase internet connection quality, especially at the vaccination centre in rural areas as they need a well-functioning and strong Internet connection.

2.4.3.3 Connectivity Equipment and Platform

Connectivity of communication networks is one of the key success factors in the administration and implementation of the National COVID-19 Immunisation Programme (PICK). It will support the flow of information (i.e., information transfer) in managing and administering the smooth operationalization of the vaccination programme at Federal COVID- 19 Immunisation Task force (CITF) and State CITF. These two task forces are further supported by various parties in order to ensure that all plans that have been put forward toimmunise the Malaysian population are successful. The overall PICK structure and operation depicts the dynamic network of communication.

Effective communication started at the very early stage of the pandemic. As the pandemic was known (at international level) the ministry set capacity to gain updated development ofvaccine(s) production. Once the vaccine(s) have been tested, negotiations for effective price and supply led to major decisions by the Prime Minister himself. In between the period of negotiation (November 2020) to receiving the first vaccine batches (February 2021) the PICK community has started establishing the infrastructure and architecture for the immunisation programme. Top leadership agreed to use the project management approach in handling the immunisation programme with involvement of consultants to assist the implementation of PICK.

In supporting the programme, various systems and applications have been developed. Firstly, MySejahtera is an application developed by the Government of Malaysia to assist in managing COVID-19 outbreaks in the country. In the beginning of its launch, the main function was to facilitate contact tracing effort in identifying individuals who are in close contact with those tested positive for COVID-19. In addition, it also assisted the appointment notification system for vaccination. In addition, it was developed for other goals such as allowing users to perform a self-health assessment, monitor health status and share the information with MOH. Furthermore, it also kept Malaysian vaccine information digital vaccine certificates. Data and detail for the vaccine information is also harmonized with other countries. Thus, during the endemic such information facilitate those who are travelling to and from Malaysia. In relation to certificates, MIMOS developed an application named Vaccine Certificate Verifier to verify the authenticity of QR code for COVID-19 digital vaccination certificate.

Other systems were, vaccine management system (VMS), and pharmacy information system(Phis). These three systems need to be integrated to connect the product data with the vaccine. There is also a VMS dashboard that was developed to display real time data to monitor the receiving and distribution of vaccines in all PSV and PPV. The dashboard is shared with the states and districts with some restrictions on information. Line of commandfor daily reporting regarding the vaccination performance and issue mitigation is from PPV to district CITF, then to State CITF and finally to Federal CITF. There is also a two-factor authentication system in the Malaysia Vaccine Administration System (MyVAS) for people who wish to manually add vaccine recipients at the vaccination centres (PPV). MyVAS feature was created to prevent instances of syndicates or cartels at PPVs who sold appointments.

To further support the capacity building in terms of volunteers, MyVAC (Malaysian Vaccine Support Volunteers) was developed through cooperation between MOH, MOSTI,

KBS, and MOHE. The Malaysian Red Crescent Society (MRCS) was a portal that facilitated those who would want to register as volunteers for PICK programme at Federal and State level. MyVAC managed the database for volunteers and it assisted in managing a pool of volunteers and matched it with the needs of various types of PPV established in the country. This system was useful in supporting the speed and development of the PICK programme as well as orchestrating the administration and supply of the vaccines.

On the other hand, in managing the worries, anxiety and curiosity of the Malaysian population, the Chatbot function named AIDA has been utilised in the website of JKJAV. This service was available to access 24/7. It was able to respond to enquiries generated by the public. Furthermore, the secretariat has also prepared more than 1,000 FAQs and kept updating them from time to time. In addition, live agents under the TMOne service were activated to reply to messages through WhatsApp messages.

2.4.3.4 Human Resources

As the PICK programme started its operation and the country aimed to reach herd immunity, the main task force for CITF and project management team were developed to assess the stakeholders' needs. Both teams are responsible to ensure the programme is well executed.The infrastructure and architecture of the PICK programme is being laid out by the government (i.e., both teams). In addition, these require coordination between ministries/agencies/state governments and need to evaluate and implement intervention for any emerging issues that arise.

The coordination of the PICK programme is supported with the existence of COVID-19 Vaccination Team that comprises coordinator, assistant coordinator, officer for safety and health, public information officer, technical and IT, logistics, and finance. Furthermore, it is further supported by the Operational Team composed of healthcare practitioners (medical officers, nurses, assistant medical officers as well as and non-medical staff (volunteers for registration, patient charting, flaggers, line attendants, traffic control/security). In addition, there were partners such as staff of local governments, state health departments, state governments, local law enforcement, auxiliary resources, and MyVAC (COVID-19Volunteering System).

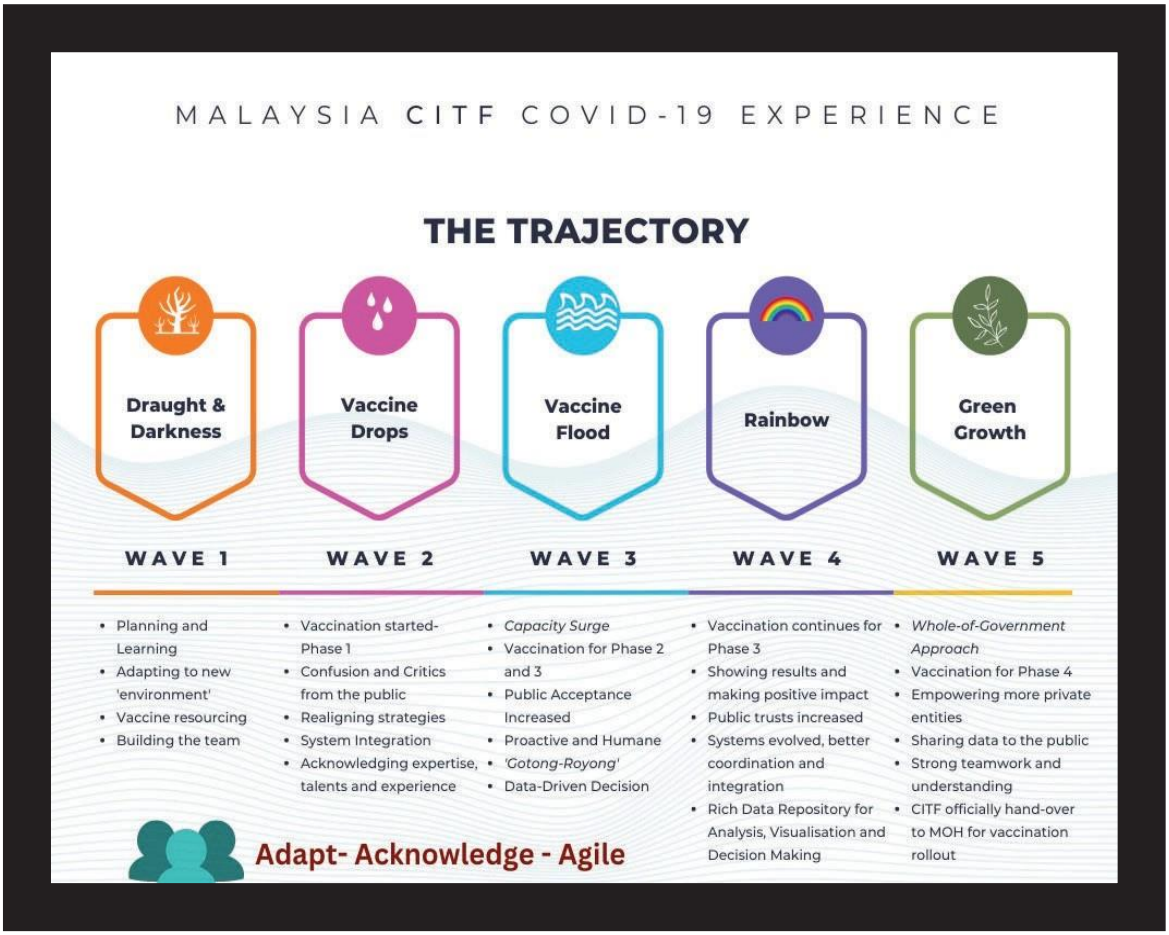
In carrying out their duties, both teams had various coordination meetings between FederalCITF and state CITF. For the period from February 2021 to October 2021, 62 meetings were held. The number of meetings held between the span of 9 months showed the rigour and effort of the teams in coordinating the PICK programme. Besides the main CITF meetings that have been conducted regularly, there were also various meetings being held by task force(s)at federal, state and district level to ensure the smooth running of the programme. Issues were discussed at the task force meeting to brainstorm, and find potential solutions. Most of the time, some issues being highlighted in the main meetings only served as notification to the members of the meeting. By the end of June 2021, our country moved towards Operation Surge Capacity due to the increased number of vaccines supplied to us. Operation Surge Capacity displayed accelerated efforts from all parties in ensuring the aim in achieving maximum population immunity. In tandem with the operation surge, the government also increased human resources, in which an orchestrated mechanism pooled information to search for more volunteers.

In handling such a huge and massive national vaccination programme, MyVAC (Malaysian Vaccine Support Volunteers) managed the volunteers. It was a centralized volunteering programme created by the government for the PICK success. Training and allowance were provided for them. They were healthcare and non-healthcare personnel and came from various backgrounds such as from the government, private corporations (such as Fireflyand Malaysia Airlines), retirees as well as university students. As the wave progressed, the resources and infrastructure were also enhanced in order to fill any gaps in each PPVs.

2.5 LESSONS LEARNED

Despite simply projecting a span of before-during-after the Vaccination Rollout, we depict the whole initiative of PICK as a trajectory of five (5) distinct waves. The entire episode elucidates a deep but dynamic and deliberate move along a spectrum from zero understanding and solutions (*Drought and Darkness)* to a cycle of the agile planning and actions (*Vaccine Drops and Vaccine Flood),* that progressively evolves into a tapestry of public trust (*Rainbow)* and impact (*GreenGrowth).* The five waves explain the concerted actions that started from **adaptation** to uncertainties arose from the pandemic, **acknowledgement** of a team of critical actors who could necessitates and catalyses the best, effective strategies. Finally, these actions allow **agility** (rather than static, *stick-to-the-knit)* in approaches, strategies and mechanisms. It is through agility and adaptation that the PICK teams could be able to face uncertainties before, during and even after the pandemic. Figure 2.4 canvasses the story of PICK in Malaysia.

Figure 2. 4 Trajectory of the Immunisation of COVID-19 Vaccination Programme Based on Malaysia CITF Experience



Rising above the weathering storms of the COVID-19, we encapsulate four (4) lessons derived from the findings based on the research objectives. Figure 2.5 projects the four-lesson learned, simplified as PICK.

Pivotal Leadership: Across the five waves, we recognized outstanding leaders who took actions, exercised courage and resilience in realizing the strategies. These pivotal leaders spread across the top and middle echelon leadership of the country ranging from the Prime Minister, Ministers, Secretary Generals, the Arm Forces and respective volunteers. This was marked by their abilities to i) detect needs for changing directions and approaches; ii) steer others toward new inflection points along the PICK trajectory; iii) intensify resources through evidence/data- driven management and most importantly; iv) make decision that impact the majority in an altruistic and humane manner, as seen in the inclusion of vulnerable communities (refugees and immigrants) in the vaccination programme.

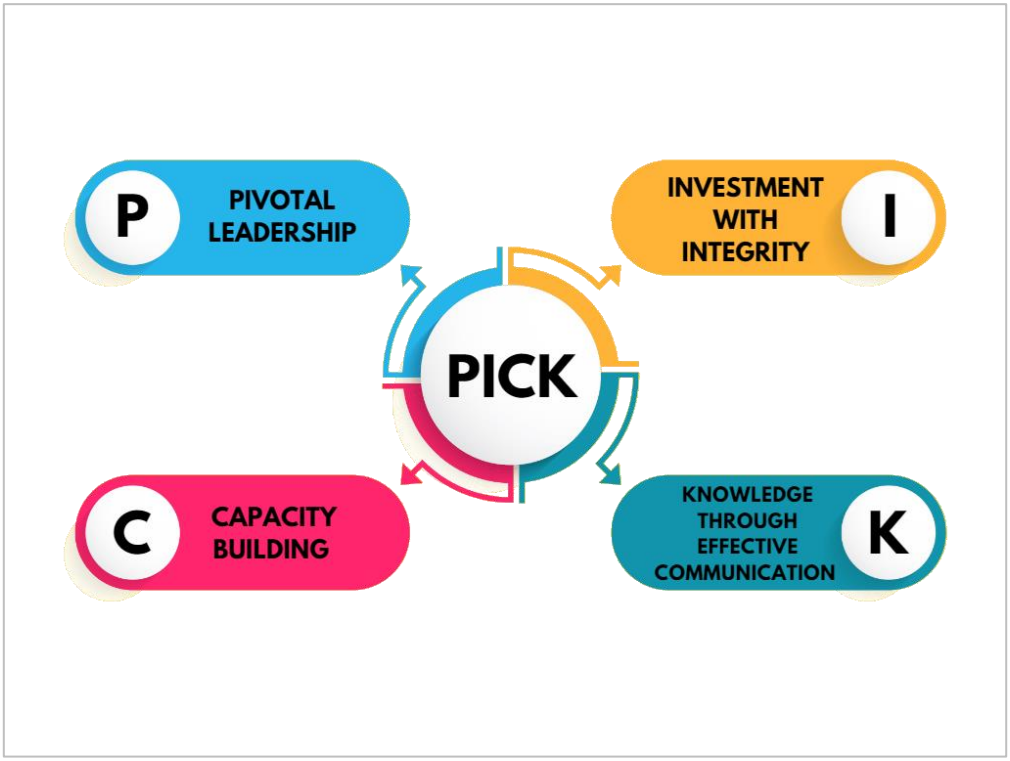
Investment with Integrity**:** Budget and spending for the roll-out COVID-19 vaccination programme were done early during the first wave, *Drought and Darkness.* The spending in terms of securing the vaccine, rentals of tools, equipment and infrastructure as well as system development took a courageous stand as it requires urgency in chaotic scenarios.

Still, pivotal leaders worked their actions along the concerns for compliance, calculated risks, careful check-and-balance as well as exercising governance.

Capacity Building: The teams that made up the PICK's team of actors constitutes front-liners, experts and volunteers who came from different backgrounds, beliefs and socio-political lines. The PICK depicts the Malaysian culture of "*gotong-royong"* in achieving a common goal of maximum population immunity. The focus toward "*breaking the difference*" and "*human rights for common cause*" effectively support the process of speeding immunisation and allowing the whole nation to open the economy in the *Green Growth* wave.

Knowledge gained from effective communication. The consistency and continuity of the CITF meetings allows for requisite information and decision making to be shared, understood and utilised for further actions. Open and transparent communication when delineating needs for changes in the SOPs and strategies over time develop the knowledge and preparedness of PICK members at all levels in handling the vaccination roll-out programme. In addition, the style of pivotal leadership seen in this case promote empowerment and authority at the state and PPV levels. To a certain extent, these practices speed up the learning curves of PICK implementers.

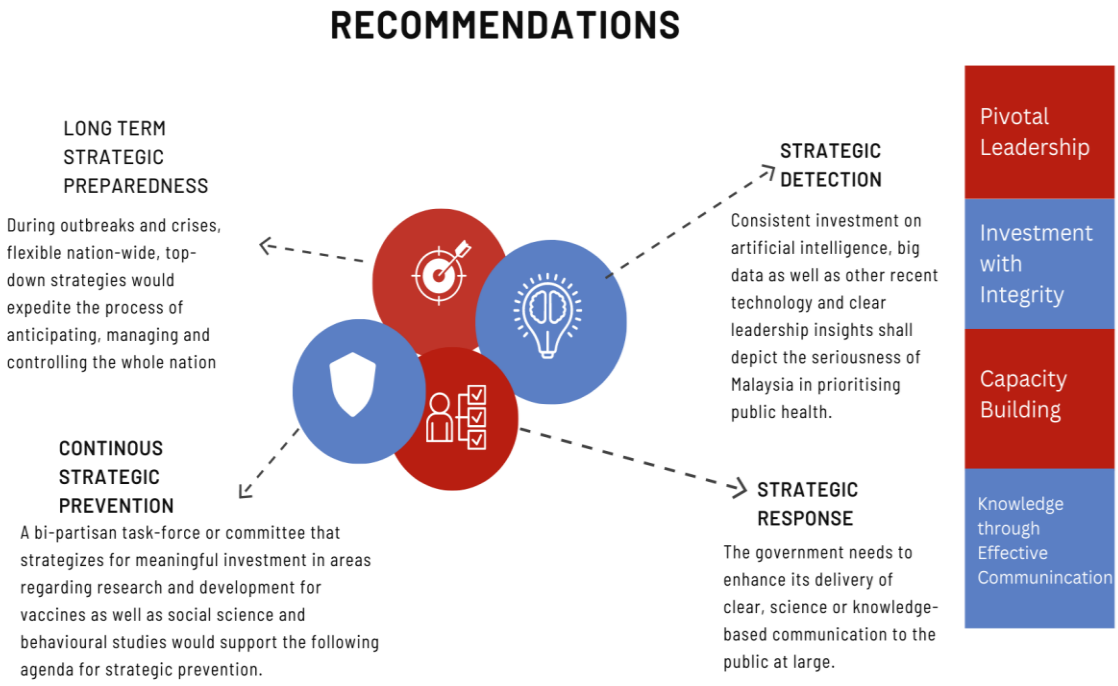
Figure 2. 5 The four-lesson learned (PICK)



2.6 RECOMMENDATIONS

In facing pandemic or similar crises, a nation should fundamentally raise resilience across four fundamental conditions, namely a) preparedness, b) prevention, c) detection and d) response. Refer Figure 2.6 below:

Figure 2. 6 Infographic for Recommendations



a) Long-term Strategic Preparedness

Although we are currently traversing the endemic phase of COVID-19, we suggest the government to continue developing **strategic preparedness** to similar pandemic or crisis. This could be done through an establishment of an enduring, long-term committee or task-force which responsibly develop strategic preparedness for the nation. It was learnt from this case that during the *Drought and Darkness* stage, the creation of strategies happened in an emergent manner. Undoubtedly, such a bottom-up, situational approach positively encourages a participative and realistic synergy. However, during outbreaks and crises, flexible nation-wide, top-down strategies would expedite the process of anticipating, managing and controlling the whole nation. Lesson learnt from the case constitutes elements of investment, capacity building and knowledge-based network of communication. These three elements are needed along the continuum of national long-term strategic preparedness with essences of pivotal leadership.

Among the points raised during the interview with YB Khairy Jamaluddin, was the needs for the country to nurture and bloom pivotal leaders along the middle and top echelons of Malaysia. Pivotal leaders, which are raised from pivotal followers are talents who ambidextrously effective in sustaining operational routines and strategizing preparedness for long-term horizons. According to him, leaders with consequentiality optimize their time in office/position to create positive strategic outcome and impacts

that reverberate and benefit maximum numbers of people across time.

b) Continuous Strategic Prevention

A bi-partisan task-force or committee that strategizes for meaningful investment in areas regarding research and development for vaccines as well as social science and behavioural studies would support the following agenda for **strategic prevention**. Investment (insulated with integrity) must be made to improve public health emergencies, digital technologies and logistics and supply chains as well as quality healthcare for public. From the case, we are proud of creating capacity building fundamentally built upon the concept of "*gotong royong".* To face other future pandemic, such a capacity building should broaden and expanded into more actors (among Malaysians) taking the roles at international and global effort for global pandemic surveillance or forecasting capabilities. Such actors foster the pipelines of pivotal leadership who has the calibres to anticipate, deal and control crises across our national ecosystem. This would lead ways for small countries such as Malaysia to gain equal opportunities and benefit from incentivized healthcare grants, technology transfers, and re-balancing of healthcare provision. The broad-based consistency in capacity building beyond national healthcare borders as well as investment on meaningful transdisciplinary research and development (encapsulating STEM, socio-economic lens) may add our national agility and resilience in facing future pandemic or related crises.

c) Strategic Detection

Investment should not only focus on drug discovery, but also rapid innovations in developing test-kits, drive-thru testing infrastructure as well as enhancement in triage and treatment. The next pandemic or other sort of viruses in future may be more threatening than COVID-19. Hence, the government of the day should not stay complacent with the current protocols and tools for real-time contact tracing as well as deployment of resources to detect those future possible healthcare threats. Consistent investment on artificial intelligence, big data as well as other recent technology and clear leadership insights shall depict the seriousness of Malaysia in prioritising public health. In return, improvement of strategic detection would lead to public confidence and trust our healthcare eco-system.

d) Strategic Response

Across the continuum of **strategic response**, the government need to enhance its delivery of clear, scientific or knowledge- based communication to the public at large. The rise of anti-vax, misunderstanding of the pandemic and vaccination as well as panic-driven society may be the results of low public awareness and education on scientific-based information. There is a need to intensify such knowledge-based programmes on television and related media as a way to decrease the potentials of relying on pseudo-truth information among the Malaysian society. Malaysians need to be encultured with the right information sources and readiness to face other uncertain crises.

2.7 LIMITATIONS

This study is not without its limitations. In completing this project, there are several identified challenges that cause limitations to the findings. The most challenging part is to have an engagement session with the leaders. From the elite list of interviews, only 2 out of 6 were successfully conducted. For the focus group, we managed to get five respondents, although they did not cover all Units at CITF. Constraints in obtaining engagement with the targeted CITF leaders contributed to a lack of rich narratives of their experience in steering the front lines of CITF. However, this constraint has been complemented through document analysis, i.e., through CITF meeting minutes and newspaper clippings.

2.8 SUMMARY

This case is intended to document workable strategies and tactics on the basis of the PICK programme for COVID-19. Similar crises and pandemic might occur in future. The experience attained in gaining maximum population immunity against the COVID-19 may not be applicable in totality as different health crises may generate contrasting spectre of waves and phases. Still, lessons learnt from this case calls for the urgency to start developing a continuous strategic preparedness. Such readiness requires a broader base of competent pivotal leaders, deeper investment, higher capacity building and clearer knowledge-based communication than what have been laid during the COVID-19 pandemic. Nothing could replace live. Thus, strategic preparedness would lead to improved prevention, detection and response to any crises or *black swan* in future.



CASE 3

SOCIAL AND ECONOMIC IMPACTS OF COVID-19 VACCINATION ROLL-OUT

3 SOCIAL AND ECONOMIC IMPACTS OF COVID-19 VACCINATION ROLL-OUT

3.1 INTRODUCTION

The COVID-19 pandemic is taking a heavy toll on Malaysian social and economic settings. Issues of job loss, living in poverty, equal access to education and food security are some of the challenges. Economically, COVID-19 has affected the micro-, small-, and medium sized enterprises (MSMEs) across all sectors, with salary payment, no customers and rental payment as the main challenges for business survival, and companies are looking for financial assistances of subsidies and tax exemption to survive. While the statistics from the Department of Statistics (2020), are estimating 42.5% of the business will require more than 6 months to recover, about 2% is expecting to close. Emergency responses and government actions together with industrial and community collaborations are in race to develop intervention programmes to provide a comprehensive support. There are variations of cross-sectional impacts of COVID-19, and the rapid pace of the Malaysian vaccination roll-out is offering a ray of socioeconomic hope and positive directions after a year of extended lockdowns. A statement by the International Monetary Fund (IMF) claims for a feasible global economic recovery. Yet, the United Nation Secretary General made a statement that the vaccination will not reverse the social and economic impacts of COVID-19 pandemics. The claim by the IMF is from the believe that the vaccines and treatment will create changes in the workplace and the chances of transmission reduction, without triggering repeated waves of infection. Somewhat less predictable are the many social changes associated with COVID-19 vaccination and the economic response to the immunisation programme. Although it is hard to estimate and quantify the values of COVID-19 vaccination, past studies which have confirmed on vaccines to reduce the burden of communicable disease indicated for significant improvements in the social and psychological wellbeing, and advancement to the economic development. Hence, it is worth to ask the question “With the availability of COVID-19 vaccination, how does it affect the social and economic conditions and what are the key priorities in building the recovery?”. It is important to assess, identify and examine how COVID-19 vaccination will impact the social and economic conditions and highlight the benefits in order to keep information and references of ongoing practical experiences, retain public trust in vaccination, to strengthen and revise, if necessary, policies and interventions and to redefine priorities in light of lesson learned and unresolved challenges.

COVID-19 vaccination has an important role for both preventing the spread of the pandemic and reducing societal and economic burden. The intervention works as a prevention to indirect costs, such as work absenteeism, loss of productivity and loss of jobs. Theoretical and empirical evidences have also demonstrated health has a major role as a significant driver to societal wellbeing and economic outcomes through higher productivity, improved educational attainment, social inclusion and mental health. However, the full economic and societal value of vaccination is complex to assess. Hence, the important facet of vaccination value comes from the indirect protection. In measuring the impacts, we should look at how the pandemic has impacted the social wellbeing and economic conditions. To the business and economy, most challenges and difficulties are the decline in demand, and challenges in supply of raw materials and human resources, lower production and employment levels. To the innovation and startups as part of the business and science, technology and innovation (STI) ecosystem, the key challenges are

negative impacts on ecosystem nodes and matching solutions to demand. To the society, the pandemics has affected the quality of life, the movement control order has affected access to education, thus influenced academic achievement, the loss of jobs has affected household income, thus impacted access to basic needs and security, and also the pandemics has affected the cognitive and physical health. Nevertheless, the vulnerable groups such as low-income households, youth and adolescence, women and low skilled workers are more susceptible to these challenges. Overall, there is an interconnectivity within the social and economic challenges of COVID-19, and how the vaccination would allow positioning the pandemic prevention as an effective strategy in the social and economic recovery. Investigating the value and benefits would promote and strengthen the role of vaccination, which is in line with the national agenda.

The above points to the overall research question being "With the availability of COVID-19 vaccination, how does it affect the social and economic conditions and what are the key priorities in building the recovery?". Hence, the objectives are:

1. To showcase how COVID-19 vaccination was promoted and enforced to the people.
2. To identify the impacts of vaccination initiatives to the economy and business.
3. To identify the impacts of vaccination initiatives to the society.

The case study used the mixed-method approach. For objective 1, data was collected from secondary sources to illustrate how government, businesses and community enforce or encourage vaccination to the people. This represents study 1. For the second objective, the approach was reviewing reports on economic development, a case on reopening of the tourism industry, and a survey on business performance and future plans. This represents study 2. For the third objectives, the main approach was a social survey, that represents study 3.

3.2 LITERATURE REVIEW

COVID-19 has resulted in a global health situation, devastating society and economy. When several COVID-19 cases were reported starting in November 2019, it quickly caught the World Health Organization's attention to declare a global pandemic alert in March 2020. Unfortunately, within three months of the pandemic declaration, over 15 million people were infected, and more than 500,000 death cases were reported worldwide (Mathieu et al., 2020). Since the cases were exponentially growing, health authorities had to enforce several confinement measures and restrict mobility to gain control over the outbreak of COVID-19. Due to these measures, the International Monetary Fund (2021) announced that the global economy was forecast to contract, on average, by 3 percent. Several studies expressed that the global economic contraction sharply affected countries such as the United Kingdom, Spain, and Italy, with a GDP decrease of at least 10 percent (Fernandes, 2020; McKibbin & Fernando, 2020). However, the United Nations (2022) stresses that top economists warn that the severe and long-lasting impact of COVID-19 on developing countries should be the international's top priority.

The Malaysian economy has been negatively harmed by the COVID-19 outbreak. The unemployment rate, depreciation in Malaysian Ringgit against USD and substantial

production disruptions can demonstrate the economic severity. The unemployment rate was recorded at 3.2% in January 2020, but it was rising steadily during the rest of the year, reaching 4.6% by April 2021 (Department of Statistics Malaysia, 2022). On the other hand, the foreign exchange rate can be used to estimate the relative degree of economic health. This is due to the fact that a country's level of trade is significantly influenced by the foreign exchange rate. Malaysia's currency rate for March 2019 was RM4.08 for every USD, and by July 2020 the rate dropped to RM4.26 for every USD. Malaysia's currency rate reported a further decline at RM 4.46 for every USD in August 2022 (Bank Negara Malaysia, 2022). Meanwhile, in April 2020, Malaysia's exports reported a decline of 23.8% year on year, the worst performance since the global financial crisis in 2009 (Department of Statistics Malaysia, 2020). The reductions are due to preventive measures taken by policymakers to slow down the spread of COVID-19.

In Malaysia, specifically, the first COVID-19 case was reported in January 2020, involving travellers from China who entered Johor Bahru, Malaysia. From there, Malaysia reported more than 6,000 infection cases, with more than 100 death cases (Lee-Peng et al., 2021). Multiple modifications to the Movement Control Order (MCO), such as Restricted MCO (RMCO), Conditional MCO (CMCO) and Enhanced MCO (EMCO) by the Government were intended to minimise the impact of the COVID-19 sudden waves on the Malaysia's economy and save lives. However, Malaysia's economy still ventured into negative GDP growth at -17.2 percent in 2020 and contracted by 0.5% for the first quarter of 2021, after the second MCO took place. In comparison to other industries in Malaysia, the hotel industry was one of the most impacted industries, with a revenue loss of more than RM60 Million (Malek, 2020).

The closure of airlines and the entertainment industry resulted in hotel owners barely surviving in the markets. The hotel industry was estimated to have a revenue loss of over RM5 billion since the beginning of 2021 (Zerin Properties Corporate Valuers, 2021). Multiple measures were taken to reduce costs and maintain their survival, such as downsizing by retrenching workers and paying half of the worker's salaries, which led to an increase in the unemployment rate in Malaysia (Zubair & Shamsudin, 2021). More than 170,000 room cancellations during the MCO, including one of Malaysia's top tourist island destinations, Langkawi. Despite the Langkawi Development Authority (LADA) making strategic plans to recover the Langkawi economy, the continuous rising of COVID-19 cases are the challenge for the island market players to stay vigilant. Statistically, the number of visitors dropped at least 30 percent from 2019 as of August 2020, Mustafa et al. (2021) and the hotel industry in Langkawi was still unable to secure bookings to recover from the surging COVID-19 cases.

Immunisations before travelling contribute to the risk reduction of the COVID-19 contraction or spreading among travellers. Host and environmental factors determine the risk of infection by COVID-19 while travelling. According to Jayasundara et al. (2021) Malaysia relies on an effective vaccination programme for safe travel, considering little natural population immunity is attributable to months of under-controlled transmission. Consequently, introducing the Malaysian National COVID-19 Vaccination Roll-Out Programme to achieve herd immunity remains the key to a full economic recovery, including uplifting national restrictions. The programme is a strategic immunisation programme initiated by the Government. It involves numerous Ministries, Government Agencies and private sectors to ensure that it runs safely and efficiently to curb and end

the COVID-19 pandemic. A newly established committee, The Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJAV), which is co-chaired by the Minister of Health (MOH) and Minister of Science, Technology and Innovation (MOSTI), was established to ensure timely access to COVID-19 vaccines for Malaysia.

The Government leveraged on its diplomatic relations and international cooperation for an integrated and structured approach to acquiring vaccines for Malaysia, including from vaccine manufacturers and world health bodies and associates. Five types of vaccines were strategically planned to be acquired, which were 32 million Pfizer, 12.8 million AstraZeneca, 12 million Sinovac, 3.5 million CanSino BIO and 6.4 million Sputnik V vaccines (The Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJAV), 2021). With the vaccines acquired, the programme strategically aimed to vaccinate 80 percent of Malaysians to achieve herd immunity by February 2022. Three vaccination phases were implemented to target different groups starting with the highest priority group (medical workers, senior adults aged 60 and above) to the lowest priority group (adults aged 18 years and above). Nonetheless, due to the increasing awareness of the importance of vaccines, the delivery and completion of the National COVID-19 Vaccination Roll-Out Programme goals were achieved earlier than scheduled (November 2021).

Another value-added initiative taken by the Government to ensure the success of the National COVID-19 Vaccination Roll-Out Programme is funding local vaccine researchers and development for COVID-19 through the MOSTI Combating COVID-19 Fund (MCCOF) to two academic institutions, which are Universiti Malaya (UM) and Universiti Putra Malaysia (UPM). This research is also one of the value-added initiatives to understand the impact of the national roll-out programme on the hotel industry and small businesses conducted by the Universiti Teknologi MARA (UiTM). Understanding that the vaccination roll-out is the key to the strength of the recovery in the Malaysian economy, it was well accepted by the majority of Malaysians, leading Malaysia to become one of the fastest nations globally for daily vaccination rate per capita (PwC, 2021). While receiving positive reactions from the Malaysians on the programme, the Government took a step further to help support the most affected industries during the pandemic, which include the tourism industry. One of which was the Langkawi Island Travel Bubble for domestic travellers that took place in September 2021.

3.3 STUDY 1: COVID-19 VACCINATION ENFORCEMENT

There were numerous programmes and strategies laid out to promote vaccination programme. Few of the samples are exhibit in the following illustrations: selected COVID-19 enforcement initiated by the government.

3.3.1 COVID-19 Immunisation Task Force



The COVID-19 Immunisation Task Force (CITF) was established on February 3, 2021, and led by the Ministry of Science, Technology, and Innovation. The objectives of the establishment were to coordinate the National COVID-19 Immunisation Program (PICK), to expedite vaccination of the country's adult population, and to accelerate the recovery of the country's economy. CITF comprehensive governance approach involved a number of ministries and government agencies, state governments, non-governmental organization, members of the community and private agencies. CITF was responsible for the coordination of various vaccination strategies and implementation actions, between the federal and state government, mobilization of civil servants and volunteers to vaccination centres, and monitoring of PICK through the use of geo-data analysis.

Source : https://www.mosti.gov.my/en/citf/

3.3.1 COVID-19 Portal: https://COVID-19.moh.gov.my/



The portal https://COVID-19.moh.gov.my/ was initiated as a platform to disseminate information about COVID-19, vaccination, guideline, research, multimedia and infographics, hotline, frequently asked questions and standard operation procedure.

3.3.2 MySejahtera Application

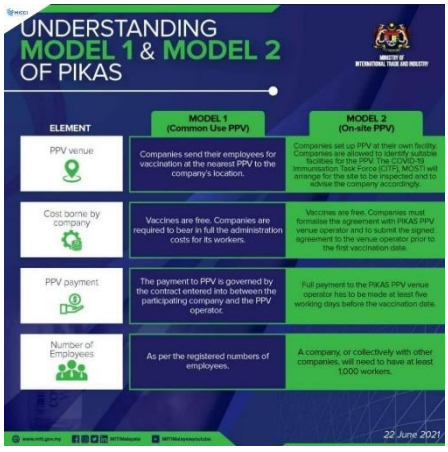
MySejahtera Application is an application which was originally developed to assist the Government in managing the COVID-19 outbreak in Malaysia by among others, allowing the App users to perform a self-health assessment, monitor health status and share the information with the MOH so necessary actions could be implemented.

The app functions are:

- View COVID-19 risk status and latest swab of the users and dependent(s)
- View and download COVID-19 vaccination certificate and their dependent(s)
- Report COVID-19 Self-Test Result and their dependent(s)
- Receive COVID-19 vaccination appointment
- Fill in Pre-Departure Form for Travellers abroad and view Traveller card
- View child's vaccination certificate in the National Immunisation Programme
- View health screening record
- Track number of Infectious Diseases within the user's location
- Locate nearby Healthcare Facilities
- Receive latest health and wellness news updates
- Receive push notifications regarding health alert

Source : *https://mysejahtera.moh.gov.my/ms/tentang-mysejahtera/polisi-privasi*

3.3.3 Program Imunisasi Industri COVID-19 Kerjasama Awam-Swasta (PIKAS)



The Special Committee on COVID-19 Vaccine Supply Access Guarantee (JKJAV) co-chaired by the Ministry of Science, Technology and Innovation (MOSTI) and Ministry of Health (MOH) agreed that the Program Imunisasi Industri COVID-19 Kerjasama Awam-Swasta (PIKAS) was to be launched to complement National COVID-19 Immunisation Programme (PICK) to accelerate immunisation of the *Rakyat*. PIKAS aimed at employees of companies which MITI has been tasked to coordinate the immunisation programme for economic sector.

Source : https://www.miti.gov.my/miti/resources/PIKAS/FAQ_PIKAS_06_July_2021.pdf

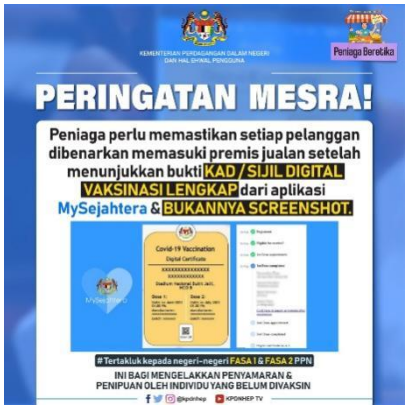
Several other ministries were also responsible for their respective sectors. The objective of this public-private programme is to facilitate the Government's efforts to accelerate vaccination for the *Rakyat* and achieve herd immunity by increasing the vaccination uptake among the Malaysian work force and reduce the number of COVID-19 workplace clusters. This would protect the well-being of employees and consequently help expedite Malaysia's economic recovery. PIKAS is a public-private partnership programme supported by the private sector that will provide the usage of worksites, convention and exhibition centres as *Pusat Pemberian Vaksin* (PPV) that includes the services of both medical, non-medical and security personnel.

3.3.4 Social Media JKJAV (Facebook, Twitter, Instagram)

Social media platforms including Facebook, twitter and Instagram have been established by Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJAV) to connect community with up-to-date information about the National COVID-19 Immunisation Programme. The social media engagement has allowed for open communication between the citizens and the task force. Likewise, the use of social media has shaped COVID-19 vaccination positive attitudes, and it acts as public health intervention to address the issue of vaccine hesitancy.

Source : https://twitter.com/jkjavmy?lang=en,
https://www.facebook.com/jkjavmy/,
https://www.instagram.com/jkjavmy/?hl=en

3.3.5 Permission to Enter Premises



Source : KPDNHEP Laman Rasmi



Source : https://COVID-19.moh.gov.my/infografik

During the pandemic, each individual must show the vaccination status, and their current health record from the MySejahtera app. The main goal was to prevent the spread of the infection by increasing compliance of the new norm. Indirectly, the regulation worked as an approach to increase awareness on the importance of COVID-19 vaccination.

3.3.6 Song: Lindung Diri Lindung Semua

Lindung Diri, Lindung Semua was the theme for the national COVID-19 Immunisation Programme which emphasized protection for all Malaysians; only to be achieved if vaccination reached its target. The idea was when each individual was vaccinated, they can protect the people around them from any infection that the individual may be the carrier. With vaccination, a network of protection could be built to protect each other. The promotion strategies included song with the title "Lindung Diri, Lindung Semua".



Artist: Alif Satar & The Locos
Composer & Lyricist: Sundara Raj

Lindung Diri, Lindung Semua

Tiap hari penuh cabaran
Menghadapi ketidaktentuan
Lindung diri
Lindung semua

Norma baharu realiti
Kita semua kan menghadapi
Lindung diri
Lindung semua

Lindung diri
Lindung semua

Perjuangan demi negara
Capai kejayaan bersama
Lindung diri
Lindung semua

Marilah kita bersama
Vaksinasi akan menyelamatkan kita
Ayuh semua sekeluarga
Kawan-kawan dan jiran tetangga

Sokong usaha umunisasi
Kita semua kan menghargai
Lindung diri
Lindung semua

Lindung diri
Lindung semua

Mari kita berganding tangan
Satu negara satu tujuan
Menghadapi sebarang cabaran
Membangun dengan penuh keyakinan

Pabila kita berjaya
Semua selamat dan ceria
Lindung diri
Lindung semua

3.4 STUDY 2: REPORT ON IMPACTS OF COVID-19 VACCINATION ROLLOUT ON ECONOMIC DEVELOPMENT

Malaysia's former Prime Minister (PM), Tan Sri Muhyiddin Yassin and Health Director-General Tan Sri Dr Noor Hisham Abdullah were the earliest individuals to be inoculated with vaccines (Pfizer-BioNTech) during the first phase of the National COVID-19 Vaccination Rollout, on 24 February 2021. The core objective of the vaccination roll-out was to ensure Malaysia to achieve herd immunity against the COVID-19. Assisted by the Vaccine Supply Access Guarantee Special Committee (JKJAV) to ensure sufficient vaccines supply for the vaccination roll-out, the vaccination roll-out includes four key components, namely vaccine supply; target groups and phases of vaccination; locations and methods of implementing the programme; and manpower for its implementation.

Three key phases were implemented to achieve herd immunity in Malaysia. The first phase took place from February (Quarter 1, 2021) to April 2021 (Quarter 2, 2021), covering the highest priority groups: public and private sectors healthcare front-liners, essential services, defence and security personnel front-liners, which was estimated to be around 500,000 individuals. The second phase took place from April (Quarter 2, 2021) to August 2021 (Quarter 3, 2021), covering two groups: 1) remainder of healthcare front-liners, and essential services, defence and security personnel, and 2) senior citizens (those aged 60 and over), high-risk group with chronic diseases such as heart-disease, obesity, diabetes and high-blood pressure and people with disabilities. Estimation of individuals were 9.4 million. The third phase, which is also the highest number of individuals (13.7 million) receiving vaccines. The third phase took place from August 2021 (Quarter 3,2021) to February 2022 (Quarter 2, 2022), targeting individuals aged 18 years and above (citizens and non-citizens) with priority given to those living in the red zone, followed by yellow and green zone. Figure 3.1 shows the vaccination roll-out chart and Table 3.1 shows the new doses on quarterly basis.

Figure 3. 1 Vaccination Roll-out Chart

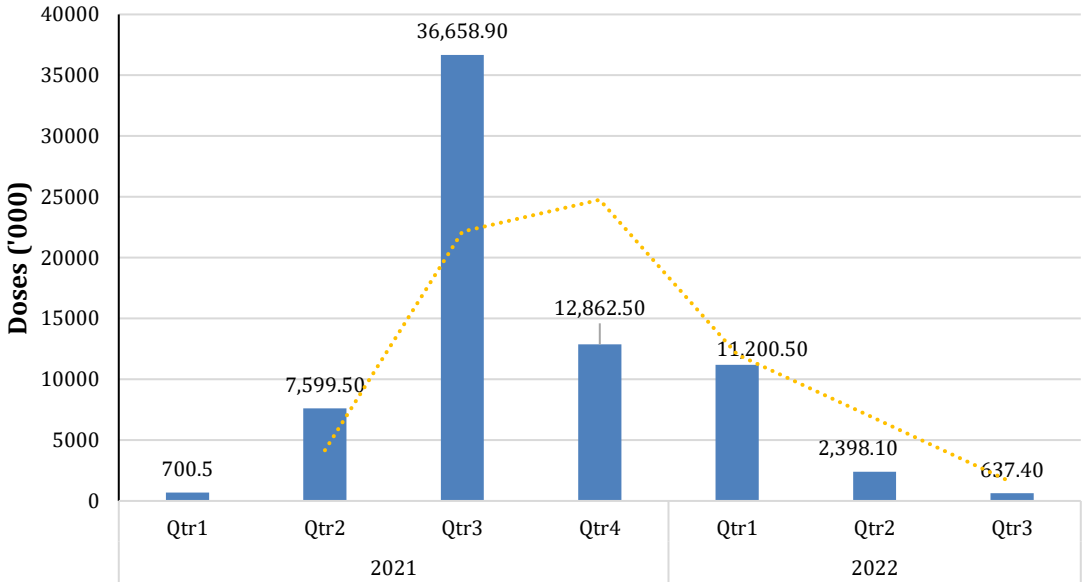


Table 3.1 Actual Total of New Doses (Quarterly)

Year	Quarter	Doses ('000)
2021	Qtr1	707,506
	Qtr2	7,599,520
	Qtr3	36,658,876
	Qtr4	12,862,479
2022	Qtr1	11,200,541
	Qtr2	2,398,081
	Qtr3	637,397
	Total Doses	**72,064,400**

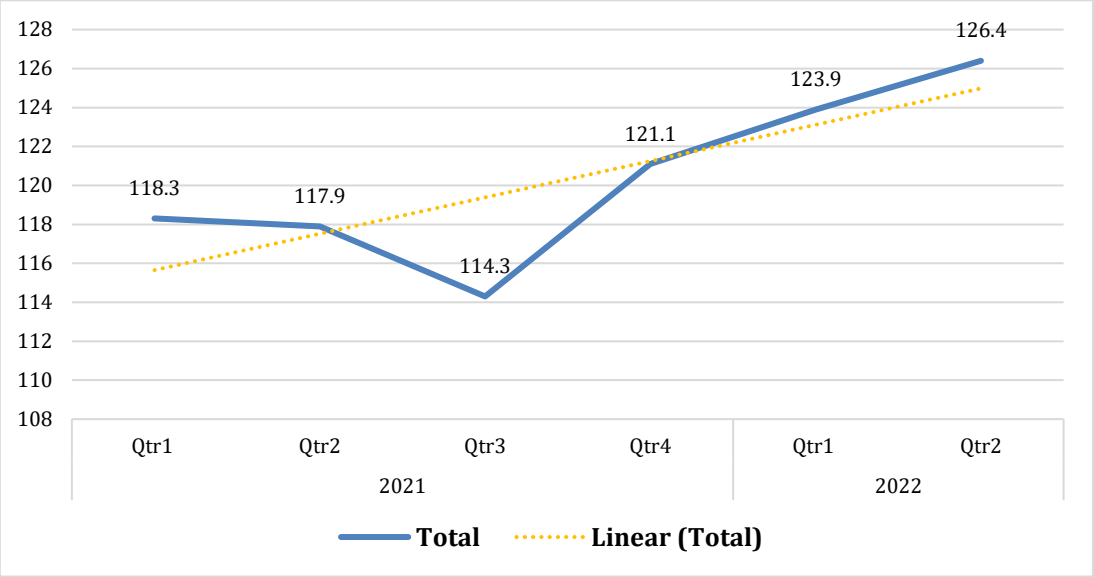
Source : COVIDNOW (link: https://COVIDnow.moh.gov.my/vaccinations/)

Explanations will be based on the following economic indicators, starting with Figure 3.2.

- Impact of COVID-19 Vaccination Rollout on Industrial Production Index (IPI).
- Impact of COVID-19 Vaccination Rollout on Export.
- Impact of COVID-19 Vaccination Rollout on Gross Domestic Product (GDP).
- Impact of COVID-19 Vaccination Rollout on Unemployment Rate.
- Impact of COVID-19 Vaccination Rollout on Consumer Price Index (CPI).
- Impact of COVID-19 Vaccination Rollout on Overnight Policy rate (OPR).

The vaccination roll-out programme is found to have a significant role to reduce societal and economic burden in Malaysia. Although it may not have a direct impact to the economy, the important facet of vaccination value derives from its indirect protection to individuals and the containment of COVID-19. Understanding that the endless movement control orders (MCOs) due to the pandemic had resulted to challenges in products demand and supplies, loss of jobs, which affected household incomes and decline in physical health, the vaccination roll-out programme is seen as a strategic solution to overcome the social and economic challenges of COVID-19. In this report, we discuss several economic indicators seen to be showing positive outcomes in response to the vaccination roll-out programme. The economic indicators are the IPI, export, GDP, unemployment rate, CPI and OPR.

Figure 3. 2 The Industrial Production Index (IPI)



Source : Thomson Reuters Eikon Datastream

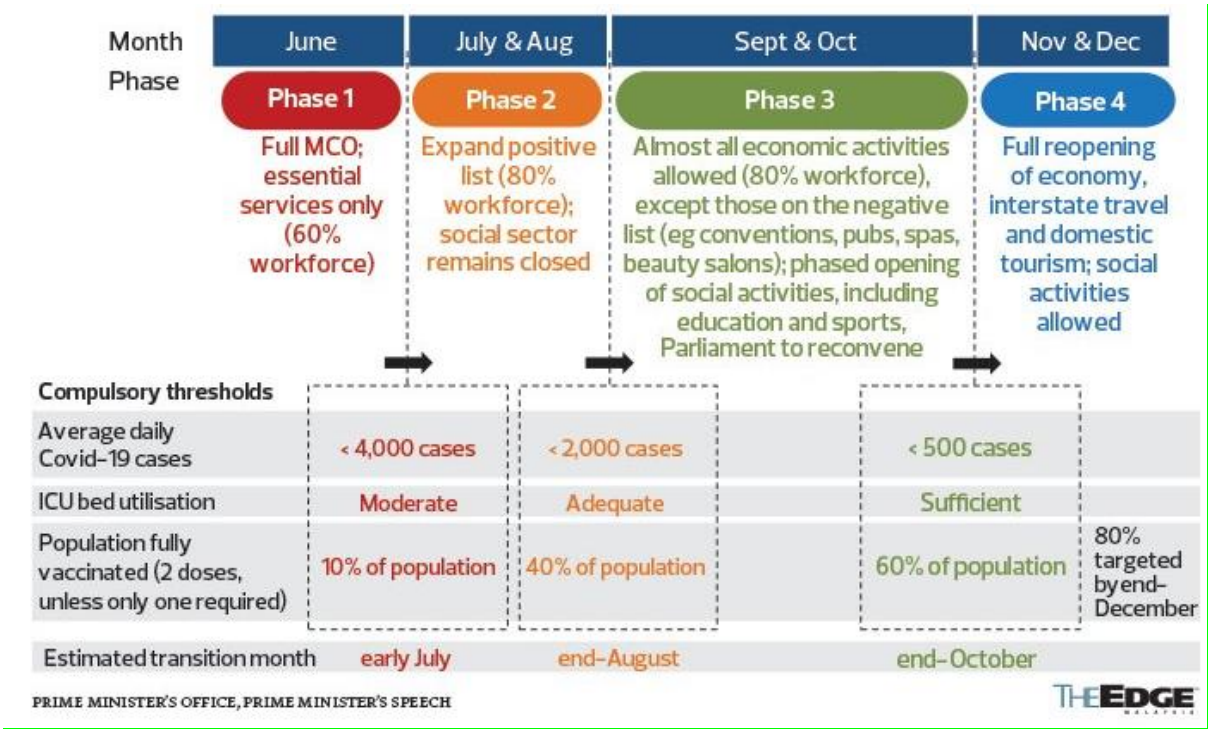
The output of companies involved in the industrial sector of the economy, such as manufacturing, mining, and utilities, is measured in Malaysia as industrial production. The Industrial Production Index (IPI) (Figure 3.2) is a gauge of how quickly industrial output production has changed over time in real terms. In other words, production volume changes are used to measure it. IPI stands for the Indicator of Mining, Manufacturing, and Electricity, which is the total index. Overall, IPI provides a summary of the current industrial activity trend.

During the observation period, IPI dropped to 117.9 basis points in Quarter 2, 2021 as compared to the same year of the previous quarter (118.3 points). The drop to 114.3 points is further reported in Quarter 3 of the same year. The consistent drop in IPI during the first half of 2021 was mainly contributed by the manufacturing sector, the most affected sector since the country was hit by the COVID-19 outbreak, according to the Ministry of International Trade and Industry (MITI). This occurred as a result of the sector being prohibited from fully operating during the Movement Control Order (MCO) 's to curb COVID-19 transmission. Note that, Malaysia was still under the Phase 3 of MCO in the first quarter 2021 which it switched between MCO, CMCO, RMCO, EMCO, and semi-EMCO until 31 May 2021, depending on the COVID-19 condition in each state.

The businesses in manufacturing sector contributed to the drop in IPI includes transport equipment and other manufacturing; non-metallic minerals, base metals & engineered metals; wood, furniture, paper products and printing; and textiles, clothing, leather & footwear. Data from Department of Statistics Malaysia (DOSM) for IPI of the manufacturing sector showed a decrease of 0.2 percent in June 2021 after recording a growth of 29.8 percent in May 2021. The decline in the IPIs reported in the line chart is consistent with the shutdown of these industries throughout the MCO, where they were only permitted to leave their equipment on standby (warm idle) for the cement, ceramics, glass, iron, and steel industries. Meanwhile, throughout the MCO period and Phase 1 of the National Recovery Plan (NRP), other industries including wood, furniture, textiles, and clothes were still prohibited from operating.

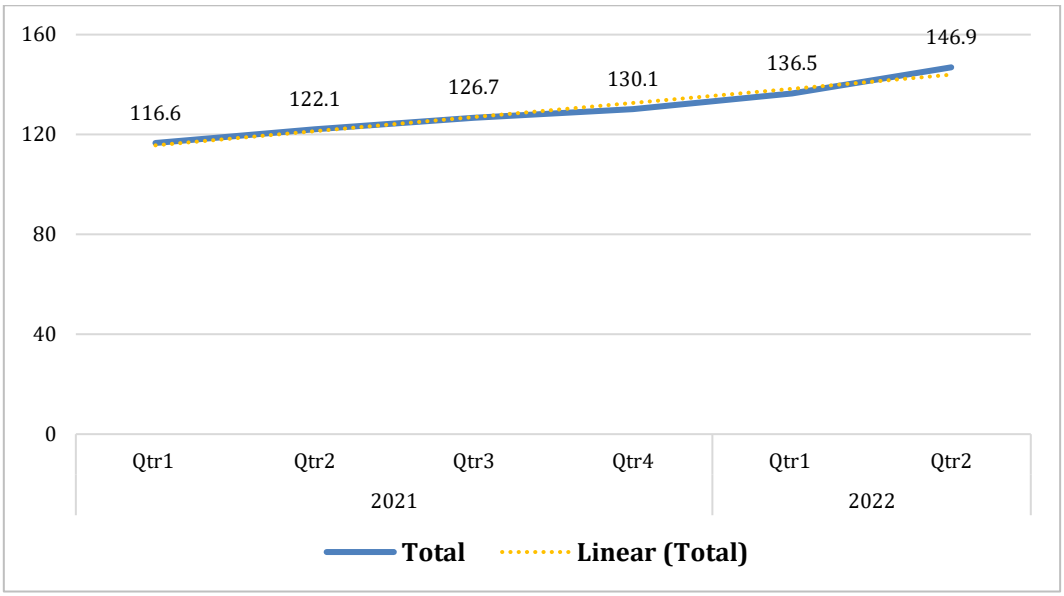
Note that, on 15 June 2021, Former Prime Minister Tan Sri Muhyiddin Yassin introduced a four-phase National Recovery Plan (Illustration 3.1) to mainly aid the nation's recovery from the COVID-19 pandemic and its effects on the economy, which Phase 1 of the NRP took place between 1 June 2021 to 1 October 2021. NRP has set an indicator of the number of new daily COVID-19 cases and vaccination rates to gauge the government's readiness to fully allow the economic sectors to operate at their optimum capacity. Notably, vaccination roll-out reached its peak in Quarter 3, 2021 with a total of 36,658,876 doses were given to Malaysians, seeing around 66 percent of the country's population were already vaccinated. The vaccination percentage surpassed the 40 percent of the country's population used as an indicator for the staggered opening of sectors for their full operation. On 23 September 2021, petrol stations, restaurants, eateries, and convenience stores were allowed to operate from 6am to 12 midnight, making the demand of manufactured raw products started to increase and portraying positive outlook of IPI in Malaysia.

Illustration 3.1 The National Recovery Plan



The expansion of IPI is reported beginning Quarter 4, 2021, with the increment of 6.8 points to 121.1 points in the quarter. Industrial production in Malaysia expanded by 2.5 points to 126.4 points in Q2, 2022, following 2.8 points rise (to 123.9 points) in the previous quarter (Q1, 2022). This expansion of IPI may offer an additional support to the significance of the vaccination roll-out programme in Malaysia as IPI evidently shows positive outcomes in response to the percentage of the country's population were vaccinated. At end of April 2022, 70 percent of adult population have already received their third dose, according to the World Bank Blogs. The percentage may not only show Malaysia's strong commitment and success in achieving herd immunity through its vaccination roll-out programme but also a significant milestone to reduce economic burden in Malaysia during the pandemic.

Figure 3. 3 Export Index



Source : Thomson Reuters Eikon Datastream

An export price index (EI) (Figure 3.3) is a measure of the prices of one or more commodities that are traded internationally and is, ideally, computed using export prices. An export price index monitors variation in the cost of goods exported from a country to international counterparts. In Quarter 1, 2021, Malaysia's exports recorded 116.6 basis points, the lowest during the observation period of this project, amid the lockdown measures in many countries that affected technical and trade-related activities. The lowest EI in Malaysia is consistent to the lowest IPI reported in the earlier section, making it to contribute the lowest to the Malaysia's Gross Domestic Products (GDP), which is again as a result of the businesses being prohibited from operating during the MCOs.

While export of products reported at its lowest in the earliest quarter of observation, the positive export growth started to portray its trend in Q2, 2021. EI increased to 122.1 basis points in Quarter 2, 2021 as compared to the same year of the previous quarter (116.6points). The rise to 126.7 points and 130.1 points is further reported in Quarter 3 and Quarter 4 of the same year (2021), respectively. The Department of Statistics Malaysia's (DOSM) chief statistician, Mohd Uzir Mahidin, said in a media release dated June 9, 2021 that the positive export increase represented a wider recovery from the pandemic's adverse impacts. The diversification of exports, the reduction of supply-chain interruptions, the fulfilment of backlog orders, and the release of bottled-up demand may all be responsible for the EIs rise. Another key factor behind the increase in general economic activity was the increment in the percentage of the population in Malaysia who were fully vaccinated against COVID-19. The 66 percent of the vaccinated population in Quarter 3, 2021 caused the relaxation of lockdown restrictions over the course of the month, which saw many businesses reopen and internal travel increase (DOSM, 2022).

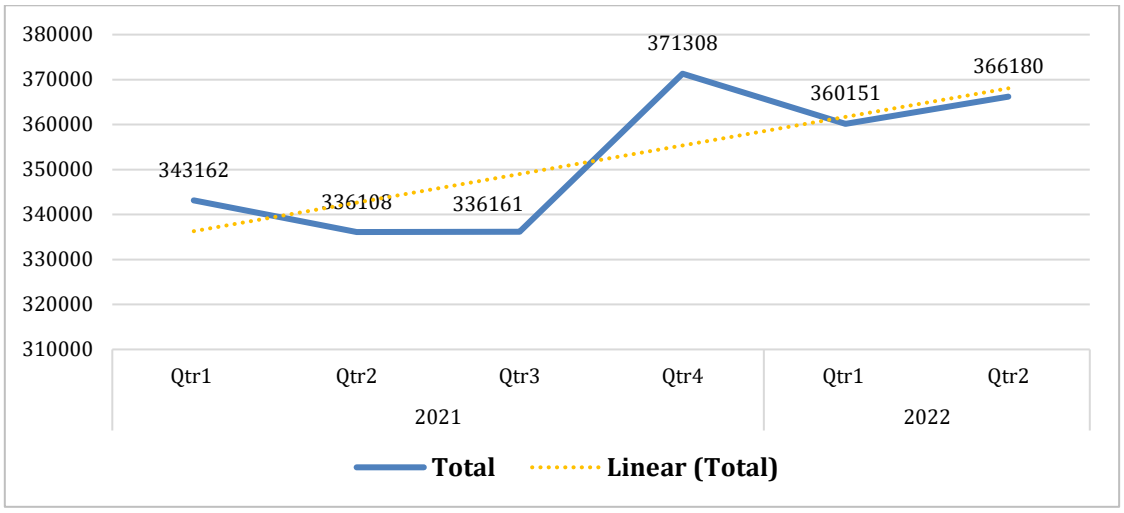
Malaysia's EI expanded further in 2022, with the increment of 10.4 points to 146.9 points in Q2, 2022, following 6.4 points rise (to 136.5 points) in the previous quarter (Q1, 2022). While the export indexes were a pleasant news for many in Malaysia, there has been significant discussion over whether the comeback represents the first indications of an

economic recovery or is merely a temporary blip. Nonetheless, seeing consistent increments in the percentage of vaccinated population in Malaysia and the continues preventive measures taken by the government to avoid the unnecessary sudden waves of COVID-19 cases in coming months, Malaysia's export continues to show its favourable trend. In specific, Malaysia's exports remained strong with a new high value of RM146.2 billion, went up by 38.8 per cent in June 2022, according to DOSM.

The favourable performance of Malaysia's export was driven by increases in domestic exports 30.6 per cent and accelerated growth of re-exports with 72.2 per cent. Domestic exports, which totalled RM110.6 billion and contributed 75.7 percent of total exports, outpaced re-exports, which totalled RM35.6 billion and contributed 24.3 percent of total exports. On the other hand, exports recorded an increase of 21.3 percent as compared to May 2022. Analysis of the seasonally adjusted terms month-on-month (m-o-m), exports rose by 19.5 percent (+RM24.4 billion) to RM149.8 billion (DOSM, 2022).

Despite the strong EIs growth in Malaysia since Quarter 1, 2021, economists are concerned that slower global growth could hurt Malaysia's trade outlook for the second half of 2022. Risks could come from weaker global demand amid rising global inflation, a weak recovery in China following the COVID-19 lockdowns earlier this year, in addition to a possible sharp slowdown in the US due to aggressive monetary tightening and a shortage of raw materials or supply chain disruption in some sectors. The Malaysian Industrial Development Finance Berhad (MIDF), nonetheless, foresees sustained recovery in the global economy as most countries have reopened their economies after the COVID-19 pandemic.

Figure 3. 4 Gross Domestic Product (GDP) Index



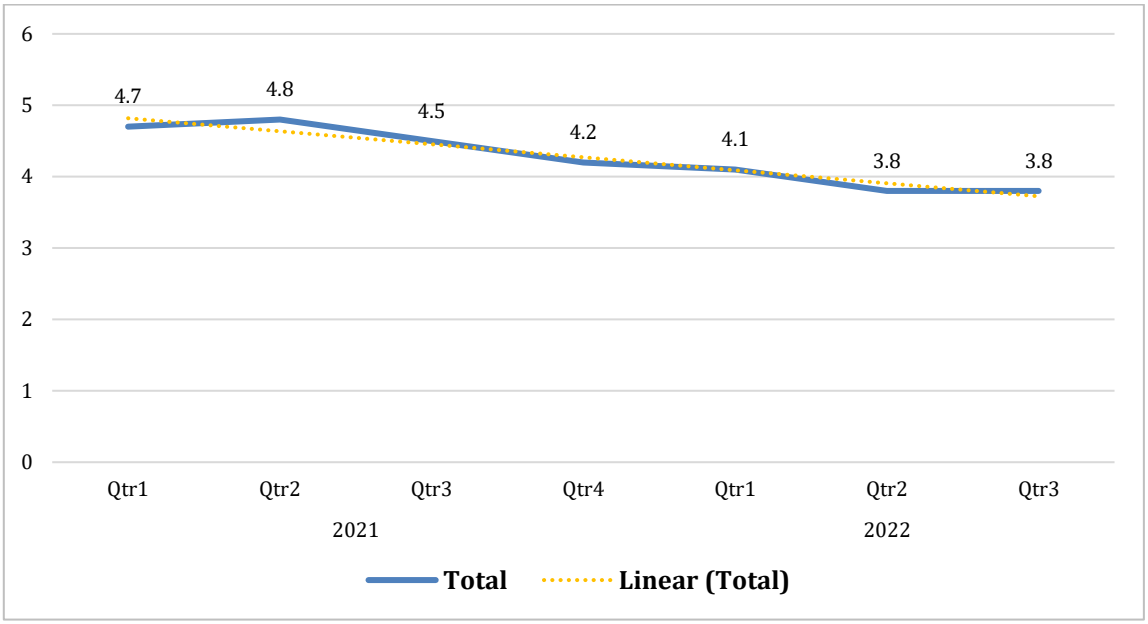
Source : Thomson Reuters Eikon Datastream

Gross domestic product (GDP) (Figure 3.4) is the standard measurement of the value added produced through the production of goods and services in a country over a certain time period. GDP serves as a thorough assessment of the state of the economy in a particular country since it is a broad indicator of total domestic production. Referring to the line chart, Malaysia's GDP grew by 53 basis points (from 336,108 to 336,161 basis points) in the third quarter of 2021 (Q3 2021), compared to a 7,054 points contraction (from 343,162 to 336,108 basis points) in the earlier quarter (Q2) during the same year. Quarterly GDP growth in Malaysia continues to be in positive territory for Quarter 4, 2021 with an increment of 35,147 basis points (from 336,161 to 371,308 basis points). This demonstrates a strengthening of the country's economic recovery momentum, which was further elevated by the roll-out of booster doses under the National vaccination programme and the transition of the entire country to Phase 4 of the NRP. Malaysia's GDP continued with a recovery momentum in Quarter 2, 2022, following an encouraging growth of 8.9 percent (from 336,108 to 366,180 basis points) between Quarter 2, 2021 and Quarter 2, 2022. Overall, Malaysia's GDP performance during the observation period of this project showed signs of improvement, with notably a temporary contraction of 11,157 points from Quarter 4, 2021 to Quarter 1, 2022.

According to Finance Minister, Tengku Datuk Seri Utama Zafrul Tengku Abdul Aziz in a media release dated February 11, 2022, the economy's commendable performance in Quarter 4, 2021 was accompanied by labour market improvements as the unemployment rate fell to 4.2 percent, and manufacturing sales increased by 15.5 percent in December, 2021. Further economic expansion in Malaysia is anticipated to be supported by the continuous loosening of movement restrictions as well as more dynamic economic and social activities that are in line with robust domestic and international demand. The on-going positive business and consumer sentiments are also bolstered by high vaccination rates in Malaysia, where at present (September 22, 2022), more than 84 percent of the entire population is fully vaccinated and more than 98 percent of the adult population have received 2 doses of their vaccination, according to the MOH.

Moving forward, as added by the finance minister, the government will also keep a close eye out for any inflationary pressures, primarily with regard to foods, and make sure that steps are taken to allay people's fears about their standard of living. In order to ensure that Malaysia's economic growth is sustainable and resilient in the medium and long term, the government will remain responsive to immediate requirements while staying financially prudent and strategically reformed. The government's commitment seems to guarantee a continued positive outlook in Malaysia's GDP at least for the medium term.

Figure 3. 5 Unemployment Rates (UR)



Source : Thomson Reuters Eikon Datastream

Unemployment rates (UR) (Figure 3.5) refers to the percentage of the labour force that is unemployed yet looking for work. The rates are measured in numbers of unemployed people as a percentage of the available labour force and it is seasonally adjusted. The battle against COVID-19 pandemic continued throughout the first half of 2021, resulting to the recovery process for the economy and the labour market was, in part, hampered by the pandemic's effects. Accordingly, the Malaysian labour market continues to face difficulties. In addition, the continued adoption of MCO in June 2021 created certain obstacles for the labour market to restore its pace by only allowing the operation of critical services while tightening travel restrictions. As exhibited in the line chart, Malaysia's UR elevated to 4.8 percent in Quarter 2, 2021 as compared to the same year of the previous quarter, Q1 (4.7 percent).

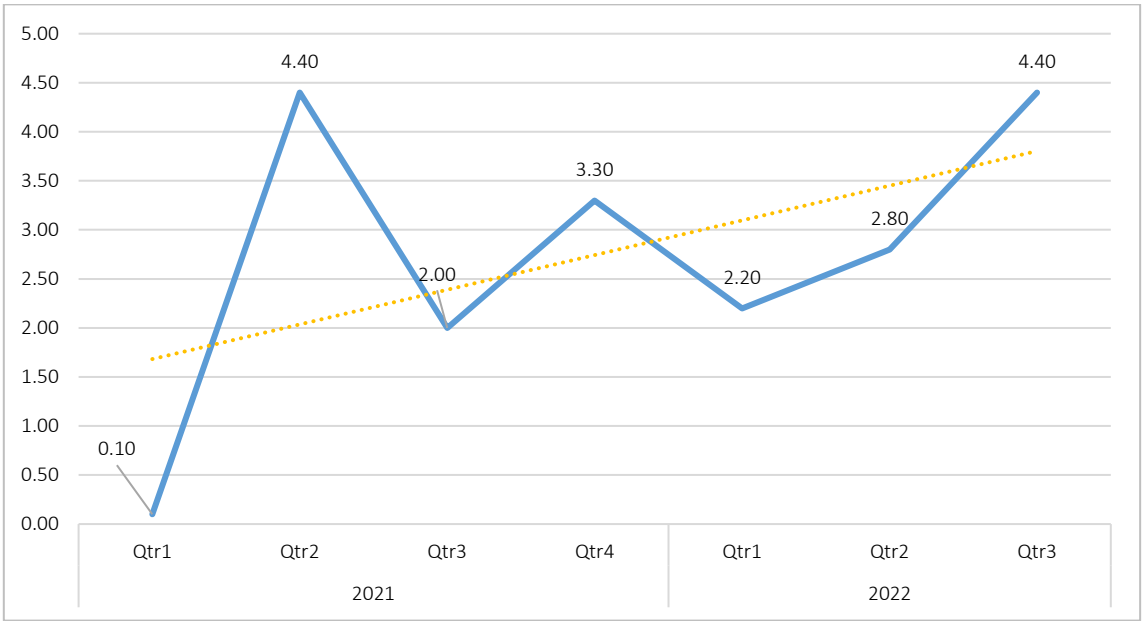
The continued restoration of economic operations with extended business hours together with permission for social activities and inter-state travel starting in Quarter 3, 2021, as the majority of states were in Phase 4 of the NRP, had greatly stimulated Malaysia's economic performance. As a result, Malaysia's labour force started to regain momentum towards recovery in the second half of 2021. Note that, Malaysia's UR started to report a drop by 0.3 percent in Quarter 3, 2021 (from 4.8 percent to 4.5 percent). The drop in UR continues to 4.2 percent in Quarter 4, 2021, demonstrating a hope for sustainable recovery in the Malaysian labour market. Comparatively, the start of Malaysia's UR's upbeat is consistent with the favourable trend of IPI, EI, and GDP

recorded starting in Quarter 3, 2021.

Looking ahead to the year 2022, according to the Labour Force Survey Report dated April 27, 2022, the national labour market had been improving steadily since January 2022 and is now on the road to recovery. Evidently from the line chart, Malaysia's UR reduced further in 2022, with the decrement of 0.4 percent (to 3.8 percent) in Q3, 2022, following 0.1 percent drop (to 4.1 percent) in the previous quarter (Q1, 2022). This could be explained by the easing of socioeconomic constraints after the country's transition to Phase 4 of the NRP. Businesses are again permitted to operate during pre-pandemic hours following the encouraging percentage of vaccinated population in Malaysia and the shift to endemic phase which was taken place on April 1, 2022.

The news on the shift to endemic phase which coincides with the fasting month of Ramadan and the subsequent Eid festival also has influenced demand for goods and services in the first half of 2022. Accordingly, these positive outlooks aided in the employment of additional workers, the creation of new jobs, and ultimately gave the economy a boost. As the economy continues to grow, it is expected that the labour market in Malaysia would continuously pick up the pace of recovery in coming quarters.

Figure 3. 6 Consumer Price Index



Source : Thomson Reuters Eikon Datastream

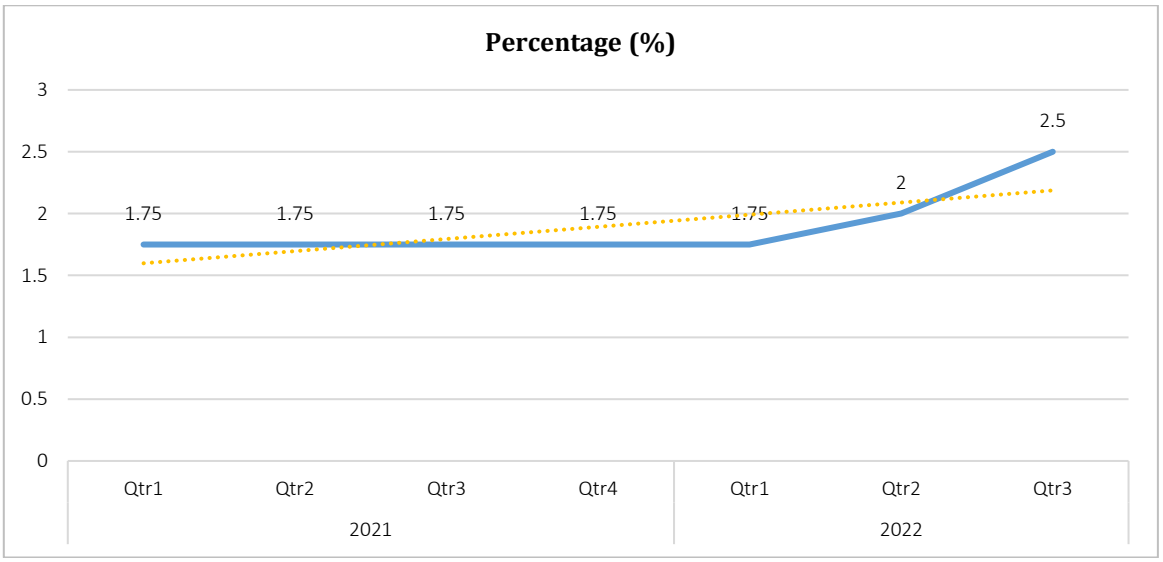
The Consumer Price Index (CPI) (Figure 3.6) measures the average rate of price growth for a basket of goods and services. The construction of the CPI assumes that there is a single basket of goods and services that reflects the consumption of all households in a country. With the premise that household spending habits are uniform and the amount and quality of the items and services in the consumption basket held constant, the CPI measures the average rise in prices. CPI is one of the widely used measures of inflation and deflation as it provides a good measure of the changes in the overall price level of goods and services in the economy.

As exhibited in the line chart, Malaysia's CPI in Quarter 2, 2021 increased 4.30 percent to 4.40 percent as against 0.10 percent in the same year of the previous quarter (Q1). The government's decision to set the unleaded petrol RON95 ceiling price at RM2.05 beginning in March 2021 was the primary factor in the rise in the inflation rate. The price of chicken increased over the 2020 average price, among other factors, which also helped to drive up inflation. The price of chicken increased as a result of rising animal feed supplies and rising grain prices worldwide (The Edge, 2022). Looking ahead to the second half of year 2021, Malaysia's CPI recorded a decline by 2.20 percent (from 4.40 percent to 2 percent) in Quarter 3, 2021. The decline was due to the re-imposition of nationwide containment measures (MCO) under the Phase 1 of NRP in June 2021, following a resurgence of COVID-19 cases due to the Delta variant. These measures reduced household spending and investment activity in the third quarter of 2021, affecting demand of goods particularly in the services and construction sectors (BNM Economic, Monetary and Financial Developments Report, 2021).

Nonetheless, the severity of containment measures in 2021 was less severe than the first MCO in the second quarter of 2020, and Malaysia's annual CPI increased more than it did the year before. In specific, Malaysia's CPI for the period January to December 2021 showed a significant increase of 2.5 percent as compared to a negative 1.2 percent for the same period in 2020 (The Edge, 2022).

The increase in cooking oil prices due to the increase in the crude palm oil prices as well as the increase in vegetable prices due to unpredictable weather at the end of 2021 also contributed to the increase in headline inflation. As evident from the line chart, CPI bounced back from 2 percent to 3.30 percent in Quarter 4, 2021. Further, Malaysia reported continuous increment in inflation rates to 4.40 per cent in Quarter 3, 2021 as against 2.20 percent and 2.80 percent in the same year of the previous quarters (Q1 and Q2), respectively. The increase in Malaysia's CPI in Quarter 3, 2022 could be viewed as a notable recovery in household spending as it influenced by the high vaccination rate among the Malaysian's population, leading to a drop in COVID-19 infections, death rates and a gradual lifting of movement restrictions. Accordingly, the lift of restriction boosted consumer confidence and retails sales. According to Manulife Investment Management, Malaysia's inflation is likely to stay between 2.0 percent and 3.5 per cent in 2023 on the back of a strong economic recovery following the COVID-19 pandemic (The Star, 2022).

Figure 3. 7 Overnight Policy Rate (OPR)



The Bank Negara Malaysia (BNM) sets the overnight interest rate (OPR), identifying the rate of interest for financial institutions which lend money to one another overnight. Banks' cash reserves fluctuate daily, depending on the bank's lending activities and the deposits and withdrawals of its customers. To ensure a stable and liquid banking system, banks with large cash reserves on a particular day frequently lend to banks with a cash shortfall to balance the available levels of cash (also known as liquidity).

As exhibited in the line chart in Figure 3.7, Malaysia's OPR from 2021 (Quarter 1) to 2022 (Quarter 1) remained consistent at 1.75 percent, the lowest OPR reported during the observation period of this project. Quarter 1 reported improvements in the manufacturing and export facility from the previous year (2020) but the resurgence in COVID-19 cases and several containment measures at the early quarters (Q1 and Q2) have resulted in an uncertain economic outlook. However, the conduction of the National Vaccination Rollout programme in early February 2021 was reported to support the global economic in gaining momentum, subbing the risks to the growth outlook (BNM, 2021).

According to the Monetary Policy Statement on 6 May 2021 (Quarter 2), the ongoing vaccination roll-out programme, sizeable fiscal stimulus measures in the U.S., and policy support in the other major economies by the government further facilitate the improvement in domestic demand. The sentiments were uplifted and has contributed to the recovery of economic activity. Similar in Quarter 3, the positive progress of the vaccination roll-out programme contributed to ease of the containment measures, swiftly recovering the economic activity. However, the uncertainty of variants emergence and the risk of prolonged global supply chain disruption in Quarter 4 of 2021 creates potential risk amid adjustments in the major economies' Monetary Policy (BNM, 2021). In an overall outlook of 2021, the volatile financial market and uncertain economic condition in 2021 have resulted to BNM to maintain the OPR lower to ensure the monetary policy is appropriate and accommodative.

As COVID-19 cases are seen to subside in Quarter 2 of 2022, and the endemic of COVID-19 in Malaysia takes place, the OPR reports higher at 2 percent, an increase of 0.25 basis point by the BNM. The inflation was expected to trend higher with an average between 2 percent to 3 percent in 2022, subject to the global commodity price developments arising from the military conflict in Ukraine and prolonged supply-related disruptions (Bernama, 2022). With the reopening of the global economy and the improvement of labour market conditions supporting economic activity, the OPR is reported to gradually increase from 2 percent to 2.25 percent to 2.50 percent in Quarter 3 of 2022. Although the policy measures and endemicity have contributed to stronger growth performance, the risk and inflationary condition to the domestic economy continue to stem from an escalation of geopolitical conflict and supply chain disruptions. Despite the global issues encountered by Malaysia, the economic condition seems to have improved since the roll-out of the vaccination programme in support of the economic activity recovery. Moving forward, the adjustments of monetary policy settings (OPR) would be done gradually, ensuring the monetary policy remains accommodative and in support of sustainable growth in a price stability environment (BNM, 2022).

3.4.1 Case On Re-Opening of the Tourism Industry

In light of this study's objective, we seek to understand the social and economic impacts of COVID-19 vaccination roll-out on the hotel industry and business, specifically at Langkawi Island and selected tourism destinations. Three research objectives are drawn:

1. to understand the strategies and tactical plans of the hotel industry and small businesses to overcome the COVID-19 pandemic challenges,
2. to understand the impacts of the Malaysia vaccination programme in terms of relevance, coherence, effectiveness, efficiency and sustainability to businesses, i.e., the hotel industry and small businesses, and
3. to understand the impact of the vaccination programme on the hotel industries and small businesses' innovation and start-ups ecosystem in preparing for the future uncertainties.

Although it is hard to estimate and quantify the values of COVID-19 vaccination programme, past studies have confirmed that vaccines are able to lessen the burden of communicable disease as indicated by significant improvements in the social and psychological well-being, and advancement to the economic development. To support this, the International Monetary Fund (IMF) and United Nation Secretary General made a statement that the vaccination will not reverse the social and economic impacts of COVID-19 pandemics.

3.4.2 Method

Since SMEs are one of the crucial elements of the economy that provide employment, wealth, and business diversification Avcikurt et al., (2011), we conducted this study by employing SME hotels and small businesses. We included several hotels and chalets located on Langkawi Island as hotel industry representatives and business owners. Six hotels and eight small businesses were included as the sample, particularly those smaller in size. We considered mainly smaller size hotels and businesses since the impact of the COVID-19 pandemic was more severe for the SMEs (National Recovery Plan, 2021). The hotels include White Lodge Chalet Langkawi (Respondent 1), Cenang Rest House (Respondent 2), Riverra Inn Langkawi (Respondent 3), HiG Hotel Langkawi (Respondent 4), Royale Chenang Resort (Respondent 5), and We Hotel Langkawi (Respondent 6). While the small businesses include Shifa Gamat Pulau Melaka (Respondent 7), Pak Malau Nasi Dagang (Respondent 8), Che Yang Retail (Respondent 9), Wildlife Park (Respondent 10), Luxury Car Rental (Respondent 11), The Village (Respondent 12), Underwater World (Respondent 13), Ilham Langkawi Holidays (Respondent 14), Mutiara Taman Negara (Respondent 15) and Tebing Guesthouse (Respondent 16).

We conducted qualitative research using an in-house questionnaire method consisting of a physical interview with the respondents. The questionnaire instrument consists of three sections (Appendix 3.1). The first section collected information regarding the strategic plans and operational activities to address challenges during the COVID-19 pandemic in the hotel industry and small businesses. The questions include strategic decision making and critical success factors of the hotel industry and small businesses to promote Langkawi Island and National Park Kuala Tahan to tourists in the pandemic era. The second section collected information regarding the future plans of the hotel industry and small businesses post-national vaccination roll-out programme. This includes the

related SOPs and protocols for safe travels post-COVID-19 and the effect of the vaccination programme on market players. The third section collected information regarding the expected business performance in the hotel industry and small businesses to prepare them for the future and uncertainties. This section focuses on identifying the expectations of the hotel industry and small businesses in Malaysia's tourism industry in the coming years, specifically the changes in the hotel industry's services post-COVID-19 pandemic.

Prior to the data collection, a research ethic was applied. The approval from the academic institution was granted with the reference number REC/11/2021 (MR/902).

3.4.3 Data Analysis

We used several data analysis phases, including screening, extracting, and managing the data acquired from the respondents. Firstly, we reviewed the respondents' answers to search for "recurring regularities" (Merriam, 1998). We used the constant comparative method by sorting and organising the data through relevant categories relative to the three sections of our questionnaire (Glaser & Strauss, 1967). Answers from respondents were coded and labelled according to each section. To search for influence within and across data sources, we analysed the coded answers and integrated the findings through the formation of a table.

3.4.4 Results and Discussions

3.4.4.1 Descriptive Analysis

Table 3.2 reports the descriptive analysis of the six hotels we interviewed. We constructed the analysis based on several characteristics such as the hotel establishment year, target market, and the past experience of the person in charge of managing the hotel (e.g., the manager or the owner). The primary purpose of market segmentation is to analyse the customers' demand (Khan et al., 2018). From our analysis, we found that different hotels have different target markets. For instance, five hotels, R1, R2, R5, R15 and R16 generally focused on targeting local and international travellers, which are the largest hotel industry segments. We also found that two hotels, R3 and R4, targeted travellers working in the government sector. The hotels relied on their diplomatic relations with the government sector to hold workshops and team building at their hotels. This way, they were able to diversify their services and sources of income without having to focus only on travellers with leisure purposes. Similarly, R6 also targeted their main market segment on working travellers. This is because of the strategic geographical factor of the hotel which is located near the Jetty area for travellers to have overnight accommodation. This is consistent with Firat et al. (2014) who emphasise the importance of geographical segment to increase the potential and commercial success of the hotel. From an overall outlook, most hotels targeted local and international travellers visiting Langkawi for leisure purposes. Due to the mobility restrictions during the COVID-19 pandemic, all hotels were severely affected as they were unable to secure bookings. Nevertheless, the six hotels interviewed successfully remained operational throughout the pandemic. Several measures taken by the hotels' management are further discussed in next section.

For small businesses, all eight respondents have been in their respective business for many years ranging from four years to 21 years. Their businesses were good until the COVID-19 pandemic hit the country. Their businesses basically relied on the local and international travellers, thus, during the pandemic they had to close their business for a while and switched to other side businesses. This aspect will be discussed later in next section.

Table 3.2 Hotels and Small Businesses

Name of Hotel/ Business	Respon-dents	Establishment	Market Segmentation	Past Experience
White Lodge Chalet Langkawi	R1	2006	Local and international travellers	Kitchen helper and front desk of a hotel
Cenang Rest House	R2	2007	Local and international travellers	Manager of the hotel since established
Riverra Inn Langkawi	R3	2012	Local, government employees and international travellers	Manager at Langkawi Hotel
HiG Hotel Langkawi	R4	2013	Local and Government employees	Worker at Pelangi Beach Resort and Spa Langkawi
Royale Chenang Resort	R5	2018	Local and international travellers	Worker at Skycab Langkawi
We Hotel Langkawi	R6	2019	Local and working travellers	Worker at a travelling agency
Shifa Gamat Pulau Melaka	R7	2001	Local and international travellers	Online business, bakery
Pak Malau Nasi Dagang	R8	2012	Local and international travellers	Hotel and airline industry
Che Yang Retail, located near Skycab Langkawi	R9	2012	Local and international travellers	Retail business
Wildlife Park	R10	2015	Local and international travellers	Biodiversity management
Luxury Car Rental	R11	2018	Local and international travellers	Car rental service
The Village	R12	2015	Local and international travellers	Arts activist
Underwater World	R13	2005	Local and international travellers	Cinematography
Ilham Langkawi	R14	1996	Local and	Travel agent

Name of Hotel/ Business	Respon-dents	Establishment	Market Segmentation	Past Experience
Holidays			international travellers	
Mutiara Taman Negara	R15	1990	Local and international travellers	Hotel Manager
Tebing Guesthouse	R16	2016	Local and international travellers	Guest house owner

We also found various past experiences of the hotel manager involved with strategic management and marketing decisions. We discovered that all of the managers that are managing the hotels are experienced in the tourism sector. The hotel managers from Cenang Rest House (14 years of experience), Riverra Inn Langkawi (24 years of experience), Mutiara Taman Negara (8 years), HiG Hotel Langkawi and those with past experience in the hotel industry. Our finding is consistent with Ngai et al. (2004) and Avcikurt et al. (2011) that one of the hotels' key successes relies on the working experience of the hotel managers because it is important that the managers have a good understanding of the travellers' demands. However, the distinctive characteristics of the hotel should play a significant role in determining its future success.

Regarding the business owners, one of them had vast experience in the hotel and airline industry (R8). The others had years of experience in their respective fields. With their experience, they were able to ensure the sustainability of their businesses although with the challenges posed by the pandemic. Most of them had to forget about their main business for a while until the situation is back to normal. They opted for other businesses such as online delivery (food) (R7, R11, R15), online retail business (R12), and heavy equipment (backhoe and lorry) and boat rental business (R14). The rest had to just wait for the situation to be over before they could continue with their businesses.

3.4.4.2 Main Analysis

The original data were acquired through an interview with the managers of the hotels and small business owners on Langkawi Island and Kuala Tahan. We reported the findings in a processual way, starting with the hotel's strategies to overcome challenges during the pandemic, the hotel's post-national vaccination roll-out programme, and the hotel's business's preparations to face uncertainties in the future.

R1 and R2 in Table 3.3 reported similar challenges: the perception and acceptance of tourists to travel for leisure during the pandemic. The surging coronavirus cases left negative perceptions on society and demotivate people from travelling (Gössling et al., 2021). However, several strategies need to be taken by the hotel industry and small businesses to overcome the pandemic challenges. For instance, for R1, R2, R5 and R6 to battle against the stigma that travelling is not safe, hotel workers were advised to be vaccinated to increase travellers' confidence on the premises. Considering that the COVID-19 vaccine confidence plays a significant role in attracting travellers during the pandemic Williams et al. (2022) the hotel industry has to make sure that they are in line with the Government initiatives to battle the virus outbreak and in support of the National COVID-19 Vaccination Roll-Out Programme. Other than that, hotel managers

also revised their room rates, maintained and upgraded the hotel facilities to remain operational. R2 also highlighted the major support they received from the domestic Langkawi travel bubble initiated by the Government in September 2021. The hotel industry made reasonable profits to cover the losses they had borne during the pandemic, consistent with the objective of the travel bubble programme to rehabilitate the tourism sector.

Another challenge the hotel industry at Langkawi Island and Kuala Tahan faced by R5, R6 and R15 was the costs they had to bear, although there were no gains. The hotel industry experienced massive reduction of travellers and due to COVID-19 pandemic, the people's economy was affected as they lost their jobs and had to accept pay cuts (10 percent to 100 percent) from their employers (Zubair & Shamsudin, 2021). Thus, budget travelling was an important factor that the hotel industry needs to cater to remain relevant. While the hotel managers need to give a discount of up to 50 percent from rooms' normal rate, hotel managers also need to break even their profits with their costs, particularly the overhead costs. One of the ways was to remove non-important room amenities such as room slippers, toiletries and items in the hotel pantry.

For business owners, they had similar challenges like the hotel industry. Although the business was not operational, they still had to pay the monthly salary to their workers. What they could do to minimize the costs was to pay the basic salary to the staff (R8). Another challenge faced by the business owners is to cover the fixed for example bank loan (R11), rental of business premise (R7, R9, R11, R12, R14 and R16), and animal food (R10 and R13). To overcome the challenges, they have to be creative to identify the opportunities in the market because every cloud has its own silver lining. Most respondents said that they opted for other businesses such as online delivery (food) (R7, R11, R15), online retail business (R12), and heavy equipment (backhoe and lorry) and boat rental business (R14). For the other respondents (R10 and R13), they had to find better alternatives since the fixed costs to cover were significant. Therefore, they chose to ask for donation from the public and private sectors, initiated animal adoption programme by the public and private sectors and organised virtual tours. For respondents (R16), they have to ask their worker to go for unpaid leave, which then the cleaning and maintaining work of their premise, they do it on their own. These programmes could lessen the costs of maintaining their businesses.

Table 3.3 Strategies Overcoming COVID-19 Pandemic Challenges

Respondents	Challenges	Strategies
R1	Perception and acceptance of travellers of the new norm of travelling for leisure purposes	• Hotel rate revision • Maintaining facilities to be in good condition • All employees are vaccinated
R2		• Upgrading facilities • Langkawi travel bubble • All employees are vaccinated
R5, R6 and R15	Break-even profit and operational costs	• Hotel rate revision • Overhead cost monitoring
R8	To continue paying monthly salary to existing workers	• Paid basic salary to workers • Used personal savings to ensure business survival

R10 and R13	To cover the expenditure although not in operation (fixed costs, animal food, and workers' salary)	• Donation from the public and private sectors • Animal adoption by the public and private sectors • Organised virtual tours
R11	To cover the monthly loan payment for cars and rental of business premise	• Involved in food delivery business
R7, R9, R12, R14	To cover the rental payment of business premise	• Involved in other businesses including bakery, online business, online retail business, and heavy equipment (backhoe and lorry) and boat rental business
R16	To cover operational cost and maintenance of business premise	• Offer low rate package • Use personal saving

The table above (Table 3.3) displays the second section of the questionnaire regarding the plans of the hotel industry post-COVID-19 vaccination programme at Langkawi island. We seek to identify the effect of vaccination initiatives on the hotel industry's relevancy, efficiency and sustainability. We found that all of the respondents' plans ensure that the travellers visiting the hotels are fully vaccinated (double doses). The face mask will also be mandatory, especially indoors, to avoid spreading COVID-19 on the premises. The strict SOPs ensure that the hotels can avoid being indicated as high-risk areas, which may force them to seize operations. Thus, after the vaccination programme is successful, the hotel industry looks forward to enforcing strict SOPs to promote safe travel for their customers.

Table 3.4 Post-COVID-19 Vaccination Roll-Out Programme Future Plans

Respondents	Future Plans
All respondents	● Strict Standard Operating Procedures (SOPs) such as face masks are mandatory, and travellers should be fully vaccinated
R3 and R5	● Building private units such as villas ● Cost-effective strategies
R6 and R15	● Following trend
R7, R9, R11, R12, R16	● Having back-up business ● Increase savings for the business earnings ● Learn from mistakes
R10 and R13	● Offering different types of services
R14	● Business diversification

R3 and R5 in Table 3.4 expressed their keenness to venture into building private villas as one of their units for their future plan, post-COVID-19 vaccination programme. The series of national restrictions, including physical distancing and limitations on social gatherings, have been a way to control the number of cases nationwide (Jayasundara et al., 2021). It has taught travellers to limit their interactions with others and prefer units where they do not have to share facilities, including swimming pools that were commonly public facilities. According to R5, adding units with private pools could be a post-pandemic tourist attraction. It could also help the hotels' future marketing strategies and increase the room rate. However, with an increased commitment, hotel managers also need to plan for cost-effective strategies. Some of the cost-effective strategies exerted by R5, R6 and R15 were minimising outsourcing by building in-house cafés to gain higher profit margins and hiring employees with multiple skills to promote multitasking among them. In the long run, the hotels can make higher returns from their investments and become sustainable. R15 also highlight on strategy to increase variation of local food menu in their café which unique for traveller.

R6 and R15 in Table 3.4 also emphasised on the importance of following the current trend to remain relevant in the market. Hotels industry should seek to capitalise on features such as remarkable room views to promote an exclusive environment to the travellers. For instance, R6 is located near the MAHA Tower in Langkawi. The hotel manager highlighted conducting a market survey based on current customers' preferences, such as tower view rooms, to increase the room rates. Understanding that travellers are into sharing their experiences through social media, the hotel industry should efficiently offer rooms that tailor to the customers' current demands. In return, the hotels can remain sustainable post-COVID-19 pandemic.

For small business owners, the pandemic had taught them valuable lessons. They should not be complacent with their current achievements (R7, R8, R9, R11, R12, R14 and R16). Therefore, they urged small business owners to increase savings from the current business earnings since anything could happen in the near future. Furthermore, they suggested that small business owners to have back-up plans or businesses that are invulnerable to any situations such as the COVID-19 pandemic. Business diversification is another strategy for business survival. If one business failed others can salvage the

business from a total failure. For R10 and R13, offering an alternative service such as virtual tour can be regarded as the new opportunity for their businesses. Using a virtual tour, the service can be experienced not only by the locals but also the international customers.

Table 3.5 shows the third section of the questionnaire regarding the preparation of each hotel and small businesses for the future and uncertainties post-COVID-19 pandemic. We seek to identify vaccination initiatives' effect on the innovations and start-up ecosystem in the hotel industry on Langkawi Island and National Park Kuala Tahan. R2 and R5 in Table 3.5 were prepared by adding values to the travel packages they offer. For instance, R2 proposed to partner with other travel agencies, i.e., mangrove agencies and car rentals. Instead of the hotel industry focusing only on offering accommodation to travellers, R2 highlighted the importance of remaining competitive in the tourism industry by offering other tourism services. R15 proposed to offer more packages and activities for traveller such as canopy walk, bird watching, fishing, jungle tracking and many others. Furthermore, R5 also stated that selling hotel merchants online can help to diversify their revenue and enlarge their business activities for better financial and risk management.

Table 3.5 Preparing for the Future and Uncertainties

Respondents	Future Plans
R2 and R5	● Value-added travel packages ● Diversification of revenue
R3	● Collaboration with airlines to gain higher visibility
R4	● Flexible room rate revision
R7, R8, R9, R11, R12, R15, R16	● Using technology such as social media to promote their businesses ● Increase product and service offerings ● Leverage on the existing customers
R10 and R13	● Using technology for online ticketing ● Offer virtual tours to online visitors
R14	● Business diversification

R3 in Table 3.5 anticipated a digitalised preparation for the hotel, which is to collaborate with airlines, such as Air Asia Berhad, to gain higher visibility in the market using an e-platform (AirAsia website) to promote their hotel to travellers. Other than that, R4 and R16 in Table 3.5 opt for a traditional method by remaining the hotel room rates flexible in the future. Suppose a virus outbreak or another pandemic occurs in the future, R4 suggested that they will reduce the room rates to cater to the current economic condition. Regardless, we find that the vaccination initiatives promote innovations in the hotel industry to remain significant in the constantly evolving market.

For small business owners, when asked about their future plans, most of them (R7, R8, R9, R10, R11, R12, R13, R16) said that they would leverage the power of existing technologies such as social media platforms to promote their businesses. Having a user-friendly website, offering secure online transactions, and optimising the customer relationship management approach are among the respondents' future business plans.

One respondent (R14) had different view on this matter. She said that business owners should not focus only on one business. They have to diversify their portfolios so that anything happens in future will not affect the overall business sustainability.

To overcome the hotel industry and small businesses downfall, the Government has laid out numerous initiatives, which include understanding the effect of the post-COVID-19 roll-out vaccination programme on the hotel industry and small businesses. Although the true pandemic size to date is incompletely tacit, the large majority of Malaysia's population is likely to remain positive in supporting the vaccination initiatives. Further, several plans and strategies were highlighted by hotel managers of the hotel industry and small business owners in Langkawi Island and Kuala Tahan to ensure that the island remains the top destination for tourist attractions in Malaysia. We found that the National COVID-19 Vaccination Roll-Out Programme significantly improves social well-being and businesses. From our findings, we successfully discover that the enforcement of vaccinations ensures relevancy, coherence and sustainability of social and economic development.

3.4.5 Needs Assessment and Vaccination Survey of Businesses and Enterprises

The study aims at investigating the needs assessment and impact of vaccination to businesses and enterprises. Prior to the data collection, a research ethic was applied. The approval from the academic institution was granted with the reference number REC/11/2021 (MR/902).

3.4.5.1 Research Design

The study was conducted as descriptive research that aims to describe the sample population. Using the quantitative research method, the research design attempts to collect quantifiable information for statistical analysis to describe the demographic segments. In addition, the design was based on cross-sectional study, which the findings could point towards the basis for future research.

3.4.5.2 Research Instrument

The instrument (Table 3.6) was developed by first reviewing the literature. In order to ensure the best possible item reliability and validity, we adopted existing construct items from ILO Bureau for Employers' Activities (ILO-ACT/EMP).

Table 3.6 Item Measurement

Measure	Item	Scale
COVID-19 Vaccination enforcement	1. Participate PIKAS vaccination programme 2. Register workers for vaccination 3. Mandatory vaccination 4. Do not allow unvaccinated workers to come to work 5. Vaccination programme in the workplace 6. Educate employees about the importance of vaccinations and health care 7. Monitor the vaccination status of employees 8. Do nothing	Nominal scale: Yes No
Business operation during COVID-19 pandemic	1. Fully on site 2. Fully but teleworking 3. Partially (working on site and teleworking) 4. Not operating	Nominal scale: Yes No
Business operation now	1. Fully on site 2. Fully but teleworking 3. Partially (working on site and teleworking)	Nominal scale: Yes No
Impact on operation		
Period to restore operation	How long did it take your enterprise to fully restore operations before October 2021? 1. Less than 30 days 2. Between 31 and 60 days 3. Between 61 and 90 days 4. Over 90 days	Nominal scale
Period to recover after October 2021 (Vaccination rate of 90%)	How long would it take your enterprise to fully restore operations? 1. Less than 30 days 2. Between 31 and 90 days 3. Between 91 and 180 days 4. More than 180 days 5. I am considering to close temporarily 6. I am considering to change the business	Nominal scale
Business plan	1. Did you change your business operations or service delivery to protect your enterprise against COVID-19? 2. Did your enterprise have a written business continuity plan prior to COVID-19?	Nominal scale

Measure	Item	Scale
	3. Did your enterprise develop a written business continuity plan following the COVID-19 outbreak	
Business challenges	Which are the main challenges your enterprise faced during the pandemic? (before October 2021. Select all that apply. 1. Cash flow to maintain staff and business operations is inadequate Employees are absent from work due to illness or government orders 2. Raw materials are not in supply or have become very expensive disrupting operations Suppliers are unable to provide inputs 3. Business partners have been badly affected and are not operating normally Customers / clients have been affected and demand is lower than normal Others, please specify Which are the main challenges your enterprise has faced after the country reached 90% vaccination rate (After October 2021). Select all that apply. 1. Cash flow to maintain staff and business operations is inadequate Employees are absent from work due to illness or government orders 2. Raw materials are not in supply or have become very expensive disrupting operations Suppliers are unable to provide inputs 3. Business partners have been badly affected and are not operating normally Customers / clients have been affected and demand is lower than normal Others, please specify 4. Strict movement control order enforcement	Nominal scale
Vaccination Impacts	What was the impact of COVID-19 to your 2020 profit, as compared to 2019? 1. Decrease over 50 per cent 2. Decrease between 25 - 50 per cent 3. Decrease up to 25 per cent Increase up to 25 per cent 4. Increase between 25 - 50 per cent 5. Increase over 50 per cent 6. I am not sure / it is difficult to estimate	

Measure	Item	Scale
	What was the impacts of COVID-19 vaccination to your forecast 2021 profit, as compared to 2020? 1. Decrease over 50 per cent 2. Decrease between 25 - 50 per cent 3. Decrease up to 25 per cent Increase up to 25 per cent 4. Increase between 25 - 50 per cent 5. Increase over 50 per cent 6. I am not sure / it is difficult to estimate	
Cost-cutting measures	What cost-cutting measures have you conducted or plan to conduct, if any? Select all that apply. 1. Reduce or completely freeze recruitment of new staff 2. Reduce or delay increase of wages or annual bonuses Dismiss employees 3. Implement compulsory leave or holidays without pay 4. Reduce staff development costs (e.g. training) 5. Reduce operational costs (e.g. electricity, water, internet, mail, logistics, transport) 6. Reduce rent costs (e.g. finish lease of work space, move to a cheaper/smaller location) 7. Reduce costs related to upgrading, acquiring and maintaining physical assets (e.g. buildings, machines, equipment, vehicles) 8. Reduce borrowing costs (e.g. loans, debts) Reduce travel costs Which are the most important strategies to increase your revenue? Select all that apply. 1. Offer new products or services 2. Decrease price of selected products or services 3. Change payment terms (e.g. establish a payment plan) 4. Change distribution channels (e.g. promote delivery or online purchases) 5. Diversify markets (e.g. operate in different locations or with new clients) 6. Modify supply chain agreements (e.g. source from other suppliers, negotiate with suppliers)	

Measure	Item	Scale
	7. Create partnerships with other enterprises or develop loyalty plans to reach more clients 8. Ensure business continuity planning 9. Acquire new talent 10. Other, please specify	
Future changes	For the next three (3) months, how will the following components change? 1. Number of employees 2. Job vacancy 3. Sales of products/services 4. Products/services price 5. Products/services demand 6. Profits 7. Cash reserve 8. Business expansion 9. Change of business model towards digitalization 10. In-person event 11. Employee policy for health and safety 12. Work not from office (teleworking) 13. Productivity 14. Internet and broadband	Nominal scale: Increase, no change, decrease, not related, do not know

3.4.5.3 Sampling

The population of the study was businesses and enterprises in Malaysia. A purposive sampling procedure was used to collect the data, based on the recommendation from Albert et al. (2009) and Galloway (2005) in determining the sample size, there are various strategies that could be adopted. One of them is to use the sample-to-item-ratio (Gorsuch, 1983). Using this method, the recommended sample size would be 160. Next is to use the sample-to-variable ratio Hair et al. (2017) and the recommended sample size would be 140. Another procedure is to use the power analysis calculation. The sample size is determined with the largest number of predictors. The inputs for the power analysis are power, effect size and significance level. As the design of the study was based on descriptive research and following the sample size determination sample by Krejcie and Morgan (1970), the sampling set was set to 300.

3.4.5.4 Data Collection

To collect the data, two methods were used. One was the paper-based survey, and second was the online survey. Both techniques were used to accommodate the background of the potential respondents. While online survey is a convenient method, it has a drawback towards respondents who have lack of access to the Internet and not competent in using the information technology. In addition, using the paper-based survey, the researchers had the opportunity to explain any item ambiguity to the respondents.

Prior to the data collection, a research ethic was applied. The approval from the academic institution was granted with the reference number REC/11/2021 (MR/902). Data was collected from March 2022 to September 2022. The final data set was 341.

3.4.5.5 Data Analysis

Data was analysed using SPSS version 28.00 for frequency, descriptive and comparisons between group.

3.4.5.5.1 Demographic Profile

The profiles of the respondents are shown in Table 3.7. Majority of the businesses were located in urban area (67.7%), small in size (39.9%), established between the year 2010 to 2019 (41.9%). In addition, 15.8% were from the food and beverage business sector, and 10.6% were from trade, wholesale and retail.

Table 3.7 Demographic Profile

Variable	Frequency	Percent
Business Location		
Urban	231	67.7
Suburban	66	19.4
Rural	44	12.9
Business Size		
Micro	49	14.4
Small	136	39.9
Medium	100	29.3
Large	56	16.4
Year of Establishment		
Before 1970	45	13.2
1970 – 1979	24	7.0
1980 – 1989	22	6.5
1990 – 1999	30	8.8
2000 – 2009	44	12.9
2010 – 2019	143	41.9
2020 and after	33	9.7
Business type		
Sole Proprietorships	103	30.2
Partnership	42	12.3
Private Limited Company	144	42.2
Limited Public Company	24	7.0
Public Corporation	22	6.5
Cooperative	6	1.8

Variable	Frequency	Percent
Business sector		
Agriculture, forestry & fisheries	24	7.0
Manufacturing	24	7.0
Construction	23	6.7
Hospital & Health	27	7.9
Utilities	15	4.4
Trade, wholesale & retail	36	10.6
Repair of motor vehicles & motorcycles	25	7.3
Transport & storage	19	5.6
Hospitality & Accommodation	21	6.2
Food & beverage service	54	15.8
Information & communication	14	4.1
Bank, finance & insurance/takaful	9	2.6
Property	6	1.8
Arts, entertainment & recreation	6	1.8
Mining & quarrying	2	0.6
Education	11	3.2
Others	25	7.3

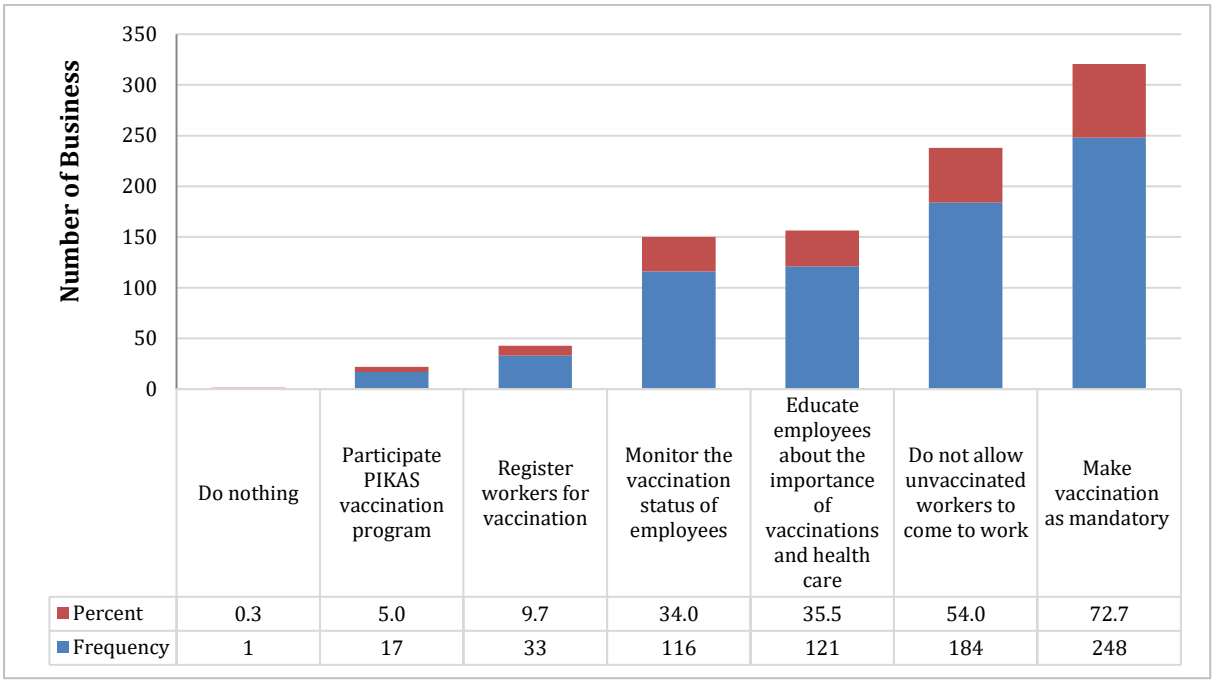
From the total of 341 companies, the bulk of which are sole proprietorships (30.2%), small (39.9%), urban (67.7%), and food and beverages (15.8%), were founded between 2010 and 2019. Additionally, they primarily began between 2010 and 2019.

3.4.6 Findings

3.4.6.1 COVID-19 Vaccination enforcement

Among these businesses, just 9.7% willingly register their workers for vaccines. 72.7% of businesses enforced the vaccination as mandatory, 54.0% forbid unvaccinated workers from reporting for duty, 35.5% created awareness to the about the importance of vaccination and healthcare. Only 34.0% of business keep track of their employees' vaccinations status. Figure 3.8 illustrates the vaccination enforcement.

Figure 3. 8 Vaccination Enforcement



3.4.6.2 Business Operation and Recovery Period

Table 3.8 Business Operation and Recovery Period

How is your business operating during the COVID-19 pandemic?	Frequency	Percent
Fully operational in the office / business location	67	19.6
Fully operational but virtual / telecommuting	73	21.4
Hybrid (combination of on-site and telework)	131	38.4
No operation	70	20.5
How is your business operating now?	**Frequency**	**Percent**
Fully operational in the office / business location	221	64.8
Fully operational but virtual / telecommuting	42	12.3
Hybrid (combination of on-site and telework)	78	22.9

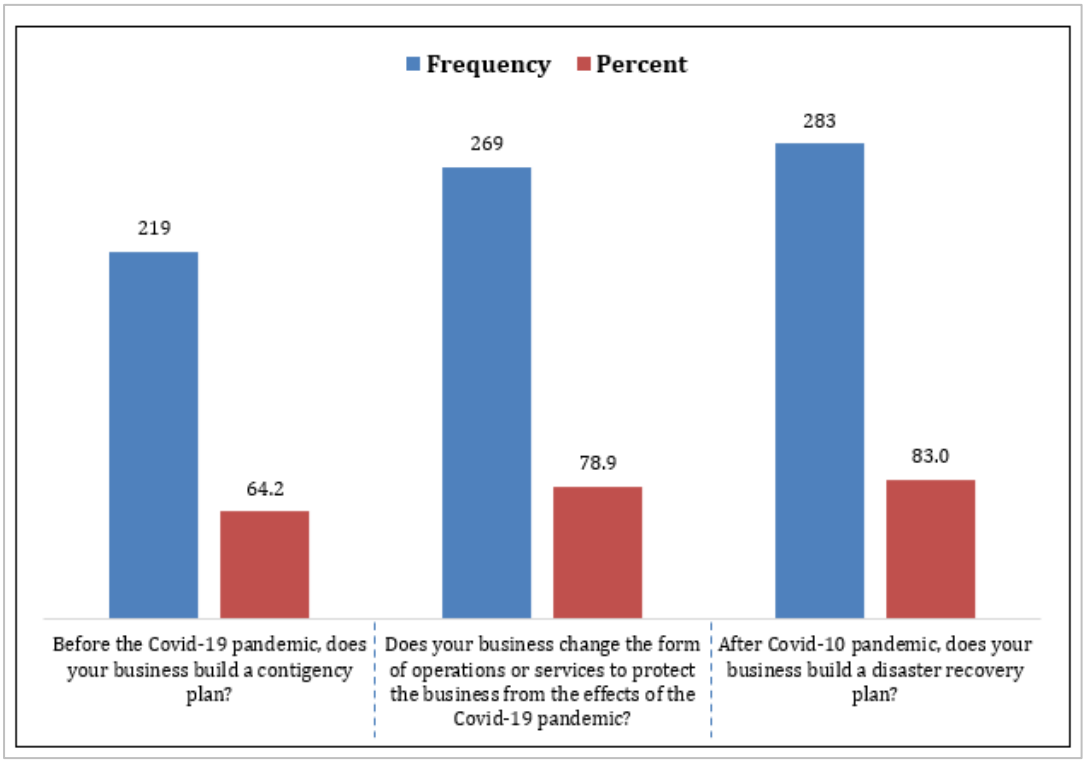
How long did it take your business to return operations during the pandemic	Frequency	Percent
Less than 30 days	121	35.5
31 - 60 days	66	19.4
61 - 90 days	103	30.2
More than 90 days	51	15.0
How long does it take to restore business as usual after the country reached 90% vaccination rate (after October 2021)?	**Frequency**	**Percent**
Less than 30 days	190	55.7
31 - 90 days	59	17.3
91 - 180 days	25	7.3
More than 180 days	28	8.2
Plan to cease operation temporarily	19	5.6
Plan to close the business	10	2.9
Plan to change the business	10	2.9

Furthermore, the majority of these enterprises (38.4%) adopted a hybrid business operating style during COVID-19. The company's on-site and telework tactics are blended into a "hybrid" strategy. Sadly, 20.5% of these enterprises went out of business during COVID-19. Additionally, 64.8% of the company's office or retail space is currently in use. Additionally, most companies that started up during the pandemic had fewer than 30 days to get ready (35.5%). Thankfully, the study also showed that businesses can resume regular operations fewer than 30 days after a country gets a 90% immunisation rate.

3.4.6.3 Business and Recovery Plan

A pandemic response strategy was established by about 64.2% of businesses. 78.9% of these companies changed the nature of their activities or services to lessen the effects of COVID-19. These results imply that companies have a catastrophe recovery strategy (83.0 percent). Thus, the pandemics and the vaccination programme have created the opportunities for the business to improve on their business strategy and create positive changes. Refer to Figure 3.9 below:

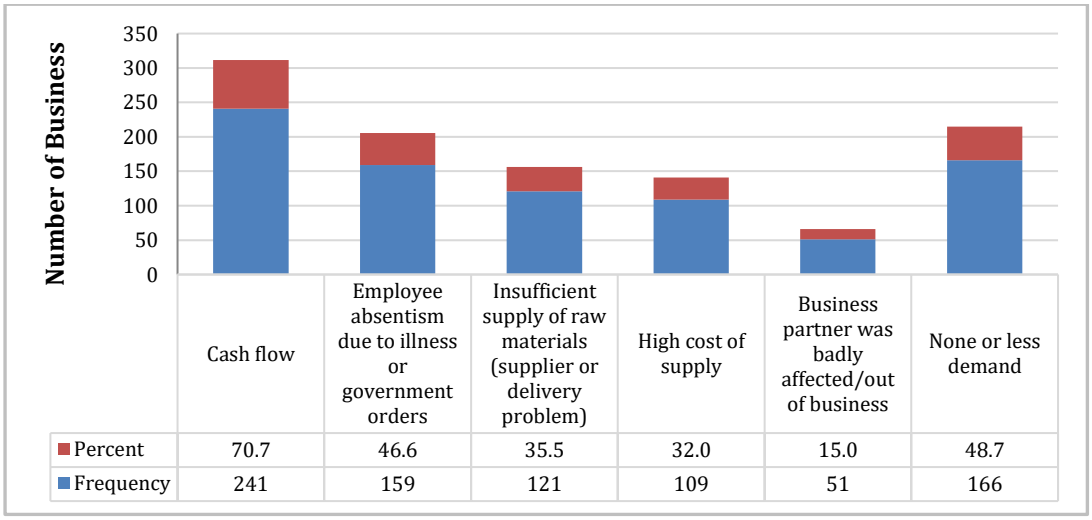
Figure 3. 9 Business and Recovery Plan



3.4.6.4 Business Challenges During the Pandemic

Based on the result, 70.7% of businesses reported that their biggest issue was with cash flow, followed by issues of product demand and services (48.7%). Next challenge was personnel absences due to illness or official orders (46.6%), followed by insufficient supply of raw materials (35.5%) and high cost of supply (32.0%). Refer to Figure 3.10 below:

Figure 3. 10 Business Challenges During the Pandemic

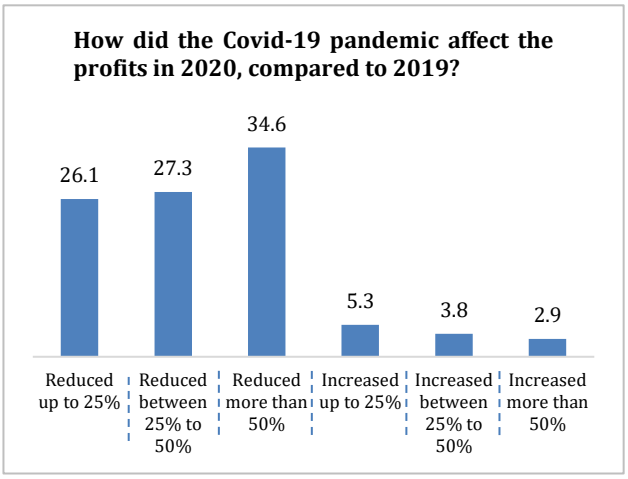


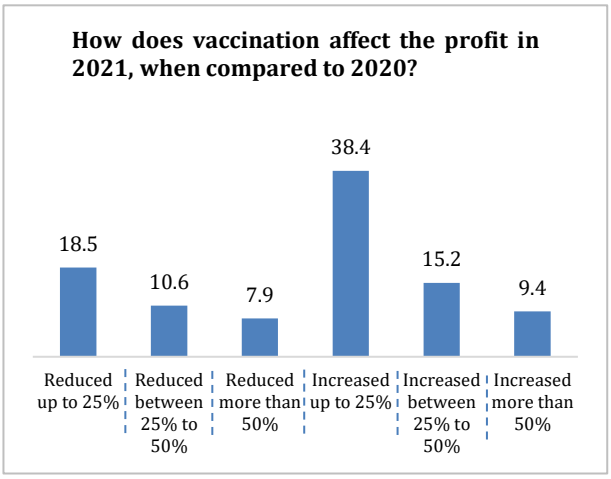
	Cash flow	Employee absentism due to illness or government orders	Insufficient supply of raw materials (supplier or delivery problem)	High cost of supply	Business partner was badly affected/out of business	None or less demand
Percent	70.7	46.6	35.5	32.0	15.0	48.7
Frequency	241	159	121	109	51	166

3.4.6.5 Business Profits During the Pandemic and After Vaccination

Additionally, most businesses' revenue in 2020 will be less than half what it was in 2019. Surprisingly, the majority of businesses saw a 25% increase in profitability after implementing immunisation programmes (38.4%). Refer to Figure 3.11 below:

Figure 3. 11 Business Profits During the Pandemic and After Vaccination





3.4.6.6 Business Strategy

In addition, the business adjusted its strategy after the COVID-19 pandemic. The most common strategy was introducing new products or services, with 41.1% claimed to do so. Next, is to change the distribution channel with 40.2%. 38.4% changed the payment term as a new strategy, 30.5% diversified their market and 28.7% established a long-term business plans based on risk management. Surprisingly, only 21.7% of businesses have implemented client loyalty-based programmes. In addition, 18.8% of businesses changed their supply chain agreements. Furthermore, only 12.3% of businesses initiate new partnerships. Please refer to Figure 3.12.

Figure 3. 12 Business Strategy

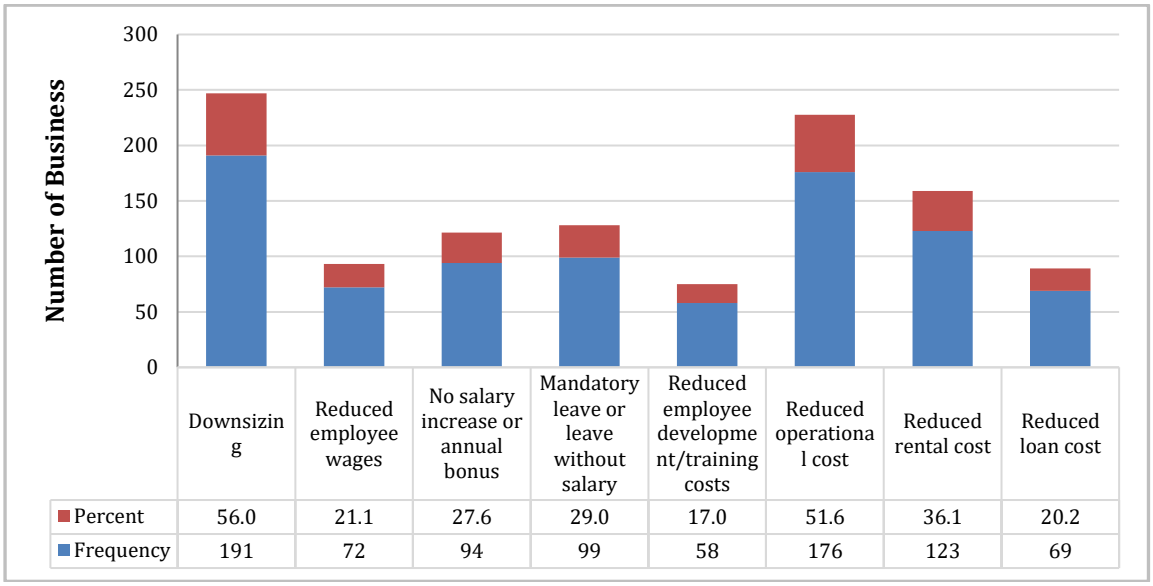


	No strategy	Employ new employees	Create new partnership	Change of supply chain agreement	Establish customer loyalty plan	Reduce product/service price	Establish long-term business plans based on risk management	Market diversification	Change of payment term (for example establishing payment plan to suppliers)	Change of distribution channel (for example online purchase)	New product/service
Frequency	13	39	42	64	74	77	98	104	131	137	140
Percent	3.8	11.4	12.3	18.8	21.7	22.6	28.7	30.5	38.4	40.2	41.1

3.4.6.7 Cost Cutting Measures

A total of 56% of the businesses practiced downsizing as a cost cutting measure, which is the most common strategy for reducing company expenses. Next, 51.6% reduced operational cost, 36.1% reduced the cost by reworking on the rental expenses, 29.0% established a mandatory leave or leave without salary to the employees and 27.6% gave no salary increase or annual bonus. Please refer to Figure 3.13.

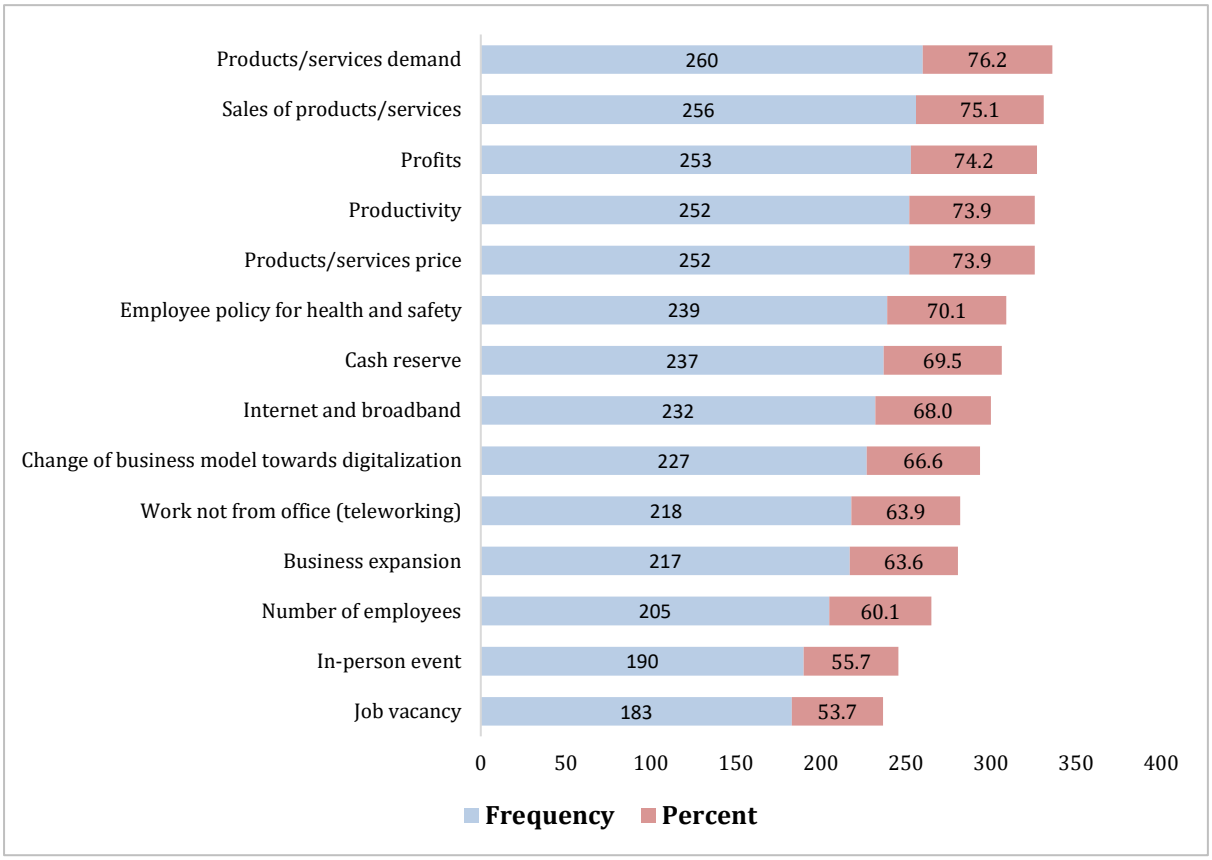
Figure 3. 13 Cost Cutting Measures



3.4.6.8 Future Positive Changes After COVID-19 Vaccination

Additionally, 73.9% of firms believed that future pricing for goods and services will rise, which will result in greater future sales of 75.1%. This is a result of a 76.2% increase in future demand projections. The predicted increase in profit is 74.2% as the economy strengthens. Most organizations (69.5%) anticipated higher case reserves. Additionally, it is anticipated that digitally aware enterprises will expand by 66.6 percent. Additionally, it is thought that the business would cooperate well with the live event (55.7 percent). The majority of companies (70.1%) thereafter gave employee health and safety measures top priority. Additionally, the results indicated that offices will be used for work (63.9%) and that future productivity is expected to increase (73.9%). These factors are expected to increase the cost of employee health insurance by 70.1%, according to businesses. Not to mention, 68.0% of organizations anticipated using the internet and broadband more frequently when they make the transition to digitization. Please refer to Figure 3.14.

Figure 3. 14 Positive Changes After COVID-19 Vaccination



3.5 STUDY 3: THE IMPACTS OF VACCINATION INITIATIVES TO THE SOCIETY

3.5.1 Research Methodology

This study aims at examining the impacts of COVID-19 vaccination initiatives to the society.

3.5.1.1 Research Design

The study was conducted as descriptive research that aims to describe the sample population. Using the quantitative research method, the research design attempts to collect quantifiable information for statistical analysis to describe the demographic segments. In addition, the design was based on cross-sectional study, which the findings could point towards the basis for future research.

3.5.1.2 Research Instrument

The instrument (Table 3.8) was developed by first reviewing the literature. In order to ensure the best possible item reliability and validity, we adopted existing construct items from (American Psychological Association, 2020), (Taylor et al., 2020) and (Kozyreva et al., 2021). The following table presents the items and their scales. Before the data was collected, the instrument and the items were validated and pre-tested. In this study, cave syndrome refers to a situation when people are worried and anxious about returning to the everyday normal activities after getting used to the new norms of living. It was Psychiatrist Dr. Arthur Bregman who called this fear as "cave syndrome," which is a non-medical term (Marples, 2021). Cave syndrome affected people's mind and caused them to develop fear about returning fully to the demand of work or society, even after fully vaccinated because of social anxieties (Buheji & Ahmed, 2021). The final questionnaire is shown in Appendix 3.2.

A pre-test is a procedure that will require responses and feedback from a small set of respondents from the population. For the face validity, the constructs and the items were checked and examined by three faculty members who were experts in the field. The procedure was performed as a strategy to ensure each item represents the meaning of the construct, to indicate the content of the research was related to the dimensions and variables, and to ensure no bias.

Table 3.9 Item Measurement

Measure	Item	Scale
Social Wellbeing	COVID-19 vaccination is important for 1. quality of life 2. survival 3. personal safety 4. safety of others	Nominal scale: Yes, No, Maybe
Psychological Wellbeing	Cave Syndrome 1. Feel uncomfortable living a new normal 2. Feel uncomfortable conducting in-person interaction 3. Feel uncomfortable to work on-site	5-point Likert-scale: 1: Very True 5: Very Untrue
	COVID-19 Stress and Danger 1. I am worried about catching the virus 2. I am worried that I can't keep my family safe from the virus 3. I am worried that our healthcare system won't be able to protect my loved ones 4. I am worried that basic hygiene (e.g., handwashing) is not enough to keep me safe from the virus 5. I am worried that social distancing is not enough to keep me safe from the virus	5-point Likert-scale: 1: Very True 5: Very Untrue
	Contact Tracing Trust 1. Contact tracing app will reduce my risk of coming in contact with COVID-19. 2. Contact tracing app has helped me to resume my normal activities. 3. Contact tracing app will help me to maintain my new normal activities in the future course of the pandemic. 4. Contact tracing app has reduced the spread of COVID-19. 5. Contact tracing app will reduce the spread of COVID-19 6. Contact tracing app has helped me to be more aware of COVID-19.	5-point Likert-scale: 1: Strongly Disagree 5: Strongly Agree
Social Implication	1. Going out to work 2. Use public transport 3. Domestic vacation with family members 4. Overseas vacation with family members 5. Domestic vacation with friends 6. Overseas vacation with friends 7. Go to shopping complex or malls 8. Go to shop or market 9. Dining out	Nominal scale: Yes, No, Maybe, Not Related

Measure	Item	Scale
	10. Sports and leisure 11. Go to cinema 12. Go out with friends or family 13. Hometown visit 14. Attending weddings or festivities 15. Go to worship 16. Send children to schools 17. Send children to day care 18. Returning to college/university	
Economic Implication	1. Going out for a vacation in the country after completing two doses vaccination should be allowed. 2. Tourism activities in the country are a necessary to relax and release stress 3. Most of the people who are important to me agree that I go on a trip after completing two doses vaccination 4. I have sufficient resources, time and opportunity to travel in the country 5. I am able to follow the SOP when traveling within the country 6. There is a high probability of contracting COVID-19 during travel activities 7. There is a high probability that the society does not comply with the SOP that has been enforced 8. There is a high probability that the chosen destination and accommodation are not safe from COVID-19 9. The local population in the tourist area welcomed the opening of tourism activities	Nominal scale: Yes, No, Maybe

3.5.2 Sampling

The population of the study was Malaysians whose age is 18 and above. A purposive sampling procedure was used to collect the data, based on the recommendation from Abbert et al. (2009) and Galloway (2005) in determining the sample size, there are various strategies that could be adopted. One of them is to use the sample-to-item-ratio (Gorsuch, 1983). Using this method, the recommended sample size would be 160. Next is to use the sample-to-variable ratio Hair et al. (2017) and the recommended sample size would be 140. Another procedure is to use the power analysis calculation. The sample size is determined with the largest number of predictors. The inputs for the power analysis are power, effect size and significance level. As the design of the study was based on descriptive research, we follow the recommendation from (Krejcie & Morgan, 1970). We also consider the effect of the sampling size. Hence, we set the sample to 3,450. The survey questionnaires were allocated based on the population ratios as shown in Appendix 3.3.

3.5.3 Data Collection

To collect the data, two methods were used. One was the paper-based survey, and second was the online survey. Both techniques were used to accommodate the background of the potential respondents. While online survey is a convenient method, it has a drawback towards respondents who have lack of access to the Internet and not competent in using the information technology. In addition, using the paper-based survey, the researchers had the opportunity to explain any item ambiguity to the respondents. The paper-based survey was mainly used to collect data among the older respondents, and also the respondents who lived in the rural area.

Prior to the data collection, a research ethic was applied. The approval from the academic institution was granted with the reference number REC/11/2021 (MR/902). Data was collected from December 2021 to September 2022. The final data set was 3,506.

3.5.4 Data Analysis

Data was analysed using SPSS version 28.00 for frequency, descriptive and comparisons between group. For assessing the item reliability and validity, we used Smart PLS 3.3.2.

The measurement items of cave syndrome, COVID-19 stress and danger, and contact tracing trust were tested for both convergent and discriminant validity. The results of the reliability convergent validity analyses are presented in the following table. The convergent validity was assessed by the indicator loadings, composite reliability (CR) and average variance extracted (AVE). The loadings for all reflective items exceeded the recommended value of 0.600. The CR values exceeded the minimum value of 0.700, and the AVE exceeded 0.500 for all constructs (Hair et al., 2017). Thus, there are evidences that indicate for an adequate convergent validity of the measurement model. Refer Table 3.10 below:

Table 3.10 Reliability and Convergent Validity

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Cave Syndrome	0.861	0.915	0.783
Contact Tracing Trust	0.925	0.94	0.725
COVID-19 Stress	0.895	0.922	0.704

The assessment of the discriminant validity was conducted by using the heterotrait-monotrait (HTMT) ratio of correlations based on the recommendation from (Henseler et al., 2015). The results are shown in Table 3.11. Kline (2016) suggested HTMT values less than 0.85 support good discriminant validity. However, based on (Gold et al., 2001). HTMT values less than 0.900 are acceptable. The results of the HTMT for discriminant validity assessment demonstrated that the measurement items are valid and reliable.

Table 3.11 Discriminant Validity

	Cave Syndrome	Contact Tracing Trust	COVID-19 Stress
Cave Syndrome			
Contact Tracing Trust	0.096		
COVID-19 Stress	0.558	0.176	

3.5.5 Findings

3.5.5.1 Demographic Profile

The profiles of the respondents are shown in Table 3.12. More females took part in the study than males. Majority of the respondents have had the COVID-19 booster. In addition, most of the respondents were from the urban area. Within the household income, majority was from the B40 group, with monthly household income of less than RM2,500. Next, respondents in the age group of 18 to 20 years all formed the majority in the age category.

Table 3.12 Demographic Profile

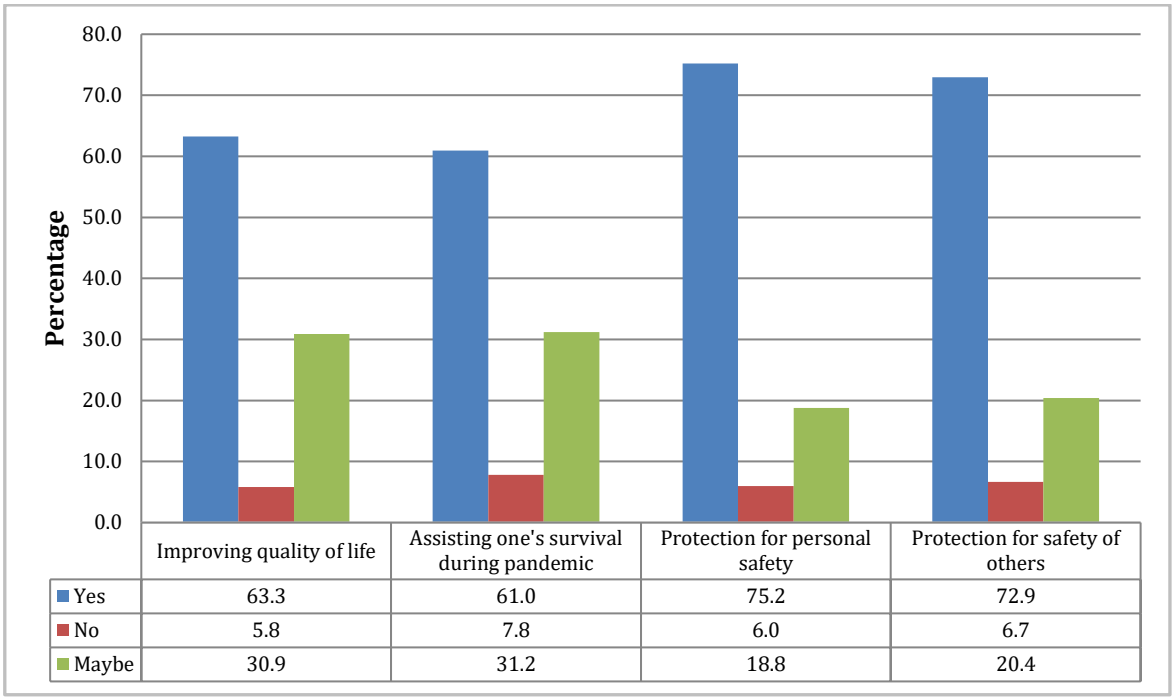
Gender	Frequency	Percent
Male	1273	36.3
Female	2233	63.7
Completed at least 1-dose booster		
Yes	1831	52.2
No	552	15.7
Residency		
Urban	2452	69.9
Suburban	439	12.5
Rural	615	17.5
Household Income		
Less than RM2,500	1340	38.2
RM2,501 – RM3,169	474	13.5
RM3,170 – RM3,969	298	8.5
RM3,970 – RM4,849	201	5.7
RM4,850 – RM5,879	224	6.4
RM5,880 – RM7,099	215	6.1
RM7,100 – RM8,699	175	5.0
RM8,700 – RM10,959	203	5.8
RM10,960– RM15,039	197	5.6
RM15,040– RM15,879	31	0.9

RM15,880 and above	148	4.2
Age Category		
18 - 29	1324	37.8
30 - 39	881	25.1
40 - 49	790	22.5
50 - 59	373	10.6
60 and above	138	3.9
Working Category		
Government Officer	1056	30.1
Private Organisation Employee	843	24.0
Self-employed	309	8.8
Pensioner	103	2.9
Student	772	22.0
Housewife	315	9.0
Not working	108	3.1

3.5.5.2 Descriptive Analysis

Descriptive analyses were run to describe the pattern of social and psychological wellbeing, social implication, and economic implications.

Figure 3. 15 Perception of COVID-19 Vaccination for Social Wellbeing Based on Percentages



	Improving quality of life	Assisting one's survival during pandemic	Protection for personal safety	Protection for safety of others
Yes	63.3	61.0	75.2	72.9
No	5.8	7.8	6.0	6.7
Maybe	30.9	31.2	18.8	20.4

The results of the social wellbeing assessment (Figure 3.15) show 75.2% of the respondents agree vaccination is important for to protect oneself from the pandemic, 72.9% agree it is important to protect the health and safety of others. However, the scores for quality of life and survival during the pandemic were 63.3% and 61.0% respectively.

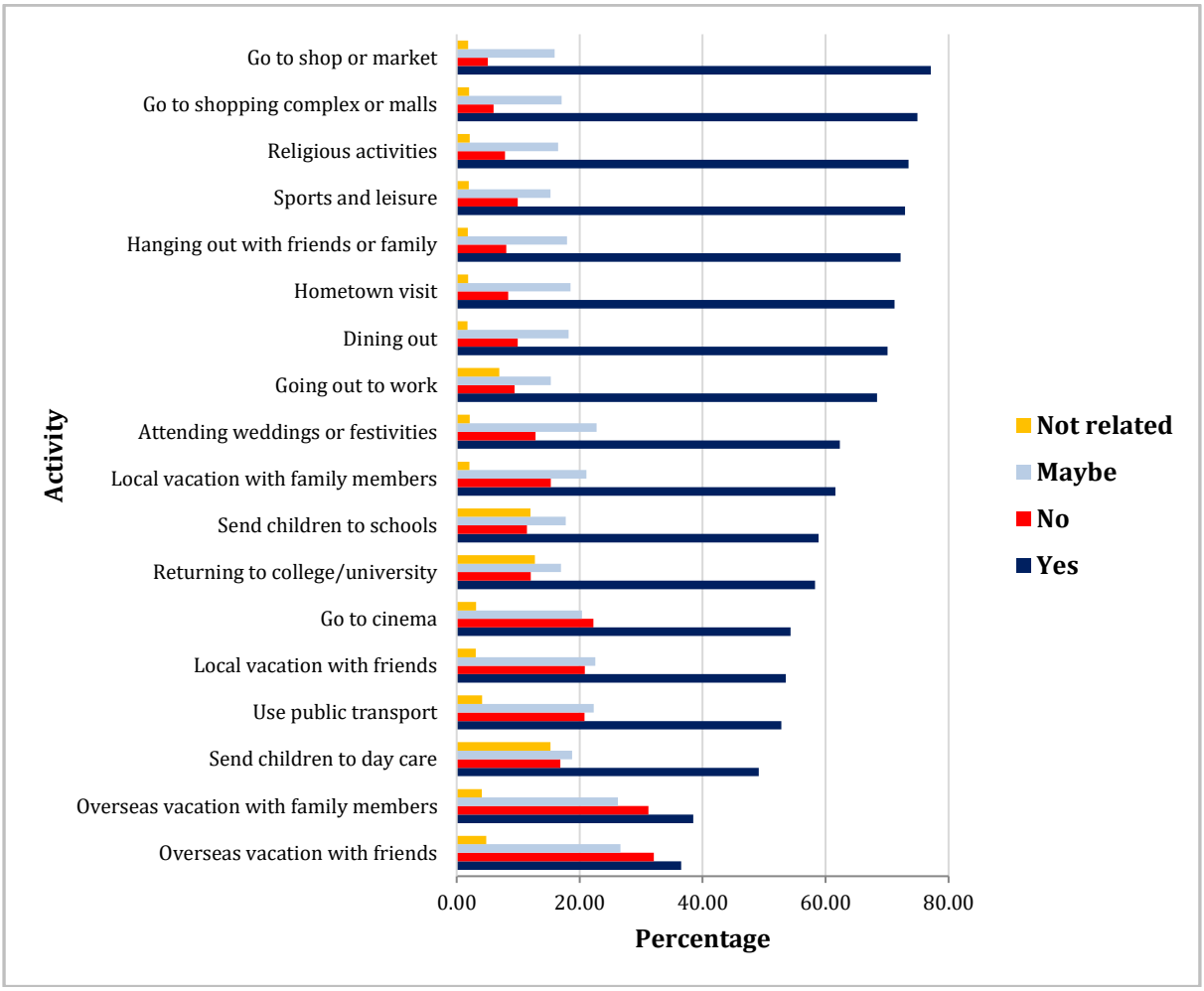
Hence, it could be concluded COVID-19 vaccination is perceived to safeguard health and only for medical purposes. However, in reality, vaccination works for improving the greater wellbeing of the society (Okan et al., 2021). With this regard, promoting health literacy should be emphasized by applying interventions such as health communication, education and mass media campaigns to influence personal behaviour and empowering society to understand the role of vaccination.

Table 3.13 Social Implications: Confidence to Do the Activity After 6 Months of the First Vaccination (%)

Activity	Yes	No	Maybe	Not related
Going out to work	68.37	9.41	15.29	6.93
Use public transport	52.80	20.79	22.28	4.14
Local vacation with family members	61.58	15.29	21.08	2.05
Overseas vacation with family members	38.48	31.18	26.24	4.11
Local vacation with friends	53.51	20.82	22.56	3.11
Overseas vacation with friends	36.51	32.09	26.61	4.79
Go to shopping complex or malls	74.96	5.99	17.06	2.00
Go to shop or market	77.12	5.08	15.94	1.85
Dining out	70.08	9.93	18.23	1.77
Sports and leisure	72.90	9.93	15.23	1.94
Go to cinema	54.28	22.22	20.37	3.14
Hanging out with friends or family	72.19	8.07	17.94	1.80
Hometown visit	71.22	8.39	18.51	1.88
Attending weddings or festivities	62.29	12.84	22.76	2.11
Religious activities	73.50	7.84	16.51	2.14
Send children to schools	58.84	11.41	17.74	12.01
Send children to day care	49.14	16.86	18.77	15.23
Returning to college/university	58.27	12.04	16.97	12.72

Assessment on the social implications (Table 3.13) and (Figure 3.16) were performed by asking the respondents on how confident they were to go out for the listed activities, specifically after 6 months of the first vaccination. The 6 months period was taken into consideration of the movement control order and after the country reached a dedicated percentage of nationwide vaccination.

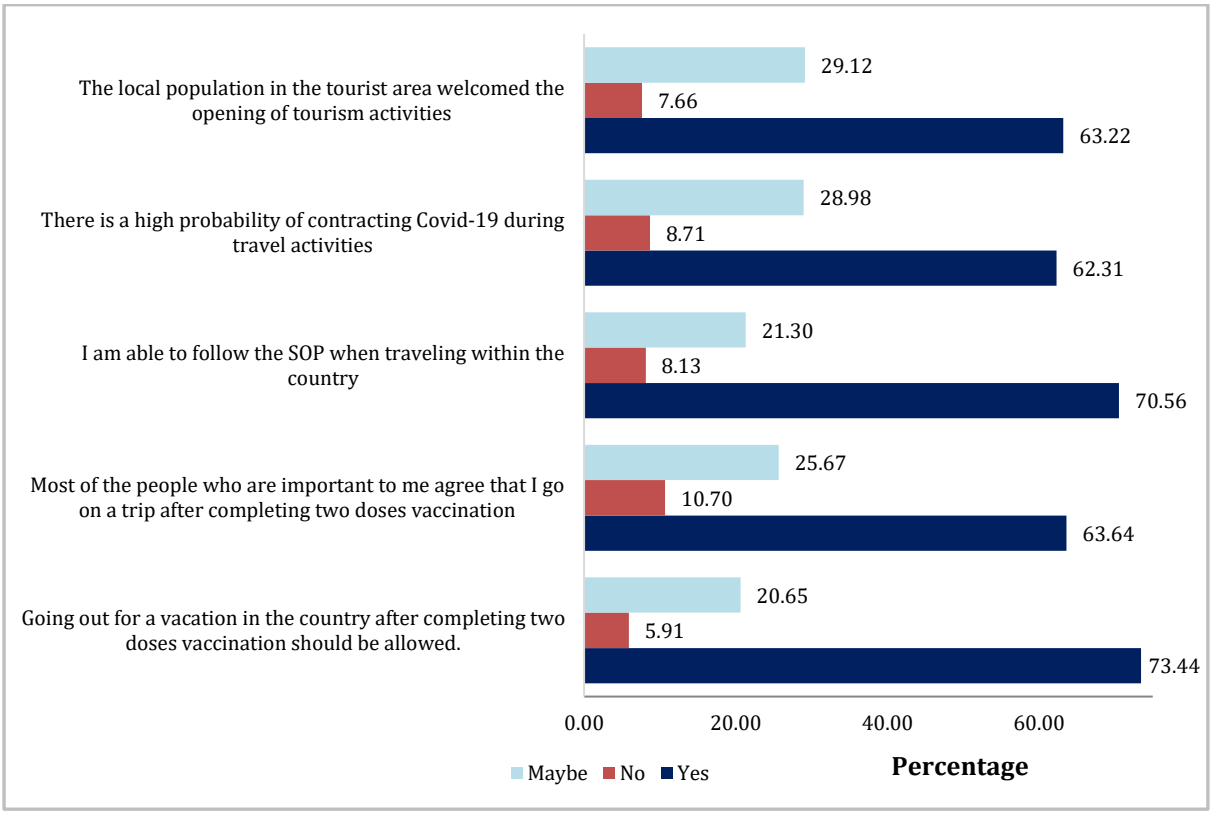
Figure 3. 16 Confidence to do the Activity After 6 Months of the First Vaccination



3.5.5.3 Economic Implication

Next, the assessment of the economic implications, perceived by the society was conducted by asking the society on their perception on the tourism activity and also their traveling capability. The results are shown in Figure 3.17.

Figure 3. 17 Economic Implications



3.5.5.4 Psychological Wellbeing: Cave Syndrome

The descriptive analysis of the cave syndrome is shown below (Table 3.14). The items were measured as a 5-point Likert scale from 1 (very true) to 5 (very untrue). The highest score that depicts the cave syndrome severity is for the item “Feel uncomfortable living a new normal” (M = 3.175, SD = 1.251), followed by “Feel uncomfortable conducting in-person interaction” (M = 3.230, SD = 1.238). Nevertheless, the general scores of the cave syndrome items suggest the severity is not high.

Table 3.14 Cave Syndrome

	Mean	Std. Deviation	Mode	Median	Min	Max
Feel uncomfortable living a new normal	3.175	1.251	3.000	3.000	1.000	5.000
Feel uncomfortable conducting in-person interaction	3.230	1.238	3.000	3.000	1.000	5.000
Feel uncomfortable to work on-site	3.368	1.229	3.000	3.000	1.000	5.000

3.5.5.5 Psychological Wellbeing: COVID-19 Danger and Stress

The descriptive analysis of COVID-19 danger and stress is shown in Table 3.15. The items were measured as a 5-point Likert scale from 1 (very true) to 5 (very untrue). The highest score that depicts the stress is for the item "I am worried that I can't keep my family safe from the virus" (M = 2.592, SD = 1.287), followed by "I am worried about catching the virus" (M = 2.648, SD = 1.286). Nevertheless, the general scores of the danger and stress items suggest for adequate level of worries. Hence, actions must be taken to reduce the stress for greater wellbeing.

Table 3.15 COVID-19 Danger and Stress

	Mean	Std. Deviation	Mode	Median	Min	Max
I am worried about catching the virus	2.648	1.286	2.000	2.000	1.000	5.000
I am worried that I can't keep my family safe from the virus	2.592	1.287	2.000	2.000	1.000	5.000
I am worried that our healthcare system won't be able to protect my loved ones	2.887	1.264	3.000	3.000	1.000	5.000
I am worried that basic hygiene (e.g., handwashing) is not enough to keep me safe from the virus	2.895	1.248	3.000	3.000	1.000	5.000
I am worried that social distancing is not enough to keep me safe from the virus	2.908	1.240	2.000	3.000	1.000	5.000

3.5.5.6 Psychological Wellbeing: Contact Tracing Trust

The descriptive analysis of contact tracing trust is shown below (Table 3.16). The items were measured as a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The highest mean score that depicts the trust is for the item "Contact tracing app has

helped me to be more aware of COVID-19." (M = 3.545, SD = 1.122), followed by "Contact tracing app will help me to maintain my new normal activities in the future course of the pandemic." (M = 3.404, SD = 1.116). In general, there is a good level of agreement that contact tracing app provided many essential values to the society.

Table 3.16 Contact Tracing Trust

	Mean	Std. Deviation	Mode	Median	Min	Max
Contact tracing app will reduce my risk of coming in contact with COVID-19.	3.232	1.180	4.000	3.000	1.000	5.000
Contact tracing app has helped me to resume my normal activities.	3.333	1.145	4.000	3.000	1.000	5.000
Contact tracing app will help me to maintain my new normal activities in the future course of the pandemic.	3.404	1.116	4.000	4.000	1.000	5.000
Contact tracing app has reduced the spread of COVID-19.	3.313	1.156	4.000	3.000	1.000	5.000
Contact tracing app will reduce the spread of COVID-19	3.304	1.152	4.000	3.000	1.000	5.000
Contact tracing app has helped me to be more aware of COVID-19.	3.545	1.122	4.000	4.000	1.000	5.000

3.5.5.7 Comparison Between Groups: Social Wellbeing & Psychological Wellbeing

Analyses were performed to compare the magnitude of social wellbeing between groups. The main findings are shown in the following Table 3.17. Details of the analysis are in Appendix 3.4.

Table 3.17 Summary of COVID-19 Vaccination Impacts to Social and Psychological Wellbeing

Group	Social Wellbeing: vaccination importance				Psychological Wellbeing		
	Quality of life	Survival during pandemic	Self-protection	To protect others	Cave Syndrome	COVID-19 Danger and Stress	Contact Tracing Trust
Booster Status							
Complete	66.7%	63.1%	80.1%	73.6%	3.2867	2.8084	3.4048
No booster	52.5%	45.7%	62.7%	60.0%	3.1914	2.7494	3.1830
Gender							
Male	64.7%	61.3%	71.6%	69.7%	3.2771	2.9496	3.4124
Female	62.4%	60.8%	77.3%	74.8%	3.2470	**2.6847**	3.3214
Residency							
Urban	63.4%	62.3%	77.0%	75.5%	3.2606	2.7901	3.3353
Suburban	58.3%	55.4%	69.2%	67.0%	3.4943	3.0918	3.4233
Rural	66.3%	59.5%	72.5%	67.0%	**3.1142**	**2.5799**	3.3912
Household Income							
B40	63.6%	59.1%	73.9%	71.7%	**3.2260**	**2.7594**	3.**3723**
M40	62.2%	63.5%	77.0%	74.7%	3.3050	2.8603	3.3535
T20	63.3%	66.8%	79.3%	76.9%	3.4674	2.8193	3.1801
Age							
18 – 29	67.3%	63.8%	80.5%	79.0%	3.3517	2.6940	3.4147
30 – 39	62.4%	57.4%	68.7%	66.5%	3.2618	2.9352	3.2954
40 – 49	59.9%	61.4%	74.1%	71.8%	3.0992	2.7681	3.2740
50 – 59	58.2%	58.4%	74.0%	70.2%	3.3388	2.9276	3.3841
60 and above	63.0%	60.1%	76.1%	69.6%	**2.9595**	**2.4607**	**3.4766**
Working Category							
Government Officer	62.2%	60.6%	71.8%	69.3%	3.3473	2.9560	**3.3971**
Private Organisation Employee	63.9%	59.9%	71.8%	70.7%	3.2915	2.9049	3.3497
Self-employed	59.9%	57.0%	70.9%	66.3%	3.0826	2.6071	3.3625
Pensioner	66.0%	64.1%	81.6%	81.6%	3.1462	2.9246	3.5673
Student	**68.3%**	**65.5%**	**84.1%**	**82.4%**	3.3054	2.6142	3.3942
Housewife	57.8%	60.0%	75.9%	717.7%	**3.0755**	2.6604	3.1301
Not working	55.6%	50.9%	76.9%	72.2%	3.1882	**2.5482**	3.3843

The main findings for social wellbeing are:

1. Respondents with complete booster have a higher agreement that vaccination is important for improving the quality of life, for survival during the pandemic, to protect on self and to protect others.

2. Males and females are not significantly difference in their perception that vaccination is important for improving the quality of life, and for survival during the pandemic. However, females were more likely to believe COVID-19 vaccination is important for personal health safety, and for health safety of others.

3. Respondents who live in urban area have a higher believe COVID-19 vaccination is important for survival, personal health and safety during the pandemic, and important for others' safety and health during the pandemic.

4. The T20 group has a higher believe that COVID-19 vaccination is important for survival during the pandemic, and important for the safety and health of others.

5. The respondents in the age group of 18 to 29 years old has a higher perception that COVID-19 vaccination is important for improving the quality of life, important for survival during the pandemic, important for personal health and safety, and important for others' survival during the pandemic as compared to the respondents in the age group of 30 to 39 years old.

6. Students show a higher perception of the vaccination for improving the social wellbeing as compared to other groups.

The main findings for psychological wellbeing are:

1. Booster status does have an effect on cave syndrome. Respondents who took the booster are more braved in facing the cave syndrome, compared to those who did not take the booster.

2. Females were more stressed in facing COVID-19, compared to males. Likewise, suggests males have a higher degree of agreement that MySejahtera is a trusted application for contact tracing, for resuming the new normal, and it helps to create more awareness of COVID-19.

3. Respondents from the rural area show the highest degree of cave syndrome and COVID-19 stress.

4. The B40 group shows the highest degree of cave syndrome and COVID-19 stress.

5. Respondents in the age group of 60 and above show the highest degree of cave syndrome and COVID-19 stress.

6. Housewives are perceived to have a higher level of cave syndrome as compared to others.

3.6 LESSONS LEARNED

To overcome the social and economic challenges, the Government has laid out numerous initiatives, which include understanding the effect of the post-COVID-19 roll-out vaccination programme. Although the true pandemic size to date is incompletely tacit, the large majority of Malaysia's population is likely to remain positive in supporting the vaccination initiatives. Further, several plans and strategies were highlighted. We found that the National COVID-19 Vaccination Roll-Out Programme significantly improves social well-being and businesses. From our findings, we successfully discover that the enforcement of vaccinations ensures relevancy, coherence and sustainability of social and economic development.

Based on the findings of the study, the COVID-19 vaccination programme is important for the society's quality of life, survival during pandemic, self-protection and also to protect others especially those close to the individuals. Female respondents perceived higher level of importance on vaccination especially in protecting self and others from the virus. However, they were more stressful than their male counterparts. Regarding the contact tracing trust, male respondents had higher trust of the application than their female counterparts.

Regarding the effect of vaccination according to the area of residency, urban respondents perceived higher level of importance of COVID-19 vaccination as compared those who reside in the suburban areas. They suffered the most from the COVID-19 pandemic since they could not experience normal working life. The respondents from rural areas felt more stressful as compared to those living in urban and suburban areas. Most probably, they earned income on a daily basis and the pandemic restricted their movement to earn for a living.

Comparing groups with different income status, B40 perceived that COVID-19 vaccination programme helps improve their quality of life. B40 group also trusted the contact tracing application more than the other groups. For T20, the vaccination programme helped them survive and protected others from the virus. They suffered the most from the pandemic since they could not work and generate enough income to pay off all the expenses.

Pertaining to the different age groups of respondents, those aged between 18 and 29 years old perceived the importance of COVID-19 vaccination programme as the highest. They believed that the vaccination programme helps improve their quality of life, ensure their survival during the pandemic and protect them from the virus. For those aged higher than 60 years old, they suffered the most from the pandemic, they were the most stressful but they trusted the contact tracing application higher than the other groups.

3.7 RECOMMENDATIONS

Figure 3.18 summarises the recommendations and the following sub-sections elaborate on the details.

Figure 3. 18 Infographic for Recommendations



3.7.1 Health Literacy and Promotion

It is suggested that the relevant agencies should increase the effort to continuously educate the public on the importance of following rules and regulations especially during the pandemic era. Although they have been fully vaccinated, they still can get infected but the implications from the infection can be minimised. Currently, the implementation of the SOPs is not as stricter as before. However, to ensure self-protection and others, the public need to continuously follow the SOPs whenever necessary especially when the are in the crowded public places.

3.7.2 Self-sufficient

The government needs to encourage the citizens to engage in self-sufficient economic activities. During the pandemic, quite a number of people lost their jobs and until now

some of them are unable to secure a stable job. It is timely for the government to focus on retraining programme for the available workforce so that they can survive the economic difficulty. The most promising economic field is entrepreneurship. Thus, equipping the public especially the new generation with the knowledge, skills and experience on entrepreneurship will help them a lot.

3.7.3 Pandemic and Vaccination Create Opportunities

The COVID-19 pandemic and vaccination programme create a new era and bring new hopes to the public. Although the public must take extra precautions when pursuing their daily routines, this practice helps the public to be more vigilant and disciplined in their behaviours and actions. Furthermore, the pandemic creates new economic activity or field as we have seen the proliferation of online business in the country. When people are more concerned on their safety, they will limit their movement, thus, allowing for the online business to grow

3.8 LIMITATION

The current study focused on the perceptions of the general public on the importance of vaccination programme. It did not examine the role of community leaders and business leaders in empowering and promoting health among the community. Community and business leaders are closer to the public and they are normally treated as the role model, having charismatic to influence public actions. The concern on how effective their roles as the community and business leaders in moulding the public behaviours and actions needs to be examined.

3.9 SUMMARY

The COVID-19 vaccination programme in general is a well-accepted programme by the general public. The programme is perceived to be successful in improving the quality of life of the public, enhance their survival, and protect them other people from infection. Although the pandemic is under controlled, the government and the public must continue with the new normal or practices so that the public safety can be guaranteed. The vaccination is not a guarantee that a person will not get infected by the virus but rather a mechanism to reduce the health implications from the infection. When the public are confident to resume their normal working lives, the socioeconomic situation of the country can be expected to improve.



CASE 4

COLD CHAIN MANAGEMENT AND THE ROLE OF ICT FOR COVID-19 VACCINATION ROLL-OUT

4 COLD CHAIN MANAGEMENT AND THE ROLE OF ICT FOR COVID-19 VACCINATION ROLL-OUT

4.1 INTRODUCTION

4.1.1 Background of the Study

Vaccination is recognized by the World Health Organisation (WHO) as a means to curb the spread of COVID-19 and to end the COVID-19 pandemic. Governments around the world have embarked on nationwide vaccination programme including Malaysia. Malaysia introduced The National COVID-19 Immunisation Programme (PICK) which was administered by the Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJAV) since early 2021. It is the largest immunisation programme implemented in the history of the country.

The immunisation programme was implemented in phases beginning 21 February 2021 to February 2022. In phase 1 (February 2021 – April 2021) of the programme, healthcare workers and frontliners were vaccinated. Phase 2 (April - August 2021) involved the remainder frontliners, senior citizens (aged 60 and above), high-risk group with chronic diseases and people with disabilities (OKU). Finally, Phase 3 (May 2021 - Feb 2022) involved the remainder of population aged 18 years and above with priority given to those in red zones. To achieve herd immunity, it is vital for the estimated 23 million *rakyat* in Phase 2 and 3 to be vaccinated.

As of 27th September 2022, it was reported that 84.2 percent of the Malaysian population have been vaccinated (https://covidnow.moh.gov.my/vaccinations/) either with Pfizer, Sinovac, AstraZeneca or CanSino.

In addition to the PICK programme, the government in collaboration with ProtectHealth Corporation Sdn Bhd (ProtectHealth)also introduced Public-Private Partnership Covid-19 Industry Immunisation Programme (PIKAS), Agrofood Industry Vaccination Programme (AiVAC), and Retail Industry Vaccination Programme (RiVAC) in the early stages of the pandemic and the PPV Outreach programme later on.

Besides the national level, there are also immunisation program at the state level such as the Selangor's Covid-19 Vaccination Programme (SelVAX) that aims to complement PICK. The main objectives of the program are to speed up the inoculation process of target groups identified by the Selangor State government and to protect the State's economy which contributes majorly to the nation's Gross Domestic Product (Industry Program). The vaccination program started in June 2021 and the vaccinees were given CoronaVac Vaccine (Sinovac).

One of the major challenges of vaccination programmes are associated with the vaccine cold chain management. This is because vaccines are considered as a perishable product and temperature-sensitive, hence the vaccines must be stored in a temperature-controlled atmosphere along the entire chain i.e., from the point of production to the end where it reaches the recipients. This study however, focused on the chain from the Malaysian airport terminal to the respective vaccinees as we would not be able to observe the chain before it reaches Malaysia.

This study will examine the processes and procedures that are in place by the various government agencies to ensure the integrity of the cold chain management of the COVID-19 vaccines. The study will also explore the issues and challenges of the COVID-19 vaccines cold chain management logistics other than the issue related to temperature.

In rolling out the national vaccines programmes, the Malaysian government has built several Information Communication Technology (ICT) applications to manage the cold chain logistics of the COVID-19 vaccines more effectively and efficiently. It is one of the objectives of this study to examine the various ICT applications used.

4.1.2 The Gap

Past studies on cold chain management focusses on food management (Han et al, 2021; Amwoka et al., 2021), technology (Zhang et al., 2021; Esmizadeh et al., 2021), and pharmaceutical (Bamakan et al., 2021). There is lack of studies that focused on vaccines (Pambudi et al., 2022) hence it is timely that study on vaccine cold chain management be carried out. Although Pambudi et al. (2022) studied the vaccine cold chain, they explored the various cold storage technology based on review of literature. No empirical data was collected thus this study addresses the gap by collecting empirical data. In addition, this study focused on the process, procedures, and the ICT used in conducting vaccine cold chain management logistics.

4.1.3 Research Objectives

The objectives of the study are as follows:

1. To identify the existing processes and procedures in place to maintain/preserve the integrity of the COVID-19 vaccines from the airport terminal to the respective vaccinees.
2. To explore the issues and challenges in the cold chain logistics COVID-19 vaccines in Malaysia.
3. To identify the current ICT applications used in managing the cold chain logistics of the COVID-19 vaccines.

4.1.4 Research Questions

The research questions formulated are as follows:

1. How was the COVID-19 vaccines cold chain management (logistics) managed during the COVID-19 roll-out in Malaysia?
    a. What are the existing processes and procedures which are in place to maintain/preserve the integrity of the COVID-19 vaccines from the airport terminal to the respective vaccinees?
    b. What are the issues and challenges in managing the cold chain logistics COVID-19 vaccines in Malaysia?
2. How was ICT applications used in managing the cold chain logistics of the COVID-19 vaccines?

4.1.5 Significance of the Study

The study was conducted with the aim of examining the vaccine cold chain management and ICT used in managing the vaccine cold chain. It is expected that the findings of the study will be significant to various stakeholders involved.

By examining the processes and procedures, we would be able to highlight best practices or specific practices that will improve the vaccination cold chain administration. Besides the Standard Operating Procedures (SOPs) and guidelines provided by the MOH, it is expected that the PSVs and PPVs would have their own practices to facilitate the running of their operations. These best practices can be compiled and used as future reference in the event a crisis such as the COVID-19 takes place. In addition, the issues and challenges identified during the data collection, would be useful for the relevant authorities to come up with a guideline on how to handle a similar situation in the event that it arises.

Knowing what type of ICT applications used in the managing the vaccines cold chain management allows the relevant authorities to be mindful of what type of ICT applications that can be incorporated during similar situation, thus making them more prepared. It also raises the question of whether the relevant authorities should purchase ready-made package or build an application which takes into consideration of the specific characteristics of the crisis.

4.1.6 Scope of the Study

The study focused on two main areas (scope). One, it focused on the cold block chain logistics of COVID-19 vaccines from the airport terminal to the respective vaccinees. Two, the study only focusses on ICT applications that are used in managing the cold chain logistics of the COVID-19 vaccines.

4.1.7 Organisation of the Report

The report consists of 12 Sections including the Introduction. In Section 4.2, the review of literature pertaining to cold chain, and ICT applications used in managing the cold chain of the COVID-19 vaccines was highlighted. The study's research design was described in Section 4.3 while the data analysis and scope of the study are presented in Section 4.4 and 4.5 respectively. The findings of the study are discussed in three sections: 4.6, 4.7 and 4.8. This is followed by the discussion on lessons that can be learned from the findings (Section 4.9) and recommendations (Section 4.10). The limitations of the study are presented in Section 4.11 and Section 4.12 summarises the report.

4.2 LITERATURE REVIEW

The review of literature discussed in this section is divided into four sub-sections. First the Cold chain management literature is presented, followed by components of vaccine cold chain management (processes and procedures). Subsequently, the challenges in vaccines distribution and ICT used in managing the cold chain logistics are elaborated.

4.2.1 Cold Chain Management

A cold chain is a branch of logistics and supply chain operations that optimises facilities and equipment to store and transport products from the point of origin to the destination within optimal temperature range. It can be referred to as the process of planning, implementing, and controlling the flow of perishable products, such as pharmaceutical goods, chilled and frozen foods (Singh et al., 2018). Differs from the traditional supply chains, products that are transported via cold chain have a short shelf life, and are susceptible to factors like temperature, humidity, and lighting intensity. Therefore, cold chain requires the use of refrigeration and dehumidification to preserve the useful life of products.

Cold chain management plays a crucial role in successful vaccination programmes. Since vaccines are considered as perishable products and temperature-sensitive, a precise temperature-controlled atmosphere along the entire chain from the point of production to recipients is required. Exposure to inappropriate conditions not only can lead the vaccines to lose their potency, but also may lead to negative health issues (Feyisa et al., 2022). Not only the recipients are not protected against the illnesses, but they are also harmed due to contamination of the vaccine resulted from the improper cold chain procedures. In Australia for example, 3000 patients had to be revaccinated in 2019, when the authority found that the vaccines injected to recipients in 2010 were found to be improperly stored (Lin et al., 2020). This is because vaccines are substances that can quickly transform their properties and efficacy when kept at inappropriate temperature (Hanson et al., 2017). Effective cold chain management is also expected to reduce wastage and prevent stock-outs. Due to the increasing costs of vaccine supplies, countries are also looking more closely on the cold chain management effectiveness than before.

The World Health Organization (WHO) reported that 25 per cent of all vaccine products has degraded quality when reach their destination. Around the globe, 300 million pounds valued of vaccines are destroyed due to inappropriate storage and transportation every year (Centres for Disease Control and Prevention, 2016). This scenario is not only typical in the developing countries, but also occur in other countries that has had surveillance for vaccine temperature monitoring (Lloyd & Cheyne, 2017). These statistics show that maintaining the integrity of cold chain is crucial for a successful immunisation roll-out programme. The integrity of cold chain can be maintained through cumulative actions achieved from materials, equipment, techniques and responsible personnel during transportation, distribution and storage until the vaccines reach the recipients. Accurate information on the temperature and logistical planning are the two keys that protect the integrity of the shipment and distribution (Rodrigue, 2020).

4.2.1.1 Components of Vaccine Cold Chain Management (Processes and Procedures)

The vaccine cold chain management can be divided into two main components:

i. packaging and storage; and
ii. transportation and distribution.

4.2.1.2 Packing and Storage

To ensure the integrity of the cold chain is not broken, vaccines must be stored, handled, and shipped at the required temperature, usually below freezing temperatures. This will need, not only the capability to deliver on time, but also relevant equipment and facilities such as cold rooms, freezer rooms, refrigerators, refrigerated transport vehicles, freezers, portable coolers, ice packs and thermometers (World Health Organization, 2005). To ensure the equipment is working properly, it must be routinely inspected and cleaned.

In the case of COVID-19 vaccines, the packing and storing are depending on the types of vaccines (Fahrni et al., 2022). For example, Pfizer's MRNA can be considered as the most sensitive to temperature, since it needs to be stored at –70 °C. Each vial contains 5 doses of 2ml. For each shipment, five trays 195 vials are transported, with 34 kg of packed dry ice, which can be stored up to 10 days. To ensure that the cold chain is not broken, the vaccines need to be removed from the thermal shipper to the ultra-cold freezer within 5 minutes of arrival at the checkpoint and can be thawed in the refrigerator at the temperature between 2-8°C for up to 5 days. Meanwhile, for Moderna's MRNA vaccine, less stringent temperature (-20°C) is required. There are also no special requirements for the preparation, since the vaccine can be stored using the refrigerator at the temperature of 2-8°C up to 30 days, until it is ready for use. Packed as 10 vials per carton, each shipper contains 2,400 doses with five doses in each vial. A similar requirement is also applied for AstraZeneca, which requires it to be stored in the refrigerator at 2-8 °C upon arrival. Yet, for this type of vaccine, the shelf-life of those that are kept in the original packaging and has not been punctured can take up to 6 months. These vaccines are typically packed in small batches, and is flowing throughout the chain, in small yet frequent deliveries.

4.2.1.3 Transportation and Distribution

A typical transportation and distribution component of vaccine cold chain management includes various stakeholders such as the sender, freight forwarder, air and cargo road transportation companies and receiving ground handling agents (de Boeck et al., 2020). Each of them plays a specific role to complete the whole processes from the point of origin to the recipient of vaccines point.

Before the process starts, the vaccine manufacturers are required to comply with the Food and Drug Authority and Federal Food, Drug and Cosmetic Act policies. The International Air Transport Association (IATA) and its members then are responsible in the transportation of vaccine consignments from the nation that supplies to the destination airport (Fahrni et al., 2022). A local road transportation company will take over the logistics responsibility once it has landed in the destination country. The vaccines are required to be stored in refrigerated trucks to be transported from the airport through to warehouses and healthcare facilities.

Besides the logistics company, local government officials or humanitarian organizations also provide on-field assistance for custom clearance at the airport (Abbasi, 2020). At the healthcare facilities, the vaccines that are transported using thermal shipper will be loaded into ultra-low temperature freezers. Equipment such as portable refrigerators and coolers, which are equipped with ice packs and electronic temperature monitoring loggers are used in the last-mile delivery. Through the temperature monitoring loggers, the temperature of the vaccines across the distribution process can be monitored and up-to-date records for traceability are available. The size of storage box (cool box), the number of icepacks and its arrangement affects the cold retention. Larger size of vaccine box requires higher number of icepacks and longer time to reach the designated temperature (Yoon, 2014).

The salient feature of transportation and distribution process of vaccines is the number of 'touchpoints', since there is a risk of improper handling during the exchanges. Therefore, checks through temperature data need to be applied to prevent vaccine potency (World Health Organization, 2015). By monitoring recording and reporting vaccines temperature throughout the transportation and distribution process, evidence to validate the vaccine quality can be provided. Besides this, temperature monitoring also helps in detecting cold chain equipment failures.

4.2.2 Challenges in Vaccines Distribution

Within existing literature on COVID-19 vaccines, issues related to production, storage and distribution are however, under-researched and under-reported. The problems and challenges in managing cold chain management of vaccines are not only observed in developing countries. In fact, it was reported by the World Health Organization (WHO) that poor compliance regarding temperature monitoring occurs at all levels of cold chain in more than 45 countries. In recent reviews by Holm and Poland (2021) and Yu et al. (2021), it was found that the lack of proper storage systems and temperature monitoring of the U.S cold chain could potentially cause adverse effects amongst the recipients. Similarly, in Ethiopia, 48 per cent of the cold chain capacity at the healthcare facilities need to be upgraded to accommodate the need of vaccines supply chain and logistics (Mohammed et al., 2021). The use of Pfizer vaccines which requires stringent temperature compliance specifically, is limiting the capacity of distributors from transporting the vaccines to countries that have poor storage systems and warm climate. In Peru for instance, the inexistence of ultracold freezers outside Lima City has required the transporters to top off containers with dry ice every 5 days to stabilize the temperature throughout the distribution process (Shretta et al., 2021).

Since vaccines travel through a complex supply chain with many handoffs from the manufacturers to the recipients, monitoring the temperature requires appropriate levels of coordination. Yet, in the Asian region, it was highlighted that there is a lack of coordination amongst the local organization, which lead to difficulties in monitoring and controlling the cold chain environment (Alam et al., 2021). Concerns were also raised about the knowledge and competence of vaccine managers or handlers. In the U.S., the health professionals' knowledge on vaccine programme was reported at only 47.6 per cent (Carrico et al., 2013). In Europe, Simone et al. (2012) highlighted that there were significant knowledge gaps and poor communication amongst the healthcare workers, contributing to poor cold chain management. Similar cases were also found in Nigeria

and Cameroon. Despite adequate implementation guidelines on the previous vaccination programmes, the healthcare workers' knowledge on the correct vaccine storage temperature was still recorded at the low level (Ogboghodo et al., 2017; Yakum et al., 2015). Since vaccines require more complex handling and storage requirements as compared to other pharmaceutical goods, due to temperature sensitivity and complex immunisation schedules, adequate training and supervision deserve recognition. Having vaccination managers or handlers who are appropriately trained may reduce the problems of accidental interruptions and wasted vaccines (Grau et al., 2021).

4.2.3 ICT Usage in Managing the Cold Chain Logistics

Digital technologies such as data dashboards, digital maps, machine learning, mobile devices, mobile apps, artificial intelligence (AI), Internet-of-Things (IoT), big data analytics (BDA), global positioning systems (GPS), Bluetooth, and digital cameras have been deployed to manage the pandemic. Generally, they have been used for diagnosis, prevention, adherence, treatment, lifestyle, patient engagement, and surveillance (Golinelli et al., 2020). Specifically, they have been used for tracking, screening for infection, contact tracing, quarantine and self-isolation, and clinical management (Whitelaw, Mamas, Harriette, and Spall, 2020; Toriumi, 2021). In addition, High Performance Computing (HPC) infrastructure, robots, 3D printing technology, and blockchain have been used to, among others, deliver food and medicine, produce protective masks, and develop health identity (He et al., 2021). The use of technology has been proven to be more effective in managing the transmission of COVID-19 than merely relying on human-driven effort (Kummitha, 2020). Additionally, cloud technology enables information sharing among health care providers in a large scale during the pandemic (Cresswell, Williams & Sheikh, 2021). Meanwhile, in a hospital setting, digital solutions of automated COVID-19 screening, daily symptom monitoring, web-based care, and knowledge dissemination, to a certain extent, have complemented offline hospital services and facilitated disease control and prevention (Lian et al., 2020; Ye, 2020).

The use of technology that has received most attention from Information System (IS) researchers is tracing. The most popular technique employed by many countries such as Singapore, South Korea, and China for tracing were through mobile phone apps. These apps, that use global positioning system (GPS) and Bluetooth to record locations, contributed significantly towards reducing the spread of the virus in those countries (Urbaczewski & Lee, 2020). Other tracking technologies include exposure notifications system (ENS), a framework developed by Google and Apple companies. Countries can use the framework to develop their own tracing system. For example, Voice-over-Internet Protocol (VoIP) technology can be coupled with the ENS framework to develop a more robust tracing system (Nisar, Zuhaib, Ulasyar & Tariq, 2021). Meanwhile, radio frequency identification (RFID) technology was proposed to improve staff safety by real-time tracking of staff in the hospital, thus allowing an emergency notification given to everyone should one be infected with the virus. Cost, however, could be the factor that hinders the adoption of this technology (Mehta, Frant, Atlin & Ackery, 2020).

Many studies have also been conducted on blockchain technology during the pandemic. However, only some were dedicated to managing the pandemic (Botene, de Azevedo, & de Aruda Ignacio, 2021). Even smaller number of studies were dedicated to developing a vaccine tracing system that will enable traceability of vaccines, patient health record

monitoring, vaccine certification, and medical supply chain. They are, however, were still in the design and experimental stage, though they do show glimpses of the possibilities offered by this technology (Surakhi & AlKhanafseh, 2021). Blockchain technology becomes the platform to build medical cooperation between the medical and scientific community in the Caribbean. The technology enables universal access to financing mechanisms and smart contracts, protecting the patient's privacy, ensuring new facilities for patient's referral through the region, and new standards for payments and reimbursements (Resiere & Kallel, 2020).

COVID-19 presents an opportunity to reimagine Information System (IS) research with the hope to build resilience in the public health information systems. A proactive public health system can be achieved with real-time surveillance systems and contact tracing to stem transmission. However, the use of technology for this purpose raises concerns such as technology design, digital inequality, and data governance. Additionally, resilience can be achieved by transforming organizations to be one that possess crisis-driven agility when fragility in facing crisis were revealed through supply chain problem and cybersecurity (Rai, 2020). It is also an opportunity to study the fast deployment of IS in coping with the fast spread of the virus (He, Zhang & Li, 2021). Streamlined governance need to be put in place to facilitate timely implementations of PhIS (Malden et al., 2021). Furthermore, the application of digital technology during the pandemic is more complex than it seems. Implementers need to be aware the success of the deployment depends on the socio-material arrangements that users assemble to link their goals to the materiality of the technological artifacts and the socio-organizational context of where the implementation takes place (Mora, Kummitha & Esposito, 2021).

4.3 RESEARCH DESIGN

In this study, we adopted a qualitative research approach to obtain rich and naturalistic data (Hyett et al., 2014). Qualitative research is research related to understanding human experience, where the research is conducted through a rich description of data (Awasthy, 2019). In this study, the qualitative research was conducted through explorative and interpretive case studies, which lead to new findings that are not prejudiced by a priori hypotheses. One of the approaches in conducting qualitative research is through a case study. A case study is an intensive study of a single unit to better understand larger similar units which contributes new knowledge (Schoch, 2020).

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident (Yin, 2003). Case study research involves examining the phenomenon in a natural setting and allows the researcher to have a holistic understanding of the phenomenon (Creswell, 1998). Therefore, this study took the interpretive stance in conducting the case study. Interpretive research provides deep insight into the complex, lived experience of people.

In this study, interpretive research allows the researchers to understand the participants' experience in managing vaccine cold chain logistics. This method also holds that the researchers play a key role in bringing "such subjectivity to the fore, backed with quality arguments rather than statistical exactness" (Garcia-lorenzo & Quek, 1997). This approach requires the researcher's direct involvement Creswell (1998) and close

interaction with the participants in data collection. Therefore, we believe that interpretive case studies are the most appropriate method to understand how the COVID-19 vaccines cold chain management (logistics) was managed during the COVID-19 roll-out in Malaysia and the ICT applications used.

Using the case study approach, we were able to collect the necessary data using three techniques: document analysis, observations and semi-structured interviews. We identified two documents which was directly related to the area of study. Both documents were published by the MOH and available online. The documents are the Guideline for COVID-19 Vaccine Products in Health Facilities and Guideline for Cold Chain Product Management in MOH Facilities in Malaysia.

To strengthen the researchers' understanding of the vaccine cold chain processes and procedures, the document analysis was complemented by semi-structured interviews. The semi-structured interviews were conducted with the relevant individuals or groups of individuals of each process in the vaccine cold chain logistics. These stakeholders include logistic partners, product warehouse, *Pusat Simpanan Vaksin* (PSV) and the *Pusat Pemberian Vaksin* (PPV).

The interviews allowed the researchers to seek clarification and insights from the various stakeholders on the process and procedure involved in vaccine cold chain management and the ICT applications used in managing the vaccine cold chain logistics.

The researchers also observed the vaccine cold chain logistics i.e., from PSVs to PPVs to the administration of the vaccine to the vaccinee in selected PPVs. The end-to-end observation allowed the researchers to triangulate the findings with the data collected from the documents and interviews. Among the activities that was observed include who are physically handling the vaccines, collecting and entering the data into the system, and monitoring the process. It will also include observing the transports used, the storage facilities, and the security provided.

4.3.1 Research Instrument

As was mentioned earlier, this project used semi-structured interview to collect empirical data. To achieve each of the objectives, questions were formulated, and the participants will be required to answer. In addition, additional questions will be asked (probing questions) whenever necessary. Sample questions are illustrated in 4.3.2, 4.3.3 and 4.3.4. Detailed questions are attached in Appendix 4.1.

4.3.2 Sampling

In this study we used the purposeful sampling technique to enable us to achieve a deep understanding of the vaccines cold chain management in Malaysia. Using purposeful sampling (also known as purposive and selective sampling) we identified participants who can provide in-depth and detailed information about vaccine cold chain management.

The qualifying criteria that we imposed was that the participants must be those involved directly in the administration of the vaccine cold chain management processes. As there

were various stakeholders involved, we categorised them into 4: Airport Terminals, Logistics Partner, Product warehouse and each type of PPV/PSV. The category, location and proposed identified person is illustrated in Table 4.1.

Table 4.1 Category, Location and Proposed Identified Person

CATEGORY	LOCATIONS*	PROPOSED IDENTIFIED PERSON
Airport terminals	KLIA, Senai Airport, Subang Airport, Penang International Airport, Kota Kinabalu International Airport Kuching International Airport	Pegawai Cawangan Penguatkuasaan Farmasi (CPF) Negeri Pegawai Imigresen Pegawai Farmasi
Logistics partners	DHL Express Pharmaniaga Logistics Sdn Bhd Zuellig Pharma Sdn Bhd DKSH Malaysia Sdn Bhd Duopharma (M) Sdn Bhd	Pengurus Operasi Pengurus Rantaian Bekalan
Product Warehouse ("Pusat Simpanan Sementara")	DHL Storage Centre – Subang, Bayan Lepas, Senai. Pharmaniaga Warehouse – Shah Alam Zuellig Pharma DKSH Duopharma	Pengurus Operasi Pengurus Rantaian Bekalan Pegawai Penerima Stok
Vaccinate Storage Central ("Pusat Simpanan Vaksin") PSV	Selangor/Kuala Lumpur – HTAR, Hospital Serdang, Hospital Selayang, Hospital Sungai Buloh, Hospital Ampang, Hospital Tanjung Karang, Insititut Kanser Negara Hospital Umum Sarawak, Kucing. Queen Elizabeth Hospital, Kota Kinabalu	Pegawai Penerima Stok Pegawai Stor Matron Ketua Jururawat Penolong Pegawai Farmasi Penolong Pegawai Perubatan Pegawai Pelulus Pengeluaran
PPV	Selangor/Kuala Lumpur 1. PPV Awam/Mega 2. PPV AZ 3. PPV Integrasi 4. PPV IPT 5. PPV Pandulalu 6. PPV Industri 7. PPV GP (General Practitioner/Pengamal/Klinik Perubatan Am Swasta) / PPV KP (Klinik Pakar) 8. PPV HS (Hospital Swasta) / PPV ACC (Pusat Jagaan Ambulatori Swasta) 9. PPV MOH (PPV KK and SPPV) – *Klinik Kesihatan* and Special PPV 10. PPV OKU 11. PPV Komuniti 12. PPV Bergerak	Pegawai Penerima Stok Penyelaras Stok Suntikan Pegawai Farmasi

Note * Number of locations was subjected to availability and accessibility. We targeted at least two interviews per category.

It has to be highlighted here that as this study is qualitative in nature, there is no specific number of targeted samples as there is no practical guidelines for estimating sample sizes for purposively sampled interviews. Nevertheless, according to Green et. al (2006) twelve interviews should suffice when the aim of the study is to understand common perceptions and experiences among a group of relatively homogeneous individuals.

There is also literature (Saunders et. al., 2018) that state that the number of interviews conducted depends on the saturation of data. Data saturation refers to the point in the research process when no new information is discovered and this redundancy signals to researchers that data collection may cease.

The sampling frame for the PPVs is shown in Table 4.2.

Table 4.2 Sampling of PPVs

NO.	TYPE OF PPV	LOCATION*
1.	PPV Awam	• Dewan Bankuet Persada PLUS, Subang
2.	PPV AZ	• World Trade Centre KL (WTCKL), KL (Mega) • UKM
3.	PPV Integrasi	• Bangi Convention Centre • Kompleks Sukan Majlis Perbandaran Kuala Langat (ceased operations on 30/9)
4.	PPV IPT	• Universiti Malaya (UM), KL • Universiti Teknologi Mara, Puncak Alam
5.	PPV Industri	• Putrajaya International Convention Centre (PICC), Putrajaya • Texas Instrument Malaysia
6.	PPV GP (General Practitioner/Pengamal/Klinik Perubatan Am Swasta) / PPV KP (Klinik Pakar)	• The KL Sky Clinic, KL • Siti Healthcare Sdn. Bhd, KL
7.	PPV HS (Hospital Swasta) / PPV ACC (Pusat Jagaan Ambulatori Swasta)	• Hospital Pakar KPJ • Pusat Perubatan MSU
8.	PPV MOH (PPV KK and SPPV) – *Klinik Kesihatan* and Special PPV	• Klinik Kesihatan Bangi • Klinik Kesihatan Bandar Tun Hussein Onn
9.	PPV Pandu Lalu	• UKM • Universiti Teknologi Mara, Puncak Alam

* Number of locations was subjected to availability and accessibility. We targeted at least two interviews per category

Facilities in Selangor/Kuala Lumpur were chosen to represent the urban site, while facilities in Sabah and Sarawak were picked to represent the rural site. For rural area, facilities were chosen if they are non-urban, away from major roads, accessible from the capital town within a day, and has lowest level of community health service delivery. Interviewees' selection will also depend on their role in the management or implementation of the vaccine's logistics distribution.

In addition to the key person involved in the various distribution categories above, we also interviewed Government Officials and Directors involved in the COVID-19

Immunisation Task Force (CITF) and ICT applications used to manage the vaccine cold chain. We also used snowball sampling techniques to identify participants. For example, we interviewed Respondent 1 and she suggested that we interview a participant in another agency who have been involved in the vaccine cold chain management. Thus, the sample builds and becomes larger as the study continues.

This project did not study the establishment of the PPVs as their establishment follows a documented Standard Operating Procedures which are developed by the Federal CITF with endorsement from the MOH. Moreover, the focus on this case study is on the vaccine cold chain management.

4.3.3 Data Collection

Data was collected over a period of more than 6 months. At the beginning of the study, we approached the participants by showing MOSTI's letter of award and ethical clearance from Universiti Malaya Ethics Committee. After the Inception Report Technical Committee meeting, we stopped our interviews as the committee required us to obtain ethical clearance from NMRR. We resumed data collection in June 2022 after obtaining the NMRR approval.

We have conducted interviews with 17 interviews (refer Appendix 4.2). Some interviews were conducted online while others were conducted Face to Face. The mode of interviews was subject to the interviewee's request. The interviews conducted Face to Face were all conducted at the interviewee's organization. Each interview lasted between one to two hours (dependent on the number of interviewees).

4.3.3.1 Challenges in Data Collection

The biggest challenge in the data collection process is obtaining the consensus from the interviewees to participate in the study. In the beginning many of the organizations require the team to obtain the National Medical Research Register (NMRR) which we eventually obtained on 24 May 2022. Once we obtained the National Medical Research Register (NMRR), the targeted participants were cooperative and participated in the study.

We were not able to conduct interviews with PPVs in Selangor due to time constraint. The *Jabatan Kesihatan Negeri Selangor* requested the team to make a presentation on the 23 September 2022, following which only consent will be given. Since the team have to submit the Draft Final Report to MOSTI on the 1 October, we decided not to continue with the interviews.

Nonetheless, as the administration of the vaccine cold chain management is subjected to the MOH's guidelines, all of the processes and procedures are standardized for every facility under MOH, hence the risk of non-participation is minimal.

The next challenge is in terms of scheduling the interviews. It requires several back-and-forth discussions before a date can be agreed upon. This meant that additional time is spent in the communication process before an interview can be conducted. Nevertheless, we managed to overcome this with due diligence from the Project Officer.

The biggest challenge of all is when the targeted organizations decline to participate in the study despite several communications being carried out. Nonetheless, since the information obtained from the other participants and the objectives of the are met, the risk of non-participation is low. In addition, as the vaccine cold chain management is subjected to the MOH's guidelines, all of the processes and procedures are standardized for every facility under MOH.

It must be highlighted here that we did not manage to conduct interviews with participants from the airport terminal category due to several constraints. At the beginning of the project, when the vaccines were arriving at the airports, all the researchers were not fully vaccinated. We then had to obtain the NMRR. Subsequently, after obtaining the NMRR, there were not many vaccines shipment made. Moreover, we needed high level security clearance to observe the transfer of the vaccine to the PSVs. Despite not conducting the interviews with participants from the airport terminals we were able to capture the required data and information from the interviews conducted with Duopharma, Pharmaniaga and Zuellig Pharma.

We were able to conduct the interviews successfully as we send the interview questions prior to the scheduled interviews. Thus, the participants were prepared with the answers which made our data collection process more efficient.

4.4 DATA ANALYSIS

In document analysis, the relevant information related to the existing processes and procedures in place to maintain/preserve the integrity of the COVID-19 vaccines were accessed and extracted. The findings from the document analysis were triangulated with the observations and semi-structured interviews carried out.

In terms of observation, the existing processes and procedures in place to maintain/preserve the integrity of the COVID-19 vaccines were recorded. The observations helped the researchers identify how the guidelines in the documents are actualized in real-life settings. For example, the observation allowed the study to see how vaccines are handled physically and how the corresponding data were entered into the systems. The findings from the observations were converted into descriptions and supported with diagrams to reflect the processes and procedures that have been observed in the field.

The interviews were recoded and transcribed. We then abstracted the data whereby we selected relevant paragraphs from each of the interview text and identified occurring patterns.

Next, we build a matrix, whereby key topics are illustrated in a tabular form and the corresponding quotes from the participants were also abstracted. From the matrix, we then write out the summaries and the major themes and common trends that are considered important were synthesised into key findings.

4.5 SCOPE

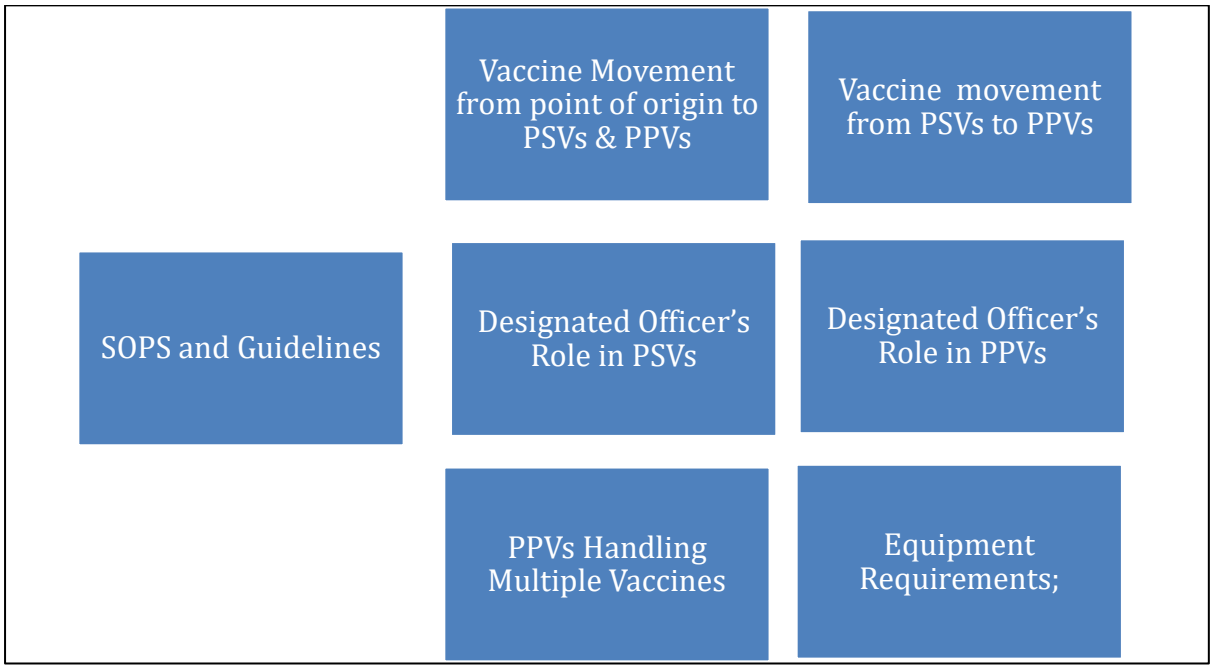
The study focused on two main areas (scope). One, it focused on the cold block chain logistics of COVID-19 vaccines from the airport terminal to the respective vaccinees. Two, the study only focusses on ICT applications that are used in managing the cold chain logistics of the COVID-19 vaccines.

4.6 FINDINGS 1 - EXISTING PROCESSES AND PROCEDURES IN PLACE

As mentioned in Section 4.3, data was collected mostly via interviews. The results are presented in accordance to the objectives of the study: processes, procedures, issues, challenges and the ICT applications used.

In this section, we examined the existing processes and procedures which are in place to maintain/preserve the integrity of the COVID-19 vaccines from the airport terminal to the respective vaccinees. The discussion is divided into several sub-sections: SOPS and Guidelines for COVID-19 Vaccine Management; Vaccine Movement from Point of Origin to PSV and PPV; Vaccine Movement from PSV to PPV; Designated Officer's Role in Managing the Vaccine Movement in a PSV (Pharmacist); Designated Officer's Role in Managing the Vaccine Movement in a PPV (Pharmacist); Equipment Requirements; and PPVs Handling More Than One Type of Vaccine in One PPV (Figure 4.1).

Figure 4. 1 Summary of Findings 1: Existing Processes and Procedures in Place



4.6.1 SOPS and Guidelines for COVID-19 Vaccine Management

In Malaysia, the COVID-19 Management Guidelines are available online at the MOH's website (Source: https://COVID-19.moh.gov.my/garis-panduan/garis-panduan-kkm). The distribution of information regarding the latest SOPs and guidelines were also distributed via emails and WhatsApp. These SOPs and guidelines were vital for health professionals and all the parties involved in the vaccine management in order to handle

the COVID-19 vaccines effectively.

In terms of SOPs, we found that all the *Pusat Simpanan Vaksin* (PSVs) and *Pusat Pemberian Vaksin* (PPVs) follow the specific guidelines (Figure 4.2) provided by MOH to handle the COVID-19 vaccines. They also refer to MOH's cold chain guideline (Figure 4.3). Both guidelines are published and available online.

Figure 4. 2 Guideline for COVID-19 Vaccine Products in Health Facilities



Source : https://www.pharmacy.gov.my/v2/ms/dokumen/garis-panduan- pengurusan-produk-vaksin-COVID-19-fasiliti-kesihatan- versi-5-tahun-2021.html

Figure 4. 3 Guideline for Cold Chain Product Management in MOH Facilities in Malaysia

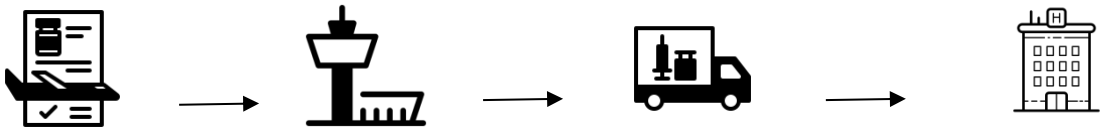


Source : https://www.pharmacy.gov.my/v2/en/documents/garis-panduan-pengurusan-produk-rangkaian-sejuk-fasiliti-kementerian-kesihatan-malaysia.html

Our findings illustrated that all the PSVs and PPVs interviewed follow closely the SOPs and guidelines thus the processes and procedures were standardised and streamlined thus making the management of vaccine effective and efficient. We also found out from our participants that when they participated in the programmes under ProtectHealth, they abide by the same guidelines in terms of receiving, collecting vaccines, recording vaccines received, distributing vaccines, storing, monitoring, reconciliation and reporting, which will be explained in Section 4.6.4 and 4.6.5.

4.6.1 Vaccine Movement from Point of Origin to *Pusat Simpanan Vaksin* (PSV) and *Pusat Pemberian Vaksin* (PPV)

Delivery is handled differently, according to the type of vaccine that will be delivered. Based on the interview data, the vaccine movement from point of origin (where the vaccines are manufactured or sourced) to the designated PSV or PPV for Pfizer vaccines are as follows:



In the case of Pfizer vaccines, they are delivered from Belgium, direct to the location (PPV/PSV). The vaccines will go through the lot release process and the vaccines can be used after the certificate is received. The Pfizer vaccines will be transported from the Kuala Lumpur International Airport (KLIA) or Subang Airport directly to the designated PSV and PPV by the logistic service provider, DHL. They are transported using storage boxes (Thermal shipper), which need to be returned. For Pfizer vaccines, the return process must be done within 30 days of the arrival at the PSV or PPV. If not, penalty will be imposed.

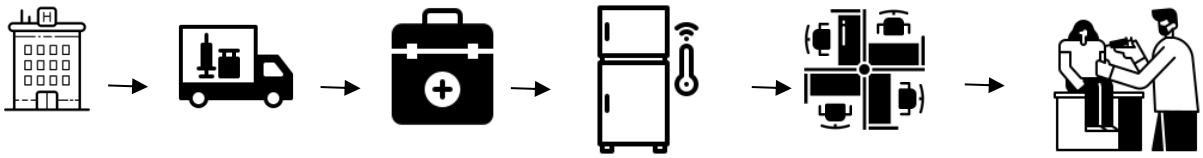
The delivery process is different for other types of vaccines, such as CoronaVac Pharmaniaga, AstraZeneca, and CanSino vaccines. The vaccine movement from point of origin (where the vaccines are manufactured or sourced) to the designated PSV or PPV for these vaccines are as follows:



Once the vaccines arrive at the airport, they are sent to a warehouse and will go through a cold chain inspection, followed by serialisation where there will be creation of code (using the VMS system) to identify them. Then, the logistic service provider, DHL will distribute to the PSVs (where the vaccines are stored) throughout Malaysia. From the PSVs, the vaccines will be collected by the designated officer from each PPV using an ambulance or the PPV's transport, escorted by the police.

4.6.2 Vaccine Movement from PSV to PPV

Based on the interview data, the vaccine movement from PSV to PPV generally follow the following sequence:



The vaccines will be transported from the PSV to PPV via ambulance, hospital transport or the PPV's transport. For every scheduled transportation of the vaccine from the PSV and PPV, the transport will be escorted by the police to ensure secured delivery of the vaccines. The PPV obtains the vaccine from the PSV (pharmacy department of a hospital or *Klinik Kesihatan*) and are collected daily or several times weekly. There are several factors that will determine the frequency of collection of vaccines, which includes the shelf life of the vaccine (expiration date varied over the period of vaccination phases), capacity of the top loader freezer in the PPV, number of cold boxes and the demand at the PPV.

The vaccines will then be transported to a central location near the vaccination stations for distribution for each vaccination station. As the vaccination process run through from morning until night for some PPVs, the vaccine stock is stored temporarily in a fridge near the vaccination stations to ease the distribution process and maintain the integrity of the vaccine. Once the vaccines are distributed to the vaccination stations, the vaccines will then be administered to the vaccinees.

4.6.3 Designated Officer's Role in Managing the Vaccine Movement in A PSV(Pharmacist)

The roles are explained according to the various functions carried out by the Pharmacist: receiving, storing, distributing, and monitoring and reporting.

i. Receiving



Before the arrival of vaccines to the PSV, the PSV will receive a delivery order, from DHL. Besides the vaccine itself, the PSV will also receive a delivery order for other consumable products from respective parties. The other consumable products include the COVID-19 Vaccine Reminder Card and syringe. These consumable products arrive at the PSV at a different point of time from the vaccines.

Vaccines that reach the PSV are transported using the thermal shipper that is equipped with a data logger. The data logger helps in monitoring the temperature of the vaccines, to ensure that the cold chain is not compromised during the transportation.

Once the vaccines reach the PSV, the MOH Malaysia's pharmacist will communicate with

Pfizer, on the confirmation of the acceptance. The information on the data logger will be updated directly by the pharmacist to Pfizer. For each vaccine that arrive, they have been identified in the packing list. Once arrived, the person-in-charge for the day will go through the document and verify it with the contents in the thermal shipper.

ii. Storing



The vaccines will be stored in the thermal shipper until the PSV obtain clearance from Pfizer. During this time, the vaccines are considered as being in the quarantine process. The quarantine process commonly takes less than 6 hours. However, in a case of inconsistent temperature (fluctuate) during the transportation, the quarantine process, could take slightly longer than usual.

Once the pharmacist gets clearance from Pfizer, a certificate of lot release is issued, and the pharmacist is allowed to transfer the vaccines from the thermal shipper to the Ultra-Low Temperature Freezer (ULTF), that stores the vaccine at +/- -80 degrees. The transformation must take less than 5 minutes, to preserve the vaccines. For Sinovac, they will be stored in a different freezer, as they are required to be stored in very low temperature storage. The vaccines are stored at 2°C to 8°C before transported using the cool box.

Each PPV need to submit an Indent Form to request for the vaccines from the PSV. Once the quantity is confirmed, then the thawing process begins, whereby the vaccines will be transferred from the ULTF to the top loader freezer. The process takes 3 hours. This freezer is used to store vaccines at +2 to +8, and also before the vaccines are transported using the cool box.

iii. Distributing



The vaccines that are ready for transportation to PPVs need to be registered and assigned with the VMS code. The VMS code will hold all the information pertaining to the vaccines. Two copies of the VMS code will be issued, one is pasted on the document, and another one will be pasted on the box of the vaccine.

Before the vaccines are moved into the cool box, the cool box itself need to be prepared i.e., temperature must be between +2 to +8. The ice packs and data logger will be kept in the box first, and once the temperature of box reach the required range, the vaccines are transferred.

iv. Monitoring and Reporting



At the end of each day, when the vaccination process has been completed in a PPV, the designated officer in the PPV will report the vaccination process by checking the indent form and administration timing form. These forms will indicate the doses of vaccines used, time of injection, as well as the leftover doses for the day (if any). This information is important, as it helps them in planning the next day i.e., how much should be taken from the PSV. This information will then be shared with the designated officer in the PSV.

4.6.5 Designated Officer's Role in Managing the Vaccine Movement in A PPV (Pharmacist)

The roles are explained according to the various functions performed by the Pharmacists: receiving, sending indent form, collecting vaccines, recording vaccines received, distributing vaccines, storing, monitoring, reconciliation and reporting.

i. Receiving Recipients Data on Appointments



Before the arrival of the vaccines, the pharmacist will obtain the list of recipients from the MySejahtera system (line listing).

ii. Sending Indent Form to PSV Requesting Vaccines and Consumables



Once the PPV has the line listing, the PPV will order the vaccine stock based on the line listing. The person in charge in the PPV will email or whatsapp (if the case is short notice), the Indent Form to match the supply and demand. For example, let say in day 1, they request 200, and then they see that the number of recipients are not as many as what was predicted, they will inform the pharmacist in the PSV to reduce the supply for the next day. This is done to avoid any wastage.

iii. Collecting the Vaccines



Normally there will be one pharmacist from the PPV and one driver that will collect the vaccines from the PSV. The Indent Form will be chopped and signed during the collection process. There is a very strict documentation and control of quantity where every vial is counted. Some days when there is collection of weekly disposables, a pharmacy clerk will also follow to help with counting the disposables (syringes and saline). The medical grade cool box RCW8 are used to transport the vaccines.

iv. Recording Vaccines Received in the System



Vaccines that reach the PPV are transported using the medical cool box that is equipped with data logger/thermometer. These equipment helps in monitoring the temperature of the vaccines, to ensure that the cold chain is not compromised, during the transportation. Once the vaccines reach the PPV, the code number of every vial is updated in the system. The monitoring of temperature is done manually, whereby they chart it by hourly. This is to ensure that the integrity of the vaccines is preserved. The temperature must be between +2 to +8. The ice packs and data logger are kept in the box.

v. Distributing to Vaccination Stations



The vaccines are stored in cool boxes with temperature that range from +2 to +8 degrees. The temperature is monitored by hour (hourly temperature charting – in every station done manually on paper). The cool box is equipped with ice packs. Any surplus for the day, will be used the next day.

vi. Storing Temporarily



In most PPVs, the vaccine stock for the day were dispensed by the end of the day. However, if there were any surplus, some PPVs will keep the vaccines at the PPV if they were equipped with a top loader freezer to store the vaccines. Other PPVs that were not equipped will return the surplus to the PSV.

vii. Monitoring, Reconciliation and Reporting



At the end of each day, when the vaccination process has been completed, the designated officer will report the process by checking the indent form and administration timing form. These forms indicate the doses of vaccines used, time of injection, as well as the leftover doses for the day. This information will then be shared with the designated officer in the PSV.

4.6.6 Equipment Requirements

Based on the interview data, the common equipment that was used include the following:



ULTF in PSV



Top loading refrigerator in PPV



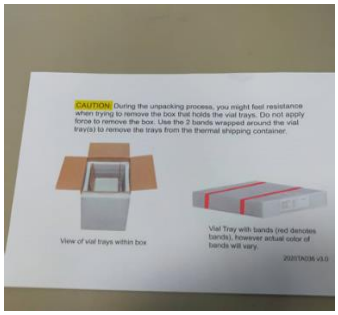
Medical grade cold box or carrier box equipped with thermometer to transport vaccines from PSV to PPV



Small cold boxes containing ice packs and fitted with data logger for internal distribution of vaccines



Top loader freezer to store ice packs



Thermal shipping container (Pfizer vaccine) with dry ice

			
Special syringe to avoid wastage	Other consumables such as COVID-19 Vaccine Reminder Card	Android phone with VMS app	Temperature data logger to record temperature in the cold box

4.6.7 PPVs Handling More Than One Type of Vaccine in One PPV

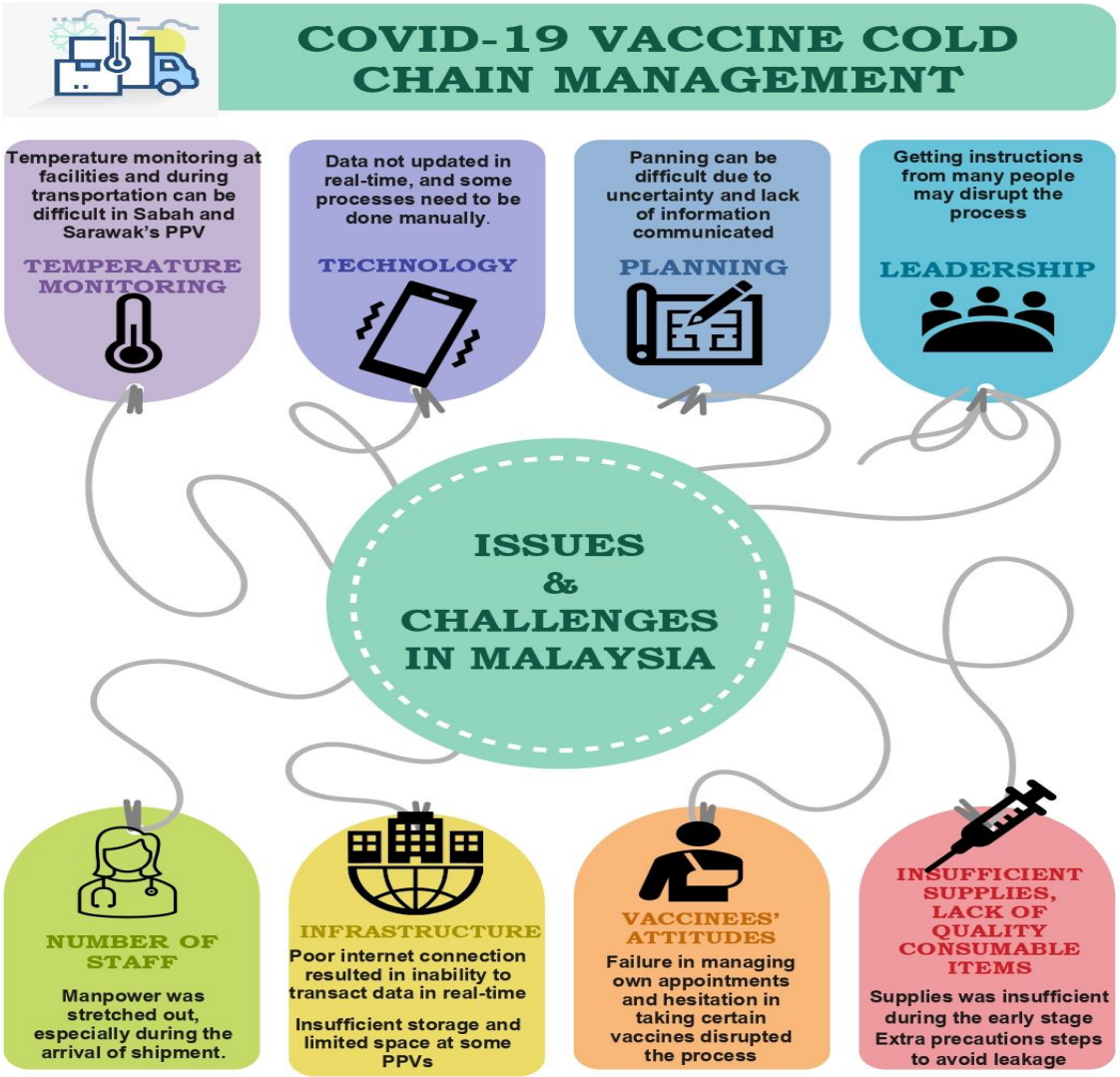
There are several PPVs in the country that handles more than one type of vaccine at a specific time. This is due to the overlapping roll-out phases of vaccination (AZ for second dose adults and Pfizer for adolescences). Based on the interview data, the Pfizer vaccine was deemed more fragile to manage, as it needs to be stored at a very low temperature, and any break down in the cold chain will lead to wastage. For the Sinovac vaccine, in terms of cold chain management and storage, it was observed to be much easier.

Whilst the handling of different vaccines at one PPV at one point in time was not common, the management of any type of vaccine to maintain and preserve the integrity of the vaccines were at the upmost priority. The monitoring and reporting process facilitated the management of the different type of vaccines under the watchful eye of the designated pharmacist and healthcare professionals in charge at the PPV.

4.7 FINDINGS 2: ISSUES AND CHALLENGES IN THE COLD CHAIN MANAGEMENT OF COVID-19 VACCINES IN MALAYSIA.

Based on the data collected, seven (7) issues and challenges were identified: Temperature Management, Levels of Technology, Management Capacity, Infrastructure, Vaccinees Attitudes, Insufficient Supply of Vaccines and Quality of Consumable Items/Equipment (Figure 4.4). The following sub-sections describe each one of them.

Figure 4. 4 Issues and Challenges of Covid-19 Vaccine Cold Chain Management in Malaysia



4.7.1 Temperature Management

There are three issues pertaining to temperature management that was found: temperature management facilities, temperature monitoring, and different requirements, which are discussed below.

i. Temperature Management at Facilities

Based on the interview data, it was observed that poor temperature management was not the biggest issue. Most of them agreed that the sufficient existence of medical boxes that were equipped with data logger had helped them in monitoring the vaccines' temperature, ensuring that the cold chain was not compromised during the transportation and distribution processes. In addition, some of the participants also described that they did hourly temperature charting to monitor the integrity of the vaccines continuously. As indicated by respondents some of the respondents:

> *"…temperature for the vaccines is tracked using the data logger every time the carrier box is open up for distribution. Ice packs are on standby mode for emergency if the temperature increases during distribution. After the delivery, the temperature report will be submitted to ATM PSV Depo"*
>
> *"…temperature excursion has never happened. Temperature maintains between 2 to 8 degrees"*
>
> [Respondent 2]
>
> *"…vaccines that reach our PPV are transported using the medical cool box that is equipped with data logger. We kept the data logger and ice packs in the box to ensure that the integrity of the vaccines is preserved. The monitoring is done manually, we chart it by hourly"*
>
> [Respondent 4]
>
> *"it is a potential challenge, but not an issue. We can monitor and maintain the temperature of the vaccines using the medical grade cool box. The quality of the medical cool box ensures that the temperature is very stable and easy to handle. Whole day temperature control. It has data logger"*
>
> [Respondent 6]

Apart from that, some of the participants, also highlighted that the existence of a good number of cold-chain facilities, such as ultra-low temperature freezers (ULTF) and top loader freezer to store vaccines, which are supported by stable electricity and power supply have help them in maintaining the appropriate temperature. According to the interviewee:

> *"…the ULTF and top loader freezer are equipped with a special plug to avoid issues of unstable electricity, which can accommodate till 72 hours. So, if the problem crop up during the weekends, we can still preserve the integrity [vaccines]. The pharmacist will be alerted through phones if anything goes wrong, even if it [freezer] is opened for quite a long time."*
>
> [Respondent 8]

Although temperature monitoring was not a big issue as there were quite sufficient numbers of ULTF, there were also respondents who acknowledged the risks of temperature excursion, since the equipment is sensitive to temperature. According to Respondent 10,

> *"…try to limit ourselves from opening the ULTF many times in short period, as it is quite sensitive to temperature. If we open it up too long, or many times, the temperature will increase"*

Respondent 12 highlighted that there were incidents of temperature excursions at the PPV in Sarawak. However, they were able to maintain the temperature, and preserve the quality of the COVID-19 vaccines. The role of pharmacist and floor manager who receive vaccines and maintain the cold chain integrity deserves recognition. Respondent 12 stated:

> *"Dr. [xxx] herself, ensured the temperature falls between 2-8 degrees. If the temperature not in good condition, she will inform pharmacist. More icepacks were obtained to ensure it remains in good condition before being distributed to recipients. Although this problem did crop up, since the PPV is located indoor, and equipped with air-conditioning, it is not severe, and can be managed"*

ii. Temperature Monitoring during Logistics and Transportation

Although temperature monitoring was not a big issue for many participants as there were sufficient existence of storage facilities and equipment, there were also some participants who expressed their concern on this issue, especially in the cases that involve distribution process to Sabah and Sarawak. This was noted by respondents 5 and 7.

> *"Distribution to Sabah and Sarawak need to be repackaged in another box to maintain temperature for 96 hours. We have to conduct simulation on how to pack the vaccines to last for 24 hours. Small cold box 4 ice packs, big box 16 icepacks. We purchase freezers to accommodate -20 degrees. We also have vaccine vial monitoring, if there is excursion, there will be colour change"*
>
> [Respondent 5]

> *"As an outsider of* MOH *[Malaysian Ministry of Health], the main challenge I would say is to ensure that when we deliver, and when it will be administered, the vaccine is not spoiled in terms of logistics."*
>
> [Respondent 7]

iii. Understanding of Different Requirement

It was further highlighted that the different requirements of temperature handling for different types of vaccines can be a challenge. Some of the vaccines require 2 to 8 degrees, while some need a more extreme condition, which pose tense to the existing cold chain infrastructure. Operating on a different requirement also requires them to update their knowledge and understanding. This issue was brought up by Respondents 2, 5,6 and 8.

> *"understanding the different temperatures needed to handle the vaccine storage as the vaccine is sensitive is quite an issue. Many SOP [standard operating procedures] to follow, and it keeps changing over time"*
>
> [Respondent 2]

"the earlier bottleneck was more on frantically searching for ULTF. At that time we were receiving Pfizer, which requires -70/-80 degrees, MOH *[Malaysian Ministry of Health] had to quickly purchase and asking all universities whether they had ULTF"*

[Respondent 5]

"Previously, the Pfizer vaccine vials can only be stored in the refrigerator for up to 5 days. But now they can be stored for up to 31 days after thawed. So, we need to manually calculate the expiration date now, as the correct date may not be reflected, as the system captures only the original expiration date.

[Respondent 8]

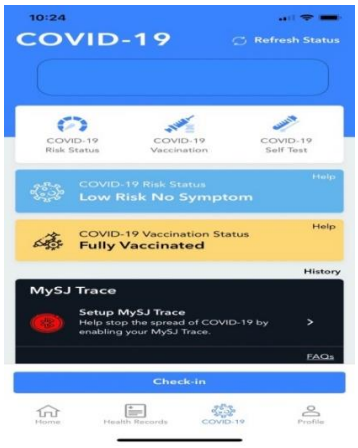
"Early days it was Pfizer, then to Sinovac, then some days, mixtures of Pfizer and Sinovac. There is no difference in training for Pfizer or Sinovac. A general training was given, but we have to attend many trainings to ensure consistency"

[Respondent 6]

4.7.2 Levels of Technology

The issues that we found related to Levels of technology are on the MySejahtera application, real time data, tedious process, and knowledge and skills.

i. MySejahtera Applications



MySejahtera is a mobile application developed by MOH. It is available in all major mobile app stores such Apple App Store, Google Play, and Huawei AppGallery. The main function of the app was to coordinate the management of COVID-19 effort between the government and the public. The coordination effort includes recording of new COVID-19 patients and dissemination of vital health information about the virus to the public. It was later used to coordinate the vaccination effort and scanning of QR codes to determine health eligibility to enter businesses and public sector's premises. The former directs the users to their place of vaccination and afterwards the production of certificates. The latter allowed the Malaysian government to implement a non-invasive contact tracing exercise.

In general, the participants in this study did not express their concern on the levels of technology. However, they have specifically noted the technical issues involving MySejahtera Application. Some of the respondents highlighted that the data were not captured correctly, causing chaos during the vaccination process.

> *"at times, data are lost. Individuals have registered, but did not receive any appointments. Data on vaccination not updated or wrongly updated. Some vaccinees data on first dose appointments went missing, while the second dose was stated as first dose"*
>
> [Respondent 1]

> *"there were problems in terms of the consistency of the data input, during the registration. Sometimes using dash and sometimes, no dash for IC [national card] registration"*

> *"early days, MySejahtera applications were uploaded on the day of the appointment itself. Some of the vaccinees did not realise that they have an appointment...end up they did not turn up"*

> *"Sometime the system [MySejahtera] is down. Mr. Shah is notified through WhatsApp and contingency plans need to be carried out. We have to it manually.*
>
> [Respondent 6]

"In some cases, the patients [vaccinees] were not able to scan the VMS code provided at the delivery point. So, there will be discrepancy of data"
[Respondent 8]

"…had a problem in issuing the certificate. But we were lucky since we had MySejahtera team to settle the issue. The vaccinees can go directly to MySejahtera counter to resolve this issue"
[Respondent 13]

ii. Real-Time Data

In relation to the technological aspects, some of the respondents interviewed commented on the lack of real-time data, which potentially disrupted the vaccination process. Some of them indicated that they had to process data in batches and record it manually, implying the problem of data integration and synchronization. According to the respondents:

"...the data are not synchronized, not real-time sometimes… use photo to snap the code number, so that any problems relating to the real-time data can be avoided."
[Respondent 4]

"…sometimes there is pending status, but it will be updated after two or three days. Sometimes longer when the system has problems."
[Respondent 6]

"...there is an issue in understanding of the system linkage between VMS and MySejahtera. Issue of mismatch of information."
[Respondent 8]

"sometimes, the recipients [vaccinees] were not able to scan the vial barcode through MySejahtera, and when this happens, it had to be done manually. There were also incidents that the barcode scanned was not tally with MyVas…the system was not mirroring…"
[Respondent 9]

"the VMS system frequently hangs and not user friendly. It is not integrated with the existing system"
[Respondent 10]

"had difficulties in retrieving old record in MyVAS, and the system is not updated in real-time…"
[Respondent 1]

iii. Tedious Process

While the existence of the three systems, MyVas, VMS and MySejahtera appears to be able to support the COVID-19 National Immunisation Programme (Program Imunisasi COVID-

19 Kebangsaan (PICK), provides visibility and traceability of the vaccines along the supply chain, from the manufacturer to the individuals at vaccination centre, many of the respondents expressed that the system could have been improved with additional features. They highlighted that there were several sub-processes, which had to be done manually, consuming time and resources.

> *"…at each station, they use forms to capture information such as the vial number, time the vial is opened, duration of the vaccination. These forms are not standard, as they are not provided by the CITF or* MOH*. Instead, they were created to smooth out the process, to facilitate in data reporting"*
>
> [Respondent 9]

> *"…monitoring and management of VMS registration form (parents-child, from the same batch) in physical paper form can be tedious. We must keep track of those quarantine, release and expiry dates. It's getting complicated with many VMS numbers…there may be possible confusion as this process is manually done"*
>
> [Respondent 8]

> *"response time could have been improved. At the beginning, it was time consuming to stick the VMS serial numbers manually"*
>
> [Respondent 5]

> *"…the VMS creates double workload and there were too much paperwork required…need to juggle and record using two systems, VMS and the pharmacy information system of the hospital"*
>
> [Respondent 10]

> *"we need to provide data for different people in different formats, through different applications. This created extra jobs and redundancies"*
>
> [Respondent 11]

iv. Knowledge and Skills

When discussing about the knowledge and skills of health professionals who are involved in the vaccination process, all the participants agreed that this was not a major challenge. All the nurses and doctors involved were able to recall some specific formal training in delivering the COVID-19 vaccines, provided by the healthcare providers and health ministry. The knowledge obtained was also continuously updated, as needed. Furthermore, most of them had acquired skills and knowledge from their involvement in previous vaccination programme and cold chain management, which they found useful to manage the COVID-19 roll-out. According to some of the respondents:

> *"…medical team have sufficient knowledge to carry out the vaccination.* MOH *have in place a good distribution system within PPUM and PPV"*
>
> [Respondent 1]

"…did a mock process of receiving and distributing vaccines. All personnel were trained and involved in the process…the mock training was recorded and used for future reference"

[Respondent 2]

"…before vaccines arrived, training was given to vaccine storage centre [PSV] and vaccine distribution centre [PPV]…involved pharmacist and medical providers. In general, the process is similar to other vaccines. However, additional training was given on handling Pfizer, especially on the thermal shipper part"

[Respondent 3]

"Before the roll-out, we have experience in handling other types of vaccines. Hence, in terms of cold chain management, we do not have any issues, as we already possess the basic knowledge. Yet, before the specific vaccines were received, we were given training on how to handle specific types of vaccines, as there is a slight difference between them, especially in terms of storage and temperature."

[Respondent 4]

"…if there are new updates, there will be another training. Jabatan Kesihatan Wilayah and ProtectHealth conduct the training. The training was adequate. It just requires us to read up, to be updated and continuously communicate with each other. Manuals are given and so much information are provided, and updates are always updated over WhatsApp group…sharing through WhatsApp is helpful, the speed we get the information is helpful (realtime)"

[Respondent 6]

4.7.3 Management Capacity

We found four issues which are related to management capacity: planning process, communication and coordination, leadership, and number of staff, which are elaborated in the following paragraphs.

i. Planning Process

In relation to the management capacity issues, some of them experienced difficulties in the planning process, as they were uncertain about the amount and types of vaccines that they will receive. This problem, however, crop up at the beginning of the roll-out programme, and appeared to be resolved with time. At the national level, the stakeholders had to adjust their response according to the actual situation, due to uncertain supplies. Some of them highlighted:

"…difficulty of knowing the number of vaccines that will be arrived, pose a challenge to plan for the verification process"

[Respondent 2]

"The distribution was a big issue, as there were not enough supplies, and vaccinees sometimes want different types of vaccines. But later on, the issue was no longer a problem as there were balanced supply of vaccines."
[Respondent 3]

"The management had to stretch and was tough in terms of structurally, at the beginning when we had 1000 incoming vaccines, we need to make sure we adhere to physical distancing, enough waiting area. We managed through communication and teamwork"

"In the early days, the vaccination roll-out was not informed on the ground early enough for preparation plans and settings up. Things were done in a rush. One week notice to prepare."
[Respondent 6]

"stock movement [distribution] are not communicated by MOH *to the pharmacy store. After the second dose phase, stocks are not moving as fast as in the earlier stage and now the stock accumulates. The schedule to receive stocks are fixed, and not upon depletion of the stocks. The pharmacist is not involved in the planning"*

[Respondent 10]

"depending on the stages of vaccination role out. At the early stage we were worried, not enough supply, during the stages of ramp up between June and July 2021, it was staff and facilities. Ideally, when we received the supply, it was based on current storage, in and out, we send directly to states. That's under normal circumstances. But it was not. So, under the current circumstances, the best way we could adapt, the better way to improve, was to add on vaccination programme and activities, so that many more people are registered, the vaccination process can get faster, so that more vaccines could be administered, and there would not be a problem in terms of storage. The states that are fast, they get vaccines fast. The states that are slow, they get vaccines later, because they are slow in implementing the programme".

[Respondent 7]

ii. Communication and Coordination

Communication and coordination were among the most important issue and recurring theme emphasised during the interviews. All the participants identified that effective communication strategies were important for managing the distribution and proved to be essential elements of the response to the pandemic. It was reported and observed that at the national and state levels, the COVID-19 vaccination programmes have the same structures. This practice helped ensure a seamless flow of communication. Respondent 7 reported that the coordination meeting was not only applied at COVID-19 Immunisation Task Force (CITF), but also occurred at unit level. For example, when they were opening a PPV, or coordinating delivery and determining the supplies for each state. As stated by the respondents:

"We want to ensure that when the supply comes in, how much is the state demand?, what is your plan in terms of vaccination in the next month? What are the other states opinion? We say that we only have this much, we think we can only supply this much… you can actually try to them equally and good amount of vaccines in terms of percentage per population for example…"

[Respondent 7]

"To overcome excess of vaccines, require clear communication with stated. When there are excess stocks, needed to communicate with CITF Persekutuan and MOSTI…there is also a need to advice the top management in future to increase or reduce order of vaccines. There is a

close collaboration between MOSTI and MOH"

[Respondent 3]

At the PSV and PPV levels, frequent communication was also highlighted as the most important mechanism for effective coordination. WhatsApp application, e-mails and phones were necessary communication channels used for rapid delivery of information for effective preparedness and response.

> *"The floor manager, diluter and pharmacist need to monitor and coordinate. Dilutor and vaccinator have to ensure that the consumable items are attached properly, so that there will be no leakage or wastage. They also need to communicate about the availability of these items to the pharmacists and floor manager. We have WhatsApp group to communicate on any arising issues that we are not certain."*
>
> [Respondent 4]

> *"For Pfizer, it is a challenge for the PPV where the pharmacist needs to communicate when we will be arriving to pick the vaccine, and what time should the vaccine be thawed, especially in the early days, when there is limited time before expiry of vaccines.*
> *[Respondent 6]*

> *"Communication is important. The reporting could be centralised to smooth out the process, especially in data collection"*
>
> [Respondent 8]

Communication and coordination also appeared to be important since it involved international logistics arrangements and distribution. Since vaccines require good cold chain management, as they are perishable items, frequent and regular meetings, through video conferences and round-table discussions were reported to be crucial.

> *"Special discussions were made with DHL China. Discussion includes time of delivery which is crucial as the vaccine storage and transport is temperature and time sensitive. We need to estimate the time needed to get airport clearance and where to place the vaccines once they arrived. Discussion with DHL could also help our company in tapping out the experiences of DHL in delivering the vaccines to Malaysia."*
>
> [Respondent 5]

iii. Leadership

When discussing the importance of coordination and communication, several respondents expressed that a well-directed communication can be established if there is clear leadership. Respondents 2 and 5 described that getting instructions from many people can disrupt the process. As expressed by Respondent 5:

> *"In the beginning, we received different directions from different people. The clarity of instructions and the process of cascading down the*

information could have been done better"

"…undecided to create own patient management system or not in the beginning. Some other companies have come out with their own. Serial number standardization – how many letters and size of printed labels. One point of communication could have been better"

[Respondent 5]

"The process of rerouting vaccinees who were unable to receive the vaccination at our PPV to hospital was quite challenging, due to lack of communication between entities at the initial stage. There were no standard guidelines on this process initially. The information on the guidelines keep on changing and the waiting time of vaccinees actually getting a new appointment at the hospital through MySejahtera was an issue".

[Respondent 9]

"…one person to lead under the vaccination programme can be a way forward for effective coordination"

[Respondent 2]

iv. Number of Staff

While all the respondents interviewed agreed that all healthcare professionals have sufficient knowledge and skills to undertake the COVID-19 vaccination programme, several of the noted that at times, they must stretch out as the numbers are insufficient to support. They, however, highlighted that the support from the top management is crucial in handling their stress levels.

"manpower was a challenge. But top management are really supported. Senior nursing staff and consultants also volunteered as vaccinators. Outside volunteers however, are not used, due to data confidentiality and concern of health condition of the volunteers. We had to juggle our day job after office hours. At each station there is a team leader that will manage the time break for the staff involved. Scheduling was done so that the staff is able to take turns during the vaccination process. The management help provide food for all staff involved, and for those working Thursday, Friday non-stop, they will be given a day off Saturday, off-record."

[Respondent 6]

"Balancing between our own work and responsibility at the PSV/PPV could be challenging. Having one team to manage the set up at the PSV, and one team to set up at the vaccination centre would be good to smooth out the process"

[Respondent 8]

"Number of manpower that can handle the receiving shipment can be an issue. At one point, we received 37 thermal shippers, and having to unbox

and store in the ULTF within 5 minutes can be challenging tasks…the pharmacist also was not able to focus on other tasks, as the management of vaccines is non-stop"

[Respondent 10]

4.7.4 Infrastructure

There were two issues that were raised related to infrastructure: Internet connection and storage capacity.

i. Internet Connection

Unlike many other developing countries, inadequate infrastructure seems to not be a significant issue experiencing by the respondents. Only two major issues indicated by them, storage capacity and internet problem that cropped up at the PPV.

"Poor internet connection at the delivery point may also arise when there were too many people trying to scan the code at the same time. The inability of the vaccinees to scan the code may lead to the inability to identify them as person who has received the vaccines. Some of them may appear as those who have not completed the first dose, when they have actually received the dose."

[Respondent 9]

"In the case of problems arising due to MySejahtera downtime or internet connectivity, the vaccinees were asked to capture the code using the camera phone. This will serve as a proof for the people at PPV to manually key-in the data, so that there will be no distortion of information"

[Respondent 4]

ii. Storage Capacity

"in the early days, the challenge was to get hold of medical grade cool box in time. There was high demand and low supply…needed to purchase the medical grade cool box in a short period of time. The product is not cheap. We had to bargain with the top management on the purchase"

[Respondent 6]

"when there are excess of vaccines, there is an issue of storage. Now, there are excess of stocks, and to overcome this issue, stocks needed to be mobilised and delivery schedules need to be adjusted. For example, if Sabah has excess stocks, it can be mobilised to Selangor."

[Respondent 3]

"we use our own facilities for transportation. If our storage space is insufficient, the vaccines will be kept in Klinik Kesihatan. If not, they will be transported directly to us."

"For Sinovac, the challenge would be in terms of managing the space. This is due to the characteristics of the Sinovac, which is kept in 1 vial."

[Respondent 4]

"We did make investments to support the government initiative. Had to do renovations as there were not enough space in the warehouse to store both insulins and vaccines"

[Respondent 5]

"in my opinion, the current bottleneck is storage. The bottleneck was more on frantically searching for ULTF. At that time, we were receiving Pfizer. MOH *had to quickly purchase and ask all universities whether they had ULTF. Warehouse, however, was not so much of issue in terms of Sinovac or AZ…we needed to reduce other medications in the cold chain that uses ULTF…we have to plan via pharmacy and cannot send to the states because there is too much of supply of Pfizer, so we have to redistribute and store temporarily in certain ULTF or PIC in other places"*

[Respondent 7]

"there is limitation of space in the pharmacy store…there are only 5 ULTF in Sabah, so this creates pressure on the store pharmacy to fulfil the demand"

[Respondent 7]

4.7.5 Vaccinees Attitudes

Several issues related to the vaccinees attitudes were raised: managing appointments and request for specific vaccines and handphones.

i. Managing Owned Appointments

The efficiency of the distribution channels was also depending on the vaccinees attitudes. Some of the respondents highlighted that there were cases whereby the individuals did not present at the vaccination appointment. Failure to attend a vaccination appointment could also resulted in wastage of vaccines, as they have a short lifecycle; and repeating the process of thawing, storing at the storage temperature and room temperature may lead to product degrade. In some cases, the individuals did not turn up for the vaccination as they were not aware of the appointments given through MySejahtera. Although their appointments were rescheduled, this process may disrupt the efficiency of the distribution. As noted by few respondents:

"sometimes, those that confirmed that they will not turn up for vaccine still come".

[Respondent 6]

"The diluter has to stop dilute when they see the number has become lesser. Before the dilution starts, we have to ensure that there are 6 people."

[Respondent 4]

"We had to call the vaccinees to determine whether they would be coming or not. Some of them did not realise that they already have an appointment"

[Respondent 5]

"vaccinees do not turn up for unknow reasons…causing wastage and excess stocks"

[Respondent 11]

"if vaccinees did not come on time, it would be wastage. We had to ask around the hospitals, and request who have fulfilled the criteria to come and get the vaccines"

[Respondent 13]

ii. Request for Specific Vaccines

Apart from failure to manage their own appointments, there were also cases where individuals refuse to take certain vaccines, due to personal doubts and social media influence. As described by the respondents:

"Vaccinees have preferences brand of vaccines, although they are not allowed to choose"

[Respondent 6]

"The vaccinees wanted different types of vaccines. This challenged the delivery and distribution process as there were not enough supplies of vaccines"

[Respondent 3]

iii. Handphones

At some PPVs, there were also cases whereby individuals who were scheduled for appointments, attended without either bringing their cell phones or the battery was dead. This situation was also influencing the smooth of the vaccination process, since all the information were uploaded into the MySejahtera, and were linked to the other two systems, MyVAS and VMS. When this situation occurred, the information had to be recorded manually and uploaded later, which may consume extra time. Some of the respondents reported:

"additional problem for us, if the vaccinees came did not bring handphone or handphone battery flat"

[Respondent 6]

Communication with the vaccinees was also deemed to be challenging when it involved teens and foreigners. For teens, some of them were quite clueless on the vaccination delivery process, while for the foreigners, language barrier was cited as a common problem.

"at each station, there is also usherer to write down the time of vaccination, and also to facilitate the process of vaccination, when it involved teens and foreigners.

[Respondent 4]

4.7.6 Insufficient Supply of Vaccine

At the beginning of the COVID-19 roll-out programme, most of the respondents indicated that they were experiencing shortage of supplies. The delivery of the vaccines had to be replanned and redistributed across the country. As noted by few respondents:

"in the first month, we were struggled to fulfil needs as there were insufficient vaccines…had to take vaccine from Sabah and Sarawak. As there were insufficient stock, the priority was given to our personnel who were on duty at the roadblocks, followed by the family members."

[Respondent 2]

"Initially, at the beginning of the vaccination roll-out, there were not enough supply from Pfizer. When there was shortage of supplies, top level of intervention was needed. Clear communication with states were also required."

[Respondent 3]

"At the early stage, the biggest concern was insufficient supply. There was a consideration if there is an outbreak in certain areas of states, where the distribution will be given more to those areas."

[Respondent 7]

"vaccinees want to change from Comirnaty to Pfizer"

[Respondent 13]

4.7.7 Quality of the Consumable Items

Of all the respondents interviewed, one of them (Respondent 4) expressed concerns on the quality of the consumable items used. From the observation made, the dilutor and vaccinator had to take extra precautions steps, in ensuring that the syringe was attached properly, to avoid leakage, which eventually lead to wastage.

4.8 FINDINGS 3: CURRENT ICT APPLICATIONS USED IN MANAGING THE COLD CHAIN MANAGEMENT OF THE COVID-19 VACCINES

Based on the interviews conducted, we found that there are at least three main ICT applications that are used in managing the vaccines cold chain logistics. They are the Vaccine Management System, Blockchain System for Vaccination Records and Public Health Analytics: The COVID-19 Dashboard.

4.8.1 The Vaccine Management System (VMS)

The Vaccine Management System (VMS) is a new system developed by the Ministry of Science, Technology and Innovation (MOSTI). MOSTI is also the administrator of VMS. It was developed as a platform to register the vaccines serial number. It is also acts as platform to trace and track the movement of vaccines from the vaccine's storage centres (*Pusat Storan Vaksin* – PSV) to the respective vaccination dispensing centres (*Pusat Pemberian Vaksin* – PPV). The system was developed rapidly between late 2020 and early 2021 due to the oncoming COVID-19 vaccine that has been procured by the Malaysian government.

The VMS acts as an intermediary between two important systems: the pharmacy information system (PhIS) and the MySejahtera system. PhIS was developed by MOH while MySejahtera was developed by KPISoft Sdn Bhd. Its development began after MOH requested assistance from the National Cyber Security Agency (NACSA), National Security Council, and the Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) to assess an app developed by KPISoft, to be made into a national-level app to monitor the COVID-19 spread (https://www.malaymail.com/news/malaysia/2020/07/01/nsc-says-mysejahtera-app-developers-a-malaysian-company-that-made-waves-int/1880601).

PhIS acts as a platform to manage the ministry's procurement of drugs, medicines, and vaccines and their distribution to the various government's hospitals and clinics. Meanwhile, the MySejahtera system manages the public's vaccination process and disseminates the latest information about the COVID-19 pandemic.

It is important that the three systems, especially the PhIS and VMS, were working in tandem during the COVID-19 pandemic. The procurement and reception of vaccines were recorded in the PhIS. Upon the release of the vaccines for usage, the serialization and commissioning of the vaccines were performed by the VMS. Based on the information from the PhIS, the serial number for each vial tray of vaccines (Figure 4.5) were generated by the VMS. The VMS also produced the barcode labels that were attached to each vial tray and the Serial Number Registration Form (VMS-1) (Figure 4.6). The form contains information such as type of vaccine, batch number, and expiry date.

Figure 4. 5 The Barcode on a Vial of AstraZeneca Vaccine

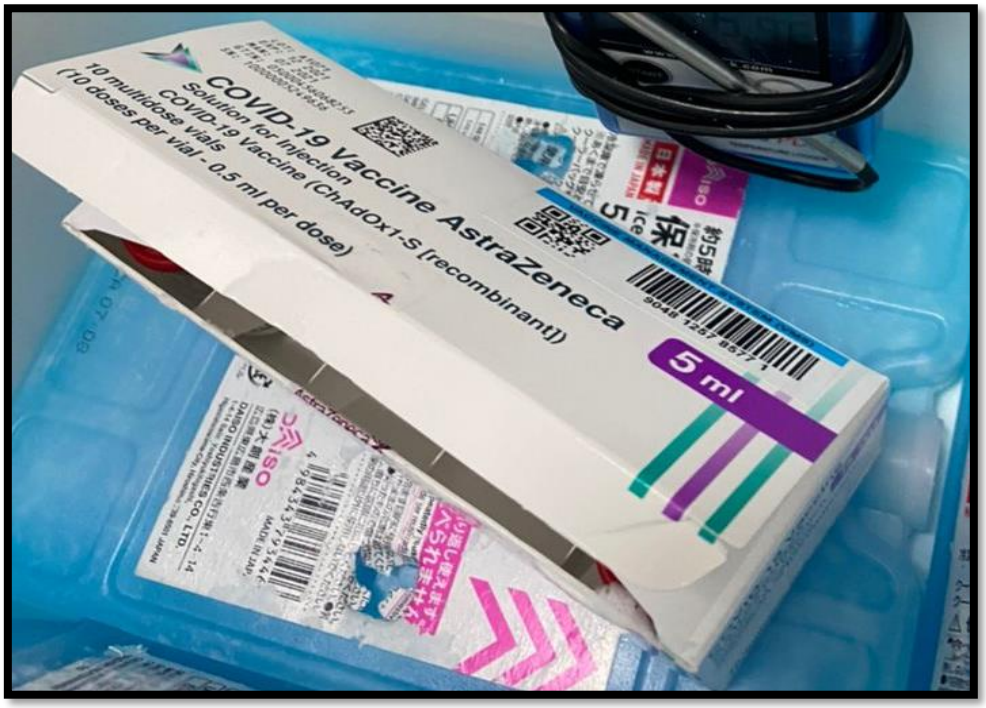
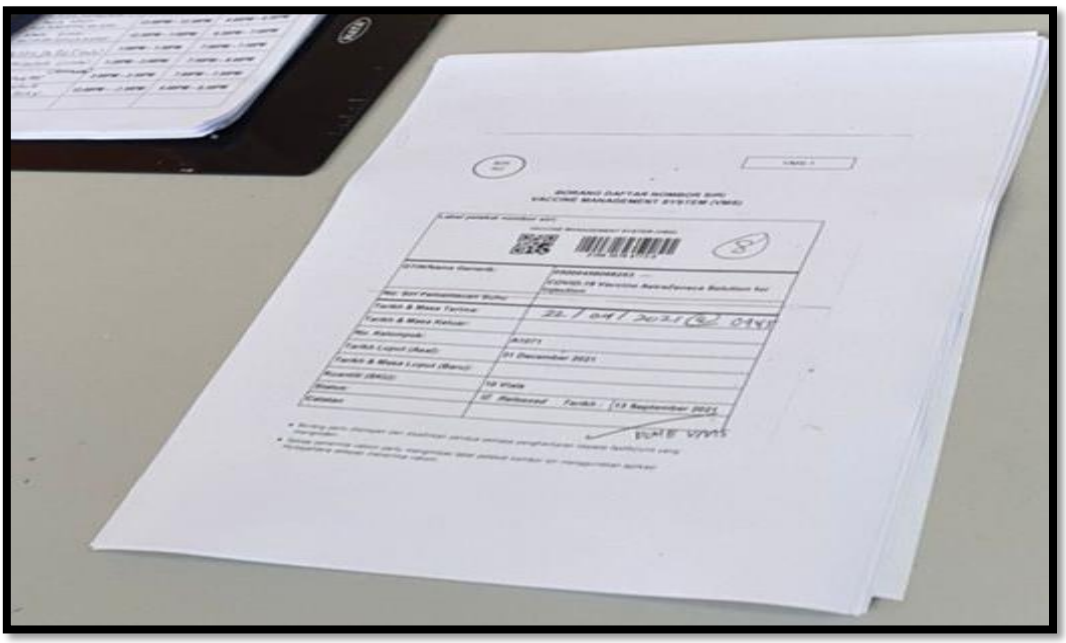
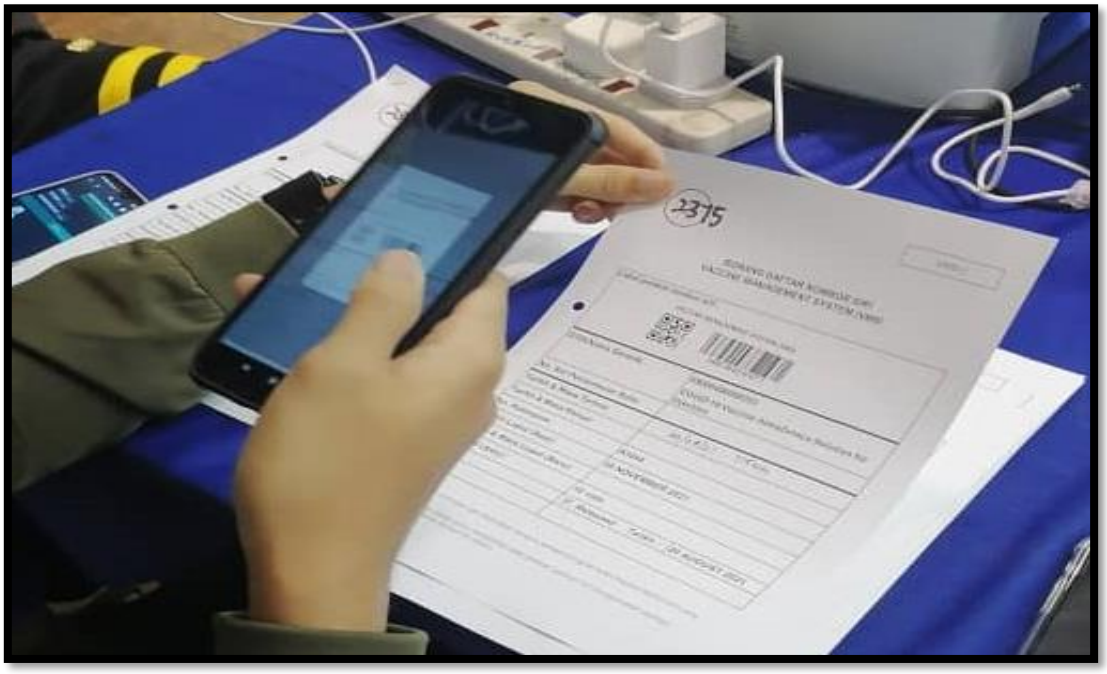


Figure 4. 6 The VMS1 Form



When each vial tray of vaccines has been registered digitally through VMS and physically through the vial tray and VMS-1, the vaccines will be distributed to the PPVs. Using the VMS, MOH issued the intra-facility instructions for the dispense of the vaccines and inter-facility instructions for transfer of vaccines. Once the vaccines arrived at the PPVs, the centres recorded the vaccine trays that they received through the VMS. (Figure 4.7). The VMS came with a mobile app that enabled this step to be performed easily by the PPVs. The app also contained other features such as monitoring of vaccines distribution.

Figure 4. 7 Entering the Data of Vaccines Received by PPVs



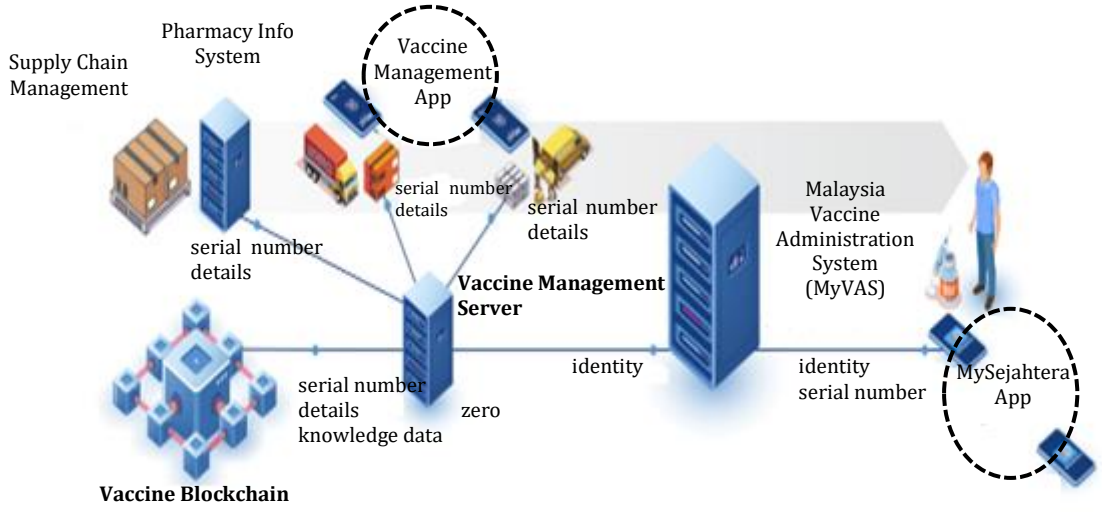
One of the biggest IT challenges faced in the vaccination process was the updating of vaccination status. The vaccine recipients were asked to scan the barcode at the PPVs when they reached the booth where they will receive the vaccines. However, updating of the information onto the recipients MySejahtera app was done in batches. So, they were unable to see the status change immediately after receiving the vaccines. Furthermore, some forgot to or did not know how to refresh the app, hence did not see the status update.

4.8.2 Blockchain System for Vaccination Records

The blockchain system for tracking and tracing of COVID-19 vaccines were developed in tandem with, and thus forms part of the VMS. The main purpose of this technology was to develop a tamper-proof system for storing the vaccination records. Blockchain was chosen as the technology to achieve that aim as it can provide a "trust less source of truth". The vaccination records will be kept in a chain of blocks that is almost impossible to tamper; the whole chain will be considered null and void if evidence of tampering was found. Nevertheless, the system still enables tracing of vaccination records while keeping the identity information confidential through cryptographic technology.
The blockchain system was developed by MIMOS Berhad under the jurisdiction of MOSTI. The system developers were the same personnel involved with the VMS development. They consisted of six MIMOS personnel in Kulim, Kedah, and ten personnel in Kuala Lumpur. The blockchain system was developed using Hyperledger Fabric, an open-source software for such purpose. Because the system was developed in tandem with the VMS, the team took a rapid development methodology as well. The team, however, was equipped with past experiences in developing such blockchain system for the palm oil industry. The experience enabled them to develop an efficient and robust system in a short period of time.

The system's process starts when MySejahtera app captures the vaccine barcode at the PPV. Once this happen, the recipient identity information will be bound to the vaccine information the person receives. This data will be sent to the MyVAS (the backend of MySejahtera) and henceforth to the VMS. Here, the blockchain system will take over. There will be a quarantine period where the data will be periodically assessed for error or evidence of tampering. Once no such evidence was found, the vaccination record will be written to the blockchain. The blockchain is intelligent enough to automatically determine the appropriate number of minutes before a block of records is created. Each block will have its own hash and the hash of the block immediately prior. The chain of blocks, or blockchain will be stored in three Government Sector's Data Centres (Pusat Data Sektor Awam): Putrajaya, Bandar Enstek, and Kulim. All three sites have the exact copy of data, ensuring that the records are well-backed up and almost impossible to tamper with. The relationship between the Blockchain System, the VMS, and MySejahtera is shown in Figure 4.8.

Figure 4. 8 The Relationship Between the Blockchain System, the VMS, and MySejahtera



There are also efforts by state governments to complement the federal efforts in combating and reducing the negative effect of COVID-19. The Selangor state government allocated RM 1 million of its 2022's budget to integrate the state's health services and initiatives through SELangkah. SELangkah is a specialized mobile application for the purpose of managing the COVID-19's spread in the state. The app's features include QR code scanning for contact tracing, home quarantine monitoring, COVID-19 screenings subsidized by the state government, vaccination under the state's coronavirus inoculation programme, and reporting of COVID-19 test results.

4.8.3 Public Health Analytics: The COVID-19 Dashboard

The COVID-19 dashboard is a type of visual analytics developed and administered by MOSTI specifically for the pandemic. It is used by the COVID-19 Immunisation Task Force (CITF) during its daily meeting to assess the current situation of the pandemic in Malaysia and consequently, decide the best action to address the pandemic situation in terms of

vaccine distribution. Among the information included in the dashboard is the COVID-19 cases and vaccines-related information. In terms of COVID-19 cases, the dashboard includes information such as active cases and whether they are home quarantining, in the quarantine centres, hospitalized, or under intensive care (ventilated and unventilated). The dashboard also shows the number of daily deaths by the virus.

In terms of vaccines-related information, the dashboard contains information about the types of vaccines that have arrived in the country and their brands such as Pfizer, Sinovac, AstraZeneca and CanSino. The destination of the vaccines -usually by states - will also be shown by the dashboard. In addition, the information of the vaccine's recipients is shown in the dashboard. The information includes the number of doses administered and the number of recipients daily and accumulatively. The number of recipients can be further divided into those receiving the first, second, or booster dose (see Figures 4.9 – 4.11).

Despite the massive amount of information included in the dashboard, it was never overwhelming to the users. There are several reasons that enable the readers to follow the information easily. First, the dashboard contains a healthy mix of numbers and charts. Bar, line, and pie charts are used extensively in the dashboard to provide visuals for information such as COVID-19 cases and the vaccination effort. Second, the developers of the system have cleverly used various colours and shades to illustrate the gravity of the situation. For example, the developers used darker shades to illustrate bigger numbers and lighter shades for smaller numbers.

The data for the dashboard comes from the PhIS, VMS, MySejahtera and MOH. Specifically, the PhIS and VMS provide the data for the vaccines and vaccination status while the MOH and MySejahtera provide the data on COVID-19 cases. These data will then be integrated by the administrator at MOSTI. Once they are ready for analysis, they will be fed into the analytics engine. After the data have been processed, the output will be displayed using a combination of numbers and charts via various colours and shades in the dashboard.

One of the issues raised by the public concerning the dashboard was the lack of such a tool for them. To address this concern, MOH and CITF have worked with the open data community (ODC) to share a similar COVID-19 dashboard with the public. The ODC is a group of innovative system and software developers who are committed towards the philosophy of open data, whereby important data concerning the public should be accessible to anyone and anywhere. They worked pro-bono to develop and maintain the CovidNow site. This site provides the COVID-19 analytics that were previously only accessible to the CITF. However, some information that is less relevant to the public was omitted from the site.

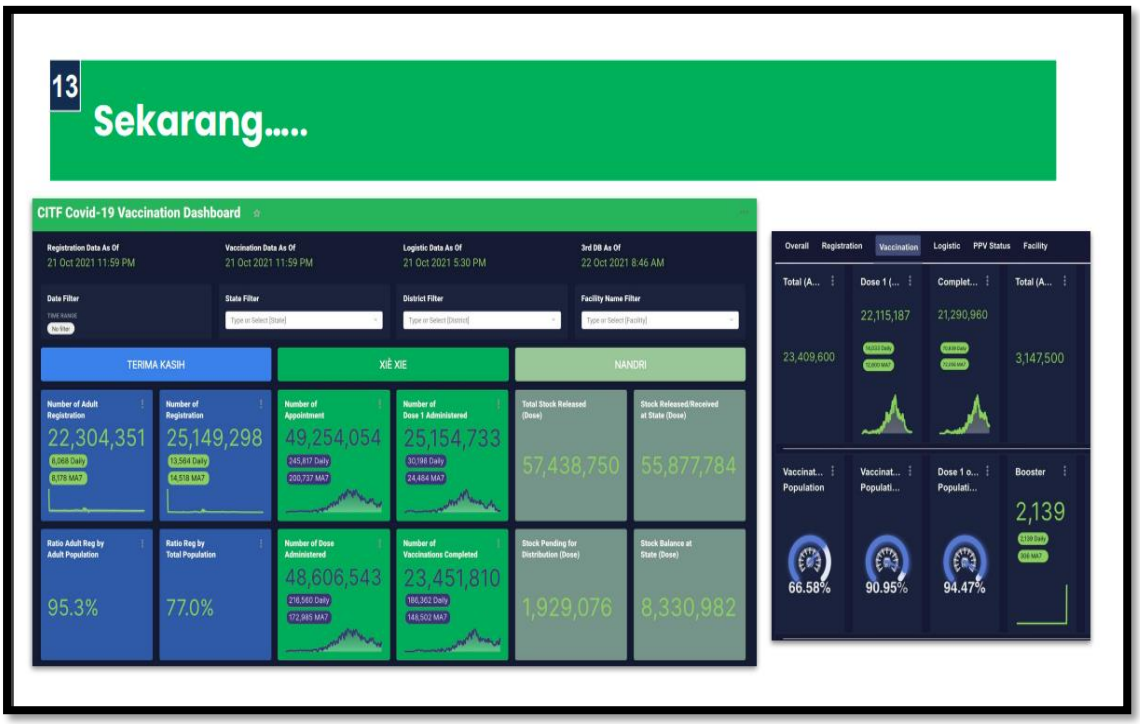
Figure 4. 9 Distribution of COVID-19 Vaccines by States



Figure 4. 10 Information on COVID-19 Vaccines Registration, Vaccination and Logistics



Figure 4. 11 More Information of COVID-19 Vaccines Registration and Vaccination Status



4.9 LESSONS LEARNED

The discussion in this section is based on findings discussed in Section 4.6. The lessons learnt are discussed in three sub-sections: processes and procedures, Issues and challenges and ICT usage.

4.9.1 Processes and Procedures

As Malaysia enters the phase of transition to the endemic phase on April 1, 2022, the situation in Malaysia progresses to fewer number of cases reported daily. The two major factors that pushes Malaysia to progress to the endemic phase is the successful implementation of the vaccination roll-out and Malaysia's structured healthcare system. Each PSV and PPV followed closely the general guideline provided by the MOH, which resulted in standardised implementation of the processes and procedures, especially in terms of maintaining and preserving the integrity of the COVID-19 vaccines.

The findings of this study show that in the beginning of the vaccination roll-out which started in February 2021, the health practitioners relied heavily of the SOPs and guideline provided by the MOH. The vaccination roll-out initiative was organised into several phases with different target groups. The initial three phases of the vaccination, which lasted over a period of one-year, were administered to frontliners comprising of public and private healthcare personnel, frontliners consisting of essential services, defence and security personnel, senior citizens, high-risk group with chronic diseases and people with disabilities, and adult population aged 18 years and above. Phase four concentrated on employees of critical industries such as the manufacturing sector, while phase five focused on adolescents aged from 12 to 17. Starting February 2022, children between age

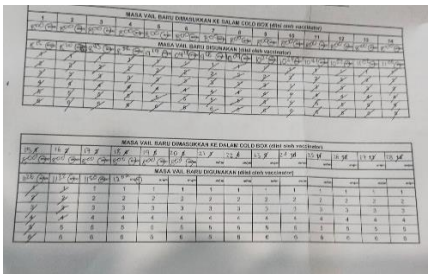
5 and under 12 were the target group for the vaccination programme.

Based on the findings of the study, there were specific practices that were put in place to improve the operations in the PPV that supplemented the SOPs and guidelines provided by the MOH. With the different phases of vaccination roll-out, flexibility and teamwork were key to ensure that any issues that arise were dealt with immediately. The example of the effect of the different phases of the vaccination roll-out was the need to change the layout of the vaccinee waiting area or vaccination stations over time to improve flow and creating a comfortable (and also safe) space between vaccinees. Special attention was also given in terms planning the layout that allows for easy access to the elderly or individuals with disabilities (such as wheelchair bound).

Some of the specific practices to improve the vaccination administration were similar in several PPVs, such as the customised manual data sheets and Excel to facilitate the recording and reporting of the vaccination process and the constant communication via WhatsApp between pharmacists and health professionals for the current status of operations throughout the day. There were also practices that were implemented in a specific PPV, such as ensuring that there are six vaccines waiting line before dilution starts and the six-digit numbering system associated to a vaccination station to avoid wastage in the case of the Pfizer vaccine.
Over the different phases of the national COVID-19 immunisation programme, the SOPS and guidelines were updated, and these updates were disseminated simultaneously, which continued the pathway of standardised implementation of the processes and procedures throughout Malaysia. As Malaysia enters to the endemic phase, there is less reliance on government interventions, such as strict SOPs and laws. In the effort to ensure that the COVID-19 virus does not spread, the emphasis is now on individual responsibility and community solidarity.

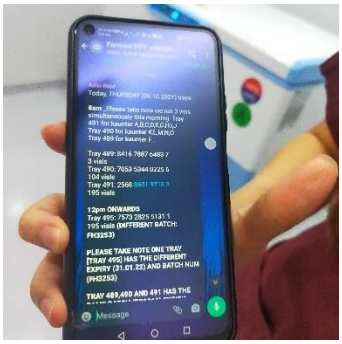
As each PPV followed the general guideline provided by the MOH, there were specific practices that were put in place to improve the operations in the PPV. These best practices include the following:

- Customized manual data sheets and Excel to facilitate the recording and reporting of the vaccination process that includes hourly temperature chart form, temperature charting report, vaccination administration timing form that records the number and time of vaccination to monitor vaccine shelf life, type of vaccine used, wastage, vial counts (total of the day), balance (if any).



Example of a Customised Manual Data Sheet

- Constant communication via WhatsApp between pharmacists and health professionals for the current status of operations throughout the day. It promoted close coordination and teamwork of the whole team on site.



Screenshot of Communication via WhatsApp

- Changing the layout of vaccinee waiting area and vaccination stations over time to improve flow and creating a comfortable space between vaccinees. This scenario was more significant in the case where vaccinees were teenagers and children and the vaccinee were accompanied by their parent or guardian.



Hall Space for Vaccinees That Were School Children

- Distribution of vaccines between vaccination stations (sharing of vaccines between three stations) to maximise the administration of doses and avoid any wastage.



Vaccination Stations

- For Pfizer, before the dilution starts, they will ensure that there are six vaccinees waiting in line. A numbering system according to station and dose number was implemented in the PPV. Example: Vaccination Station C, number C-1 to C-6.



The Numbering Cards Used for the Numbering System

- Knowledge sharing on the SOPs that evolve throughout the different phases of vaccination in Malaysia to speed up the implementation process, improve efficiency and quality of service.



SENARAI EDARAN

YBhg. Datuk/Dato' Indera/Dato'/Tuan/Puan,

EDARAN *GUIDELINES COVID-19 MANAGEMENT IN MALAYSIA* No. 05/2020 (EDISI KELIMA)

Dengan segala hormatnya perkara di atas adalah dirujuk.

2. Jangkitan COVID-19 di Malaysia telah menunjukkan peningkatan terutamanya semasa gelombang kedua ini. Oleh yang demikian, Kementerian Kesihatan Malaysia telah menambahbaik garispanduan sedia

3. Bersama ini dikemukakan *Guidelines COVID-19 Management in Malaysia No. 05/2020* (Edisi Kelima). Adalah dipohon untuk YBhg. Datuk/Dato' Indera/Dato'/tuan/puan untuk mengedarkan garispanduan ini kepada semua fasiliti kesihatan di bawah tanggungjawab masing-masing. Dokumen ini juga boleh dimuat turun dari laman sesawang rasmi KKM di www.moh.gov.my. Penggunaan garispanduan ini berkuatkuasa serta merta, bersamaan dengan tarikh surat ini dikeluarkan.

Letter from the Ministry of Health related to the Distribution of the COVID-19 Management Guidelines in Malaysia No. 5/2020

4.9.2 Issues and Challenges

The findings of this study show that the challenges that were experienced by the stakeholders involved in the COVID-19 vaccination roll-out programme were dynamic. It changed according to the phase of the programme. From the observations and interviews conducted, it was found that at the early stage of the programme, the concern was more on the insufficient supplies of vaccines to accommodate the needs of the country's population. The insufficient supplies of vaccines have urged the responsible authority to replan and change the distribution plan, so that priority was given to those who were in need. Although the demand planning was first made based on the number of adult populations to be vaccinated in each state, the supplies had to be redistributed in accordance to the outbreak that occurred in certain areas. This step was taken in the effort to manage the outbreaks. Apart from that, Malaysia has had to balance COVID-19 portfolio to include other types of vaccines, such as AstraZeneca and Sinovac as well. The distribution of vaccines across the country, was also depending on the efficiency of the state's Health Director and teams. The slower management of registration process at the state level led to the different pace of vaccination programme.

As the roll-out of COVID-19 vaccines entered the next phases, the problem of supply shortage had decreased. As it entered another phase, the country was experiencing insufficient facilities in terms of storage as well as human capital. For the PSVs, they need more ULTF when handling the Pfizer, as this vaccine requires a very low temperature as compared to Sinovac. Any breakdown in the cold chain will lead to wastage, and in extreme case, it could jeopardise the health of vaccinees. During this phase, the MOH had to quickly purchase and requested ULTF from the country's universities. Similarly, there was also a need to reduce the production or incoming of other medications that are depending on the cold chain management, so as to support the COVID-19 roll-out programme. The storage capacity became an apparent problem when the country received a higher number of Pfizer. The supplies also needed to be redistributed depending on the storage capacity that was possessed by the states. To cater the problem of storage, the vaccines were also mobilised around, and the demand planning and delivery schedule need to be flexible, according to the capacity. To further avoid the storage problems, the vaccination programmes and activities were increased. This situation had challenged the planning of the vaccination process.

Looking at the uncertainty that surrounded the national vaccination programmes and the complexities of the supply and distribution chains, it is expected that coordination and communication play important roles. For example, to overcome the problem of excess vaccines, and to facilitate the process of mobilization, clear communication between responsible authority at the state and national levels are required. At the PPV level, communication amongst doctors, pharmacists and health coordinators in determining the number of stations, doses, vaccinators help smooth the distribution process. Communication between pharmacists at PSV and health coordinators at PPV is also important in ensuring that the supply matches the demand at the health facilities, as well as to avoid any wastage. The internal and external coordination between the different functions are the key factors that promote the readiness of the local facilities in handling the roll-out. In relation to coordination and communication, this study also found the clarity of leadership is important. It helps in steering in the right direction and reduce ambiguity. As the roll-out programme is quite dynamic, everyone needs to have a clear instruction, to ensure they are in the same direction.

Although there was an issue of finding and mobilising the ULTF equipment at PSVs, the issue of cold chain equipment appeared to be minor at PPV levels. There were sufficient medical boxes, equipped with data logger provided to help in storing and monitoring the temperature. In some cases, however, they used the normal cool box, and altered it to suit the needs of vaccine cold chain. The temperature data provided by the data logger were used for temperature charting and monitoring the integrity of the vaccines. This process, however, could be improved if it can be done automatically, without the need of manual intervention.

While the process of temperature monitoring was not an issue, the process of generating, sticking and assigning the VMS code at the PSVs can be tedious and time consuming, as in certain cases it was not based on tray but vial unit. When this occurred, the person in charge was required to issue another document (child). At the PPV levels, the process of manual recording of data vaccinations, such as number of vials, time of vaccination, code number, and balance of doses left for the day can get overwhelming. The complication of many VMS numbers may result in errors, as this process was manually done.

In terms of information technology, almost all the respondents agreed that the system provided – MySejahtera, VMS and MyVas are able to facilitate the vaccination process. Yet, the smoothness of the process was disrupted many times, when the data were not synchronized, and considered as "real-time" data. When this problem occurred, they have to manually recorded the data and processed them in batches, illustrating that the system may have not working well at all times. In relation to the information technology, poor Internet connection at the facilities may also disrupted the vaccination process. This resulted in the case of mismatch of information, i.e., individuals who have completed the first dose, appeared as have not received it in the system. In certain PPVs, the issue of information technology may not be a high concern, as they have technical people to help resolve it. Yet, in others this issue may create stress and disrupted the process, since they do not have technical assistance.

Due to the various training and guidelines provided by the responsible authority, there was no problem of insufficient skills and knowledge reported by the interviewees. Since many of them were familiar with cold chain management, and had been involved with vaccination programme before, they feel that their skills and knowledge are fit with the current roll-out programme. Although skills and knowledge were not an issue, the problem of insufficient staff may create stress amongst the health professionals involved. This is because they have to perform two separate duties: at the vaccination centre as well as at health facilities.

The disruption at the vaccination centre may also be contributed by the vaccinees' attitudes. Some of them were reported to have missed out their appointments, did not bring their handphones or requested specific types of vaccines. Language barrier was also one of the common challenges faced by the health professionals at the centre that involve foreign vaccinees.

4.9.3 ICT Usage

The use of ICT is crucial in ensuring the success of the cold-chain management. It is unimaginable for the MOH and MOSTI to manage the reception and distribution of COVID-19 vaccines without the assistance of ICT. The combination of the PhIS, VMS, and MySejahtera enabled the CITF to monitor the COVID-19 cases and distribution of vaccines effectively using the analytics dashboard. The dashboard was instrumental in the management of vaccines distribution as it become the focal point for discussion among the health representatives of each state.

The additional layer, i.e., the VMS, although crucial, did add another layer of complexity to the system. It requires a smooth data transfer between the system and the PhIS. To a large extent though, the data transfer between the two systems was smooth. The smooth data transfer was enabled by the relatively fast systems' servers and telecommunication network in the country. However, since some of the steps require manual processing, e.g., the PPVs entering the vial's data through the barcodes on the VM1 forms. There is a small but real possibility that the person entering the data might miss some barcodes or the forms themselves might go missing.

The use of advanced and emerging ICT such as blockchain, although risky, can assist in

the vaccine management system. The risk comes from untested technology in a pandemic context. Additionally, the knowledge of its applicability is still limited because most related studies were still in the design and experimental stage. Nevertheless, the use of blockchain for the archiving of vaccination records in Malaysia can be seen as a success. It provides an inexpensive solution to the problem of keeping the vaccination records for future references. Additionally, public health analytics shown through the COVID-19 dashboard illustrates the value of decision support systems in managing the pandemic. Meanwhile, other advanced technologies such as IoT and AI have yet to show its value. However, we believe that it is a matter of time before they show their value to public health and pandemic management in Malaysia.

Malaysian government departments and agencies have the capability to adopt and implement rapid system development's methodologies. MOSTI through MIMOS has shown that it can develop a VMS to assist in the cold chain management of the COVID-19 vaccine. The development took less than four months to come up with the solution. Additionally, the team was able to use emerging and advanced technologies such as blockchain to complement the VMS. This capability augurs well for the competency of the Malaysian government to deliver efficient and effective services to the public through ICT.

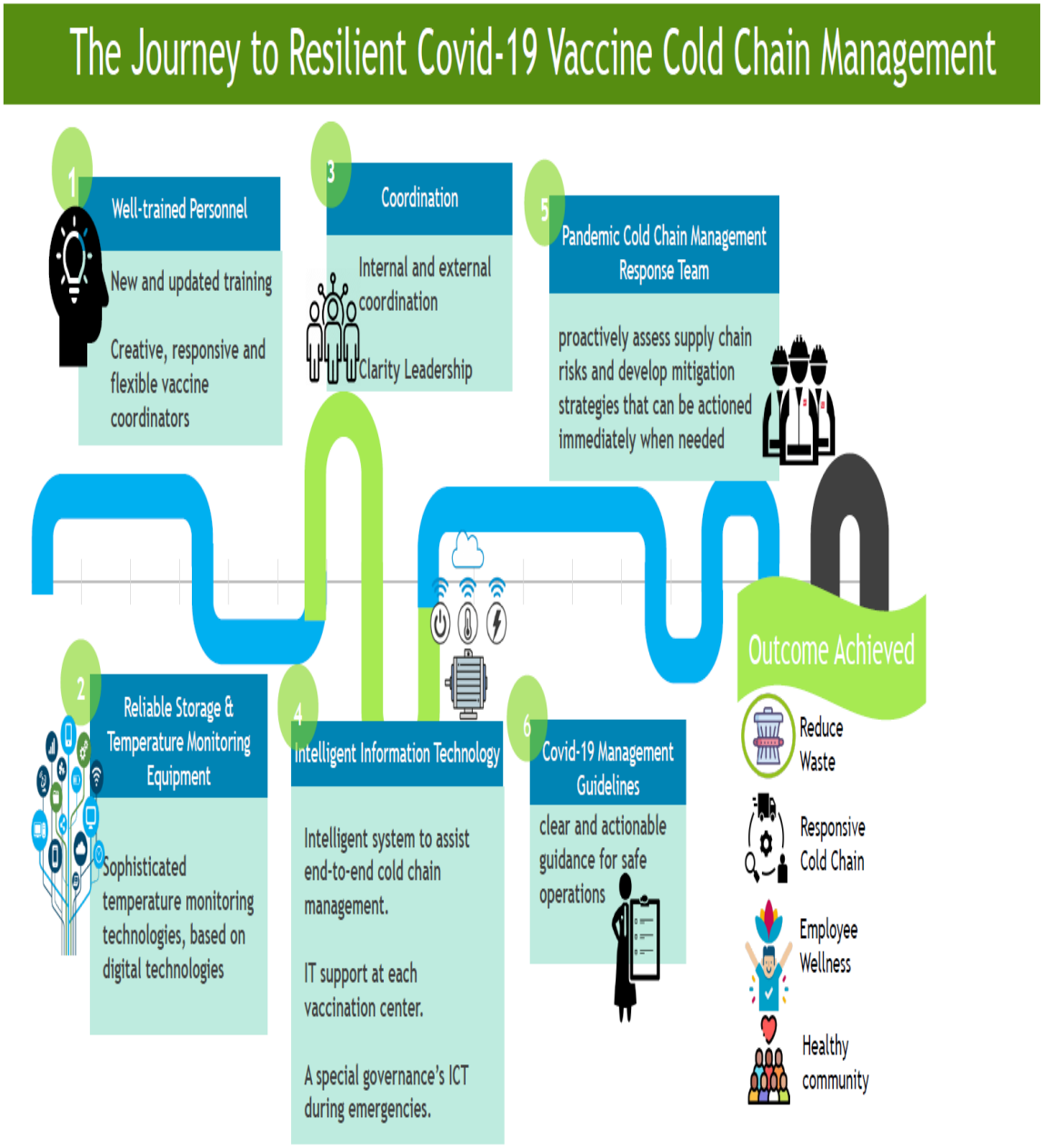
The need for agile ICT governance during emergencies. The existing governance's structure and process are too slow for emergency situations which require quick decisions and actions. Currently, there are numerous committees that review an ICT project before it is approved. Whilst this kind of governance is necessary to ensure that public funds are not spent on wasteful project, emergency time such as a pandemic requires a different set of rules. In such times, decisions and actions need to be quick. The government cannot afford to take one year to develop relevant ICT solutions. People's lives are at stake here.

Putting the ICT's helpdesk at the PPVs was an excellent move. It allows the users, either the public or the vaccine administrators to get immediate assistance. This is especially important for the public who uses the MySejahtera app as this group often has the biggest grouses and complaints about it. Although it still would not eliminate all complaints from the public, it reduces them significantly. However, not all PPVs received such assistance. Those who did not, must rely on their experiences to troubleshoot the problems faced by the public. The results were mix.

4.10 RECOMMENDATIONS

Evidently, administering vaccines on this scale at this speed has never been done before in Malaysia. Notably, the storage and distribution of COVID-19 vaccines are quite challenging since it requires a cold chain that is built on extensive infrastructure and to ensure the efficacy of the vaccines is preserved. Effective management for vaccines requires a shared responsibility amongst vaccine manufacturers, distributors, public health personnel and health care providers. It relies greatly on six main elements, namely Well-trained Personnel, Reliable Storage and Temperature Monitoring Equipment, Coordination, Intelligent Information Technology, Pandemic Cold Chain Management Response Team, and the COVID-19 Management Guidelines. Figure 4.12 summarises the recommendations and the following sub-sections elaborate on the details.

Figure 4. 12 Recommendations for a More Resilient Covid-19 Vaccine Cold Chain Management



4.10.1 Well Trained Personnel

Appropriately trained personnel for cold chain management help avoid accidental interruptions of the storage temperature conditions, which eventually lead to reduced cases of ineffective/wasted/spoilt vaccines. Adherence to good storage practices such as arrangement of vaccines in the refrigerator, temperature monitoring and recording also requires an attentive eye from the personnel involved. Although the experiences of personnel in the previous vaccination programmes may be useful to manage the recent COVID-19 roll-out, it is recommended that new and updated training focusing on administration, storage and distribution of COVID-19 vaccines to be provided. This is

because different types of vaccines demand different storage and transportation needs. Besides, the new immunisation workforce may have come from various backgrounds and may have not involved directly in the previous vaccine roll-out programmes. Training is also required in temperature monitoring using the new devices. With each new device introduced, the personnel involved need to be retrained to acquire sufficient experience and knowledge in using the device.

Notwithstanding this, the managers involved with the programme need to also be creative, able to reconfigure the existing resources and responsive to changing needs. For example, some of the healthcare providers interviewed have alternative options deployed which include converting their conventional facilities from open spaces to vaccination spots/centres to support the large-scale programme. In another case, to increase the number of daily vaccinations administered and to mobilise the stocks, the managers conducted outreach programmes for their own patients, instead of relying on the pre-listing and waiting for the vaccinees to attend the scheduled appointment. This highlights the needs of having managers or vaccine coordinators who are responsive and flexible, to ensure a more resilient system of distribution can be built.

4.10.2 Reliable Storage and Temperature Monitoring Equipment

Although the results show that the problem of cold chain facilities in our country is not acute as in other nations, the capacity of distributors to transport the vaccines to much outskirt areas, especially in the case of Pfizer vaccine can be limited since it requires deep-freeze storage and transportation networks. In Sabah for example, there are only five ULTF that exist to accommodate the cold chain needs. The country's warm climate region and the state's poor intercity connectivity may pose obstacles to deliver the vaccines to the public in remote communities. One of the proposed solutions is therefore, to opt for COVID-19 vaccines that require minimal cold chain requirement, since the infrastructure for 2-8°C is already in place in many communities in the country. In relation to reliable storage, data logging is also required to ease the process of temperature monitoring. At the moment, the ground handling personnel will need to open the package to monitor the conditions to ensure the vaccines are not exposed to extreme temperatures. Temperature charting is also done manually. Since this process is done at the destination point, the problem of temperature excursion may only be realised when it is too late for corrective measures. Hence, it is recommended that more sophisticated temperature monitoring technologies, based on Internet-of-things (IoT), analytics, mobile and cloud technologies to be used as means for comprehensive cold chain feedback mechanisms to reduce the risks at all levels.

4.10.3 Precise Coordination

Looking at the supply and distribution of vaccines, there exists multiple stakeholders, who has a specific role to complete the entire process flow. Should any of the processes fail to run its course, it may adversely affect others. Hence, to ensure the management of cold chain is effective a carefully coordinated orchestration is required. Coordination can be achieved when the parties involved in the processes work together by sharing information and resources to execute the vaccination programmes. Early and continuous community engagements to increase vaccine uptake and dispel misconceptions about certain types of vaccines should also be intensified in all communities. This is crucial to

avoid the cases of withdrawal, which eventually will lead to wastage. Besides appointment information provided by MySejahtera, mobile messages and phone calls to each individual detailing their vaccination centres and time to be around for the vaccines should be made to improve vaccination uptakes and prevent delays during the inoculation exercise. The precise coordination can only take place if each stakeholder is clear of their roles and functions in the entire cold chain management process. The leaders of the various stakeholder groups must steer their subordinates along the entire process to ensure an efficient, effective and resilient vaccine cold management process takes place. It is recommended that a government agency such as MOH to spearhead the cold chain management taskforce and coordinate the cold chain management processes among the various stakeholders. The person in charge must be someone who is of calibres and exerts leadership in dealing with any unforeseen circumstances.

4.10.4 Intelligent Information Communication Technology

The tracking, storage and distribution of millions of COVID-19 vaccine doses are quite a daunting task that necessitates a variety of information technology systems to be adopted. In the case of Malaysia, the visibility and traceability of the vaccines along the chain are provided by three different systems, namely MyVas, VMS and MySejahtera. Although the existence of the three systems can support the roll-out programme, the interview data shows that there are some time-consuming processes that need to be conducted manually. Tasks such as sticking and assigning the VMS code, are not only tedious, but are also prone to errors. Hence, to reduce the overwhelming process, a more intelligent system that can assist end-to-end inventory management is critical. Having a centralized/integrated end-to-end inventory management system may enhance the response time and reduce work redundancies. To further enhance data reporting processes, it would be helpful if the system is able to create customized reports to suit the different needs of people involved in the roll-out programme. To reduce any hiccups of vaccination process due to IT glitches, it is also important to maintain IT personnel for IT support at each vaccination centre. By maintaining IT personnel at the vaccination centre, the problem of computer anxiety and low self-efficacy amongst healthcare personnel when using technology can also be reduced.

Continue honing the skills of the Malaysian government departments and agencies in various system development methodologies. The ICT teams should be exposed to the latest system development methodologies, tools, and techniques, through training and exercises. They should then be entrusted with more ICT projects in the domain of public service delivery.

Develop a special governance structure and process for ICT during emergencies. This special ICT governance requires a significant reduction in bureaucracy and red tapes to ensure that projects can be delivered at a significantly quicker time. It should also outline the necessary committees to ensure government spending is optimised and to identify those that can sideline during the emergency.

Continue exploring the use of emerging and advanced ICTs in government's services. Technologies such as AI, blockchain, analytics, and IoT have a place in the government's effort to deliver seamless services to the public. The government should continue to pursue this technology appropriately. It can take heed from the way these technologies

have been deployed successfully or otherwise in other countries. In some instances, the government could be bold and employ these technologies in areas where they have not in other countries.

Ensure that each PPV will have an ICT helpdesk on standby. Although this decision may not be the most cost-effective, it is necessary to ensure that the public's wellbeing is looked after. By having an ICT helpdesk nearby, the public is ensured that help is on the way if they have trouble with the MySejahtera app. The health providers should not be burdened with this responsibility, thus allowing them to concentrate on their tasks.

4.10.5 Pandemic Cold Chain Management Response Team

The fluctuations in supplies of covid-19 vaccines are knocking the national programme off balance. Due to this issue, the government needs to adopt a more agile way of working to reduce the impact of uncertainty. One way of doing this is through the establishment of pandemic cold chain management response team. The function of this team is to proactively evaluate the risks along the cold chain management processes and develop mitigation strategies that can be actioned immediately when needed. They need to come out with a cold chain contingency plan to manage the cold chain of covid-19 vaccine as a means to ensure business continuity in the event of supply disruptions. This is becoming crucial especially during the first phase of the national programme, since at this stage, it was reported that obtaining a sufficient supply is an issue. Through the establishment of this response team, they will be able to shape and execute a short-term tactical plan that helps mitigate the risks to human health. For example, the original supplies that are initially planned to be distributed to target populations may need to be redistributed, if there is an outbreak that occurred in certain areas. This is to ensure that the outbreak is manageable and has not affected other areas. In doing so however, they need to have data and analytics capabilities to understand the situation, anticipate potential disruption and quickly develop a response.

For the response team to be effective, they need to consistently monitor the logistics risk factor that may influence the cold chain management of covid-19 vaccines, to protect its distribution process. Every level of the supply nodes should be carefully observed for potential risk indicators. One of the easiest ways is to invest in a scalable digital solution that can automate the monitoring process starting from arrival at the airport through to the delivery to the vaccinees. This will help streamline the operations of the covid-19 roll-out programme, while at the same time reducing the wastage of spoilt vaccines as well as securing the safety of community.

4.10.6 COVID-19 Management Guidelines in Malaysia

Currently, the latest information and developments regarding the current prevention and management policies of COVID-19 are incorporated in the COVID-19 Management Guidelines. These guidelines have been emphasised in this study as being a vital guide to promote the standardization of processes and procedures, and also streamlining the vaccine management in the respective PSVs and PPVs.

Having up to date information on the guidelines about COVID-19 management will continuously help diminish uncertainties around the implementation of processes and

procedures, and also the ability of medical practitioners and other related parties in handling the COVID-19 management, and more specifically, the vaccine management aspect. These guidelines are considered crucial to provide clear and actionable guidance for safe operations through the prevention, early detection and control of COVID-19 and promoting public health in general.

As these guidelines are published and available online for the reference of many parties, a special committee is proposed to look into the updates of the contents that would be relevant to be included in the COVID-19 Management Guidelines for the use of the present and in the future.

4.11 LIMITATIONS

There are several limitations in conducting this study.

The researchers were not able to observe the operations of some categories of the PPVs as many have been closed down by the time, we obtained the ethical clearance from NMRR. Nevertheless, since all the PPVs need to abide by MOH's SOPs and guidelines, the administration of the COVID-19 vaccines is streamlined and standard across all PPVs. Hence, although we were not able to interview participants from some categories of PPVs, we believe that the findings of the study are not affected. Moreover, we also found that after interviewing participants from six PPVs, our data was saturated as no new information was obtained with regards to the processes and procedures in managing the vaccine cold chain logistics.

Besides the PPVs, the researchers have to depend on other logistics companies such as Pharmaniaga and Duopharma to study the vaccine distribution from the airport terminal to the various PSVs. We were unable to interview DHL who handled most of the distribution from the airport terminal to the PSVs. Nevertheless, the findings were not affected as we obtained information from other logistics companies.

The researchers have to rely on the experiences and opinions of the VMS and PhIS users. We do not have access to the system. Thus, our observations were purely based on the actual users. We did get to view some of the screens in the systems. However, without actual usage of the two systems, our analysis will be limited. Our exposure to the system was also limited as many of the PPVs were closing by the time we started this research.

The number of respondents was limited. Although we did meet the developers of the VMS and did get relevant documents about the system, we did not manage to get access to the developers of MySejahtera. Since many of the complaints were directed towards MySejahtera, perhaps it would be better to meet the developers of the system. Unfortunately, we did not get the opportunity to meet them to discuss the relevant issues. Nevertheless, this did not affect on our overall aim of the study as the focus of the study is on ICT applications that helps manages the COVID-19 cold chain and MySejahtera was initially developed as an application to assist the government in managing the COVID-19 outbreaks in the country.

4.12 SUMMARY

COVID-19 has impacted the lives of every human being in the world. At the beginning of the pandemic, life was no longer the same. Many were quarantined and most of the people have to work from home. The Malaysian government in its effort to curb the spread of COVID-19, embarked on a vaccination programme i.e., the National COVID-19 Immunisation Programme (PICK). The programme was big in scale and have never been implemented before. One of the biggest challenges of the programme is that vaccines require special infrastructure and resources.

This study aims to demonstrate how the COVID-19 vaccines cold chain management (logistics) was managed during the COVID-19 roll-out in Malaysia. The objectives of the study were to examine the processes, procedures, issues, challenges and the ICT applications used in managing the cold chain logistics of the COVID-19 vaccines programme.

We collected empirical data mainly through interviews with selected participants form the various stakeholder groups. The findings showed that there are SOPs and guidelines for the management of vaccines cold chain i.e., Guideline for COVID-19 Vaccine Products in Health Facilities and Guideline for Cold Chain Product Management in MOH Facilities in Malaysia. Hence, most of the administration of the vaccines adhere to these guidelines. Nevertheless, it was also found that many of the PPVs put in place several additional practices to manage the vaccine cold chain coordination more effectively and efficiently. In implementing the vaccine cold chain management, we found that there were several issues that arise. The issues were related to Temperature Management, Levels of Technology, Management capacity, Infrastructure, Vaccinees Attitudes, Insufficient Supply of Vaccines and Quality of Consumable Items/Equipment. The study also found that there are three ICT applications (i.e., the Vaccine Management System, Blockchain System for Vaccination Records and Public Health Analytics) used by the relevant agencies to manage the COVID-19 cold chain logistics.

Based on the findings, several lessons learned was highlighted and some best practices were shared. The main lesson is that managing the vaccine cold chain logistics requires a collaborative effort from all stakeholders not only the government. Hence, it is suggested that all the relevant bodies to work together to ensure a more effective and efficient vaccine cold chain logistics management.

At the end of the report, we provided several recommendations for the relevant agencies to strengthen the vaccine cold chain management processes and procedures so as to prepare the country if and when the need arises.

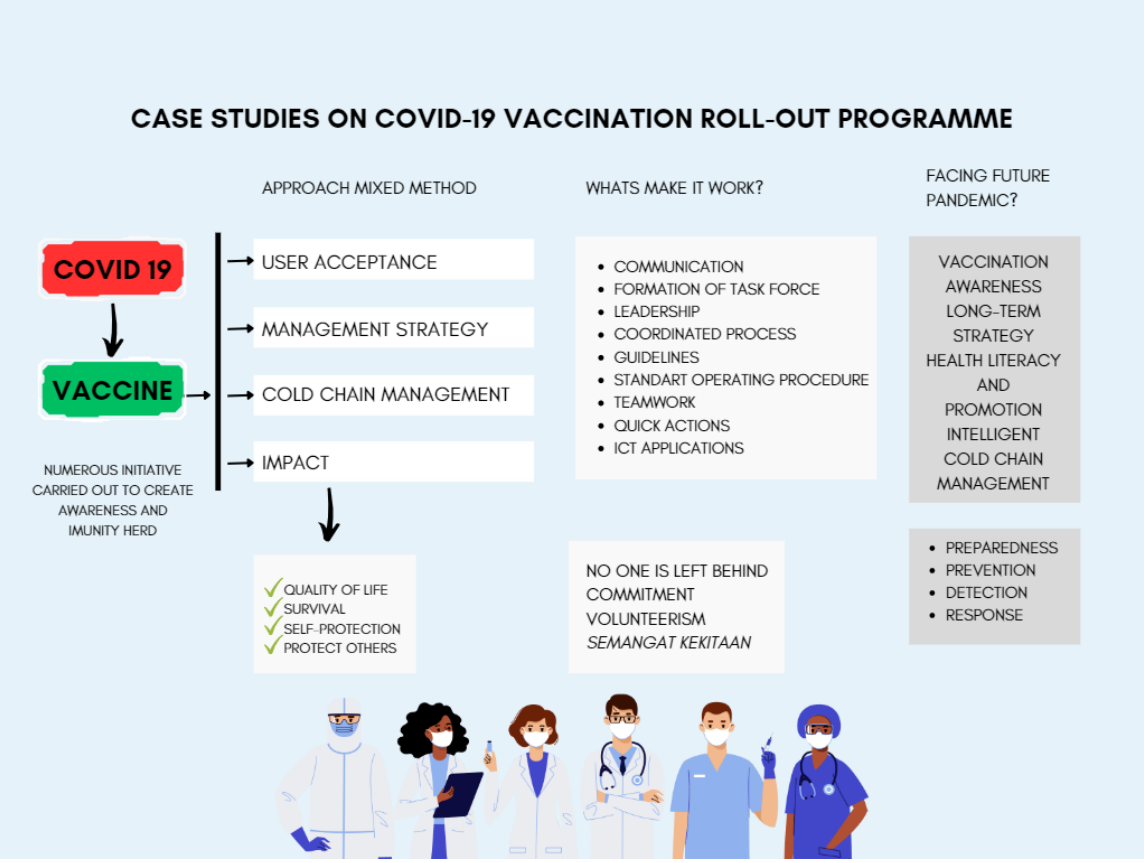


CONCLUSION

5 CONCLUSION

This chapter focuses on the conclusion of the programme. Figure 5.1 shows the overall view of the contents and the subsequent paragraphs describe them in detail.

Figure 5. 1 Conclusion of the COVID-19 Vaccination Roll-out Programme



The vaccination implementation process under the National COVID-19 Immunisation Programme (PICK) was a mega effort that had been initiated with its ultimate aim of creating awareness about COVID-19 vaccination and immunity herd in Malaysia. The study covers the important segments of the society which are directly and indirectly affected by the roll-out programme which include individuals, businesses, ministries, Government agencies and regulators. Numerous efforts and initiatives had been carried out by many parties all in pursuit of overcoming national health crisis that had never been done before. The health crisis was pertinent as it impacted the society around the globe. It had definitely changed the way people work and perform daily routine activities.

The COVID-19 Immunisation Roll-out Programme was studied on the main societal perspectives of its first implementation. This involved the COVID-19 vaccination acceptance among individuals or vaccinees who were the main subjects of concern in the programme. The programme was also studied on the management strategy and governance of the overall vaccination roll-out initiatives in overcoming the national health crisis. The management of the COVID-19 vaccine cold chain was also given attention which could further help improve the vaccine distribution in the future if similar crisis occurs. In addition, the various impacts of the roll-out programme were also

highlighted with aim of understanding the economic and social effects as a whole as a result of the pandemic. These include the quality if lives of people, survival of businesses and individuals, vaccine as self-protection from the virus spread and also on the vaccine as a mean to protect the virus from spreading to others.

The success of the COVID-19 roll-out programme depended on many lessons learned that provided evidences from the four cases presented in the report. These lessons learned are the driving forces that made the whole PICK programme a success despite of its many challenges and obstacles especially in handling and managing a national health crisis like never experienced before by most of the parties. One of the most important forces was on the communication that assisted in the smooth operation of the teams that were involved in PICK. This was further enhanced with the formation of the COVID-19 Immunisation Task Force which gathered many ministries, government agencies, private organisations and NGOs to work together under the leadership of MOSTI in managing the roll-out of COVID-19 vaccination. All of the formations had resulted in a COVID-19 coordinated management process that ensured all issues were immediately addressed and problems were solved with ultimate aim of exiting the pandemic for the benefits of Malaysians. In managing the vaccination roll-out, many COVID-19 guidelines were prepared by the ministries which became the main point of references for many parties in carrying out their duties especially when they were in the dark about specific situations. The standard operating procedures which were in place during the roll-out had also been able to assist all parties in handling and managing the vaccination processes at the vaccination centres. All of these required an effortless teamwork from every parties involved in the roll-out regardless of ranks and positions. The success of the roll-out was further assisted with quick actions from all the parties involved including the usage of advanced ICT applications such as the MySejahtera, VMS and the dashboards that facilitated quick dissemination of information.

The roll-out programme is one national effort that ensured no one is left behind in facing the COVID-19 pandemic. As we were aware, the impacts were huge and extended that caused many disruptions to daily lives of our society. The commitment of the Government through tremendous collaboration and cooperation among ministries and agencies showed their true commitment in solving the health crisis which was crucial to the country's economic survival as important as its people health. The roll-out programme further evidenced some parties and group of individuals who helped out based on volunteerism in pursuit of help everyone as brothers and sisters. These efforts were utterly amazing that promoted *Semangat Kekitaan* among Malaysians more prevalent during the phase of overcoming national health crisis.

There are a few important lessons that we must learn from the episode of COVID-19 in Malaysia. One of them was on the importance of creating vaccination awareness among the population to create immunity herd. We must have a long-term strategy in managing and governing the vaccination for similar future pandemic to avoid disruptions to the economic and social activities of our people. We should also focus on the health literacy and promotion among our people for them to prepare for similar crisis in the future. The importance of an intelligent cold chain management for vaccines could never be denied to ensure the quality of the vaccines. All in all, the success of the COVID-19 vaccination roll-out programme relied in the level of our preparedness, our prevention efforts, our detection actions and immediate responses from all parties involved

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6 APPENDICES

Appendix 1.1: User Acceptance of First Roll-out of COVID-19 Vaccination in Malaysia Survey Questionnaire (Case 1)

Dear respondents,
The purpose of this survey is pertaining to factors that influence the user acceptance of Covid-19 vaccination in Malaysia. Please answer all questions to the best of your knowledge. There are no wrong responses to any of these statements. All responses are completely confidential. Thank you for your participation.

Instructions:

1) There are **two** (2) sections in this questionnaire. Please answer **ALL** questions in ALL sections.
2) Completion of this form will take you approximately 10 to 20 minutes.
3) The contents of this questionnaire will be kept **strictly confidential**.

Section A: Demographic Profile

In this section, we are interested in your background in brief. Please tick your answer (√) and your answers will be kept strictly confidential.

QA1: Gender: ❑ Female ❑ Male

QA2: Age:

❑ Below 20 Years Old	❑ 35 - 39 Years Old	❑ 55 - 59 Years Old
❑ 20 - 24 Years Old	❑ 40 - 44 Years Old	❑ 60 - 64 Years Old
❑ 25 - 29 Years Old	❑ 45 - 49 Years Old	❑ 65 - 69 Years Old
❑ 30 - 34 Years Old	❑ 50 - 54 Years Old	❑ 70 and above

QA3: Marital status: ❑ Single ❑ Married

QA4: Ethnicity:

❑ Bumiputra ❑ Chinese ❑ Indian ❑ Others ___

QA5: Current residence:

❑Selangor	❑Kelantan	❑Negeri Sembilan
❑Sabah	❑Pulau Pinang	❑Melaka
❑Johor	❑WP Kuala Lumpur	❑Perlis
❑Sarawak	❑Pahang	❑WP Putrajaya
❑Perak	❑Terengganu	❑WP Labuan
❑Kedah		

QA6: Highest level of academic qualification:

- ❑ No College Degree
- ❑ Diploma/Advanced Diploma
- ❑ Bachelor Degree/Professional Qualification
- ❑ Master/PhD Degree

QA7: Respondent Industry:

- ❑ Banking
- ❑ Financial Institutional
- ❑ IT Related
- ❑ Manufacturing
- ❑ Retail
- ❑ Telecommunication
- ❑ Tourism
- ❑ Education
- ❑ Unemployed
- ❑ Others

QA8: Household income:

- ❑ Less than RM2500
- ❑ RM2500 – RM3169
- ❑ RM3170 – RM3969
- ❑ RM3970 – RM4849
- ❑ RM4850 – RM5879
- ❑ RM5880 – RM7099
- ❑ RM7110 – RM8699
- ❑ RM8700 – RM10959
- ❑ RM10960 – RM15039
- ❑ More than RM15039

QA9:How often do you check your MySejahtera application for updates (e.g. hotspot, digital health) about the Covid-19 pandemic?
[ ] Very often
[ ] Often
[ ] Seldom
[ ] Never

QA10: From the scale of 0 – 10, how do you rate the usefulness of the MySejahtera application? _____
QA11:Do you agree that taking Covid-19 Self-Test is a social responsibility?
[ ] Yes
[ ] No
[ ] Maybe

QA12: How often do you take Covid-19 Self-Test?
[ ] Daily
[ ] Twice a week
[ ] Once a week
[ ] Once every two weeks
[ ] A longer intermittent
[ ] None

QA13: How often do you update your Covid-19 Self-Test results in your MySejahtera application for contact tracing?
[ ] Very often
[ ] Often
[ ] Seldom
[ ] Never
QA14: From the scale of 0 – 10, how do you rate your trust of the MySejahtera application? _____

Section B: Factors that influence the user acceptance of Covid-19 vaccination in Malaysia

This section is seeking your opinion regarding the factors that influence your acceptance of Covid-19 vaccination in Malaysia*. Respondents are asked to indicate the extent to which they agreed or disagreed with each statement using 7 Likert scale [(1) = strongly disagree; (2) = mostly disagree; (3) = partially disagree; (4) = neutral; (5) = partially agree; (6) = mostly agree; (7) = strongly agree] response framework. Please circle one number per line to indicate the extent to which you agree or disagree with the following statements.*

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B1	Government social media information quality (IQ)							
IQ1	"I feel that the Malaysia government agency provides sufficient contents of news & information to me in order to understand and get necessary facts".	1	2	3	4	5	6	7

IQ2	"The Malaysia government agency provides accurate information to me in order to understand the government & policy news correctly on the vaccination".	1	2	3	4	5	6	7
IQ3	"The Malaysia agency provides diverse and various information to me regarding the vaccination".	1	2	3	4	5	6	7
IQ4	"The Malaysia government agency provides the news & information timely regarding the vaccination".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B2	Trust in government social media agency (TSM)							
TSM1	"I have confidence in the Malaysia agency and its service regarding the vaccination".	1	2	3	4	5	6	7
TSM2	"I have confidence in the contents that the Malaysia agency provides on its social media regarding the vaccination".	1	2	3	4	5	6	7
TSM3	"I feel that the Malaysia agency's social media provides better government services to contacting citizens regarding the vaccination".	1	2	3	4	5	6	7
TSM4	"The Malaysia agency's social media promoted me to have positive outlook towards government authorities regarding the vaccination".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B3	Informational support (IS)							
IS1	"On my favourite social commerce site, some people would offer suggestions when I needed help regarding the vaccination".	1	2	3	4	5	6	7
IS2	"When I encountered a problem, some people on my favourite social commerce site would give me information to help me overcome the problem regarding the vaccination".	1	2	3	4	5	6	7
IS3	"When faced with difficulties, some people on my favourite social commerce site would help me discover the cause and provide me with suggestions regarding	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B4	Perceived Critical Mass (PCM)							

PCM1	"Most people in my group have received the vaccination".	1	2	3	4	5	6	7
PCM2	"Most people in my virtual community have received the vaccination".	1	2	3	4	5	6	7
PCM3	"Most people in my class/office have received the vaccination".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B5	Privacy Concern (PC)							
PC1	"I am not concerned that the information I submit to MySejahtera platform could be misused".	1	2	3	4	5	6	7
PC2	"I am not concerned that others can find private information about me from MySejahtera platform".	1	2	3	4	5	6	7
PC3	"I am not concerned about providing personal information to MySejahtera platform, because of what others might do with it".	1	2	3	4	5	6	7
PC4	"I am not concerned about providing personal information to MySejahtera platform, because it could be used in a way I did not foresee".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B6	Infection Severity (ISE)							
ISE1	I believe that the consequence of Covid-19 infection is severe".	1	2	3	4	5	6	7
ISE2	"I believe that Covid-19 is a health threat to people in crowded public area".	1	2	3	4	5	6	7
ISE3	I believe that Covid-19 will impact people's life if infected".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B7	Infection Susceptibility (ISU)							
ISU1	"I believe that the risk of being infected by Covid-19 is high in crowded public area".	1	2	3	4	5	6	7
ISU2	"I believe that the possibility of contact with infected people in crowded public area is high".	1	2	3	4	5	6	7

ISU3	"I believe that people will be more susceptible to Covid-19 if they travel to crowded public area".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B8	Self-efficiency of Pandemic Prevention (SEPP)							
SEPP1	"I believe that I am able to take measures to prevent Covid-19".	1	2	3	4	5	6	7
SEPP2	"I believe that I have the necessary knowledge and equipment to protect myself from being affected by Covid-19".	1	2	3	4	5	6	7
SEPP3	"I could learn to perform preventive measures to protect myself from being infected by Covid-19".	1	2	3	4	5	6	7
SEPP4	"For me, taking actions to protect myself from Covid-19 is easy".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B9	Response Efficiency of Protection (REP)							
REP1	"I think the efforts to keep safe from Covid-19 threats are effective".	1	2	3	4	5	6	7
REP2	"I think the available measures to protect myself from being infected by Covid-19 are effective".	1	2	3	4	5	6	7
REP3	"Measures that can be taken to stop people being infected by COVID-19 are adequate".	1	2	3	4	5	6	7
REP4	"I feel less likely to be exposed to the Covid-19 threat if performing the preventive measures".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B10	Face to Face Avoidance (FFA)							
FFA1	"I will try to avoid face to face service contact during and after Covid-19 period".	1	2	3	4	5	6	7
FFA2	"I would like to delay making decisions about having face to face financial service during and after Covid-19	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B11	Perceived Benefits (PBEN)							
PBEN1	"I believe that Covid-19 vaccine will have high efficacy in preventing significant suffering and	1	2	3	4	5	6	7
PBEN2	"I believe that if I get vaccinated against Covid-19 the risk of getting infected with the disease or infecting	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B12	Perceived Barriers (PBBA)							
PBA1	"Getting vaccinated is expensive, requires time and effort".	1	2	3	4	5	6	7
PBA2	"Getting vaccinated is a tedious process that requires time and effort".	1	2	3	4	5	6	7
PBA3	“I am worried that the possible side effects of the Covid-19 vaccination would interfere with my usual activities”.	1	2	3	4	5	6	7
PBA4	“I am concern that I may receive faulty/fake Covid-19 vaccine”.	1	2	3	4	5	6	7
PBA5	“It concerns me that the development of a Covid-19 vaccine is t0o rushed to test its safety properly”.	1	2	3	4	5	6	7
PBA6	“I am concern about the long-term side effects of the Covid-19 vaccination”.	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B13	Cues to Action (CA)							
CA	"The chances of me getting vaccinated against Covid-19 will increase if opinion leaders on social media express support for the benefit of the vaccine".	1	2	3	4	5	6	7
CA2	"The chances of me getting vaccinated against Covid-19 will increase if friends and family express support for the benefit of the vaccine".	1	2	3	4	5	6	7
CA3	The chances of me getting vaccinated against Covid-19 will increase if official guidelines from the Ministry of Health are published".	1	2	3	4	5	6	7
CA4	"The chances of me getting vaccinated against Covid-19 will increase if my GP recommends me".	1	2	3	4	5	6	7

CA5	"If my workplace takes care of vaccinating the workers against Covid-19, I will vaccinate".	1	2	3	4	5	6	7

No	Questions	Strongly Disagre	Mostly Disagre	Partially Disagre	Neutral	Partially Agree	Mostly Agree	Strongly Agree
B14	Behavioural Intention (BI)							
BI1	"If a vaccine against Covid-19 infection is available in the market, I would take it"	1	2	3	4	5	6	7
BI2	"I intend to get vaccinated against Covid-19".	1	2	3	4	5	6	7
BI3	"I will get vaccinated against Covid- 19 even if I must pay for the vaccine".	1	2	3	4	5	6	7
BI4	"I am willing to put my name on the MySejahtera list to get vaccinated against Covid-19".	1	2	3	4	5	6	7

Thank you for your time and cooperation.

~ The End ~

Appendix 1.2: Loadings, Composite Reliability and Average Variance Extracted for Case 1

Constructs	Items	Factor Loading	Dijkstra Henseler's (rho pA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
BI	BI1	0.822	0.833	0.871	0.631
	BI2	0.866			
	BI3	0.654			
	BI4	0.818			
CA	CA1	0.790	0.888	0.915	0.684
	CA2	0.840			
	CA3	0.846			
	CA4	0.836			
	CA5	0.823			
CIG	CIG1	0.866	0.900	0.928	0.765
	CIG2	0.883			
	CIG3	0.886			
	CIG4	0.862			
FFA	FFA1	0.922	0.806	0.909	0.833
	FFA2	0.904			
IQ	IQ1	0.849	0.873	0.913	0.723
	IQ2	0.858			
	IQ3	0.847			
	IQ4	0.847			
IS	IS1	0.890	0.869	0.920	0.792
	IS2	0.894			
	IS3	0.886			
ISE	ISE1	0.859	0.855	0.911	0.773
	ISE2	0.888			
	ISE3	0.890			
ISU	ISU1	0.900	0.874	0.922	0.797
	ISU2	0.903			
	ISU3	0.875			
PBA	PBA1	0.518	0.937	0.914	0.647
	PBA2	0.623			
	PBA3	0.873			
	PBA4	0.896			
	PBA5	0.916			
	PBA6	0.907			
PBEN	PBEN1	0.824	0.823	0.878	0.643
	PBEN2	0.837			
	PBEN3	0.817			
	PBEN4	0.724			
PC	PC1	0.903	0.941	0.955	0.84
	PC2	0.915			

	PC3	0.933			
	PC4	0.914			
PCM	PCM1	0.887	0.863	0.916	0.784
	PCM2	0.889			
	PCM3	0.880			
REP	REP1	0.830	0.852	0.900	0.692
	REP2	0.849			
	REP3	0.818			
	REP4	0.830			
SEPP	SEPP1	0.840	0.861	0.905	0.705
	SEPP2	0.867			
	SEPP3	0.854			
	SEPP4	0.795			
TSM	TSM1	0.873	0.886	0.920	0.743
	TSM2	0.870			
	TSM3	0.862			
	TSM4	0.841			
VISE	VISE1	0.907	0.884	0.922	0.797
	VISE2	0.909			
	VISE3	0.862			
VPS	VPS1	0.918	0.907	0.940	0.840
	VPS2	0.923			
	VPS3	0.909			

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Appendix 1.3: Hetero-Trait-Mono-Trait Assessment for Case 1

	Original Sample (O)	Sample Mean (M)	Bias	2.50%	97.50%
CA -> BI	0.739	0.739	0.000	0.702	0.778
CIG -> BI	0.634	0.633	-0.001	0.595	0.674
CIG -> CA	0.608	0.608	0.000	0.574	0.646
FFA -> BI	0.586	0.585	0.000	0.537	0.629
FFA -> CA	0.661	0.660	-0.001	0.618	0.700
FFA -> CIG	0.412	0.411	-0.001	0.359	0.464
IQ -> BI	0.657	0.657	0.000	0.612	0.697
IQ -> CA	0.649	0.650	0.000	0.610	0.683
IQ -> CIG	0.735	0.735	0.000	0.697	0.771
IQ -> FFA	0.558	0.557	-0.001	0.511	0.607
IS -> BI	0.639	0.640	0.000	0.596	0.682
IS -> CA	0.668	0.668	0.000	0.634	0.704
IS -> CIG	0.679	0.679	0.000	0.639	0.720
IS -> FFA	0.595	0.594	-0.001	0.549	0.635
IS -> IQ	0.785	0.786	0.000	0.753	0.815
ISE -> BI	0.514	0.514	0.000	0.464	0.561
ISE -> CA	0.676	0.676	0.000	0.636	0.714
ISE -> CIG	0.459	0.459	0.000	0.414	0.505
ISE -> FFA	0.560	0.56	0.000	0.514	0.609
ISE -> IQ	0.535	0.536	0.001	0.487	0.576
ISE -> IS	0.502	0.502	0.000	0.459	0.550
ISU -> BI	0.509	0.510	0.000	0.462	0.554
ISU -> CA	0.677	0.678	0.001	0.640	0.713
ISU -> CIG	0.419	0.419	0.000	0.373	0.462
ISU -> FFA	0.523	0.524	0.000	0.472	0.569
ISU -> IQ	0.498	0.498	0.001	0.457	0.537
ISU -> IS	0.452	0.453	0.001	0.406	0.494
ISU -> ISE	0.889	0.890	0.000	0.863	0.916
PBA -> BI	0.154	0.157	0.003	0.119	0.191
PBA -> CA	0.206	0.207	0.001	0.176	0.239
PBA -> CIG	0.251	0.250	0.000	0.209	0.299
PBA -> FFA	0.107	0.109	0.002	0.071	0.144
PBA -> IQ	0.092	0.094	0.002	0.064	0.122
PBA -> IS	0.111	0.113	0.002	0.075	0.150
PBA -> ISE	0.135	0.136	0.000	0.104	0.159
PBA -> ISU	0.125	0.125	0.000	0.100	0.150
PBEN -> BI	0.770	0.770	0.001	0.731	0.807
PBEN -> CA	0.792	0.792	0.000	0.763	0.821
PBEN -> CIG	0.667	0.667	0.000	0.628	0.703
PBEN -> FFA	0.747	0.746	-0.001	0.702	0.785
PBEN -> IQ	0.749	0.751	0.002	0.715	0.782
PBEN -> IS	0.699	0.700	0.001	0.661	0.733
PBEN -> ISE	0.622	0.622	0.000	0.582	0.661

PBEN -> ISU	0.556	0.556	0.000	0.511	0.598
PBEN -> PBA	0.192	0.192	0.000	0.154	0.233
PC -> BI	0.391	0.390	-0.001	0.349	0.438
PC -> CA	0.273	0.272	-0.001	0.230	0.317
PC -> CIG	0.512	0.512	0.000	0.473	0.550
PC -> FFA	0.236	0.235	-0.001	0.186	0.286
PC -> IQ	0.361	0.361	0.000	0.317	0.405
PC -> IS	0.396	0.397	0.001	0.352	0.435
PC -> ISE	0.161	0.161	0.000	0.117	0.204
PC -> ISU	0.060	0.065	0.005	0.042	0.092
PC -> PBA	0.493	0.492	0.000	0.453	0.529
PC -> PBEN	0.420	0.419	-0.001	0.374	0.466
PCM -> BI	0.577	0.577	0.000	0.535	0.618
PCM -> CA	0.587	0.588	0.001	0.544	0.624
PCM -> CIG	0.440	0.439	0.000	0.394	0.480
PCM -> FFA	0.499	0.498	0.000	0.453	0.549
PCM -> IQ	0.600	0.601	0.001	0.560	0.637
PCM -> IS	0.560	0.560	0.000	0.517	0.604
PCM -> ISE	0.669	0.668	-0.001	0.627	0.707
PCM -> ISU	0.668	0.668	0.000	0.624	0.709
PCM -> PBA	0.100	0.105	0.005	0.081	0.114
PCM -> PBEN	0.613	0.613	0.001	0.572	0.648
PCM -> PC	0.134	0.134	0.000	0.092	0.175
REP -> BI	0.709	0.709	0.000	0.663	0.747
REP -> CA	0.773	0.773	0.000	0.739	0.803
REP -> CIG	0.596	0.596	0.000	0.552	0.633
REP -> FFA	0.731	0.731	0.000	0.685	0.772
REP -> IQ	0.686	0.687	0.001	0.645	0.723
REP -> IS	0.665	0.666	0.001	0.624	0.705
REP -> ISE	0.643	0.642	-0.001	0.600	0.684
REP -> ISU	0.65	0.650	0.000	0.606	0.684
REP -> PBA	0.153	0.157	0.004	0.119	0.182
REP -> PBEN	0.819	0.819	0.000	0.783	0.851
REP -> PC	0.323	0.323	0.000	0.285	0.367
REP -> PCM	0.654	0.654	0.000	0.614	0.690
SEPP -> BI	0.680	0.680	0.000	0.635	0.727
SEPP -> CA	0.742	0.742	0.001	0.705	0.775
SEPP -> CIG	0.569	0.568	-0.001	0.520	0.609
SEPP -> FFA	0.658	0.657	-0.001	0.608	0.700
SEPP -> IQ	0.634	0.635	0.001	0.589	0.672
SEPP -> IS	0.624	0.625	0.001	0.580	0.666
SEPP -> ISE	0.683	0.682	-0.001	0.638	0.724
SEPP -> ISU	0.656	0.655	0.000	0.613	0.697
SEPP -> PBA	0.195	0.197	0.003	0.160	0.221
SEPP -> PBEN	0.745	0.745	0.000	0.703	0.782
SEPP -> PC	0.302	0.301	-0.001	0.259	0.343

SEPP -> PCM	0.641	0.641	-0.001	0.602	0.681
SEPP -> REP	0.913	0.914	0.001	0.888	0.932
TSM -> BI	0.671	0.671	0.000	0.628	0.710
TSM -> CA	0.682	0.682	0.000	0.646	0.717
TSM -> CIG	0.779	0.780	0.000	0.742	0.813
TSM -> FFA	0.573	0.572	-0.001	0.524	0.620
TSM -> IQ	0.939	0.940	0.000	0.918	0.957
TSM -> IS	0.842	0.842	0.000	0.814	0.869
TSM -> ISE	0.565	0.566	0.001	0.524	0.607
TSM -> ISU	0.550	0.551	0.001	0.508	0.592
TSM -> PBA	0.089	0.093	0.003	0.055	0.117
TSM -> PBEN	0.767	0.768	0.001	0.733	0.799
TSM -> PC	0.379	0.379	0.000	0.339	0.421
TSM -> PCM	0.610	0.611	0.000	0.569	0.649
TSM -> REP	0.710	0.710	0.001	0.666	0.748
TSM -> SEPP	0.651	0.652	0.001	0.606	0.688
VISE -> BI	0.387	0.387	0.000	0.327	0.442
VISE -> CA	0.397	0.396	0.000	0.351	0.448
VISE -> CIG	0.377	0.376	-0.001	0.335	0.429
VISE -> FFA	0.455	0.454	-0.001	0.408	0.506
VISE -> IQ	0.348	0.347	-0.001	0.299	0.398
VISE -> IS	0.403	0.403	0.000	0.358	0.449
VISE -> ISE	0.401	0.401	0.000	0.357	0.446
VISE -> ISU	0.309	0.309	0.000	0.265	0.353
VISE -> PBA	0.424	0.424	0.000	0.378	0.464
VISE -> PBEN	0.454	0.452	-0.002	0.406	0.504
VISE -> PC	0.365	0.364	-0.001	0.316	0.406
VISE -> PCM	0.272	0.271	-0.001	0.225	0.319
VISE -> REP	0.468	0.468	0.000	0.416	0.513
VISE -> SEPP	0.486	0.485	0.000	0.44	0.532
VISE -> TSM	0.369	0.368	-0.001	0.321	0.419
VPS -> BI	0.263	0.264	0.001	0.207	0.322
VPS -> CA	0.328	0.328	0.000	0.282	0.38
VPS -> CIG	0.301	0.300	-0.001	0.254	0.351
VPS -> FFA	0.432	0.432	0.000	0.384	0.481
VPS -> IQ	0.293	0.294	0.001	0.244	0.340
VPS -> IS	0.348	0.348	0.000	0.302	0.402
VPS -> ISE	0.260	0.261	0.001	0.211	0.306
VPS -> ISU	0.190	0.190	0.001	0.144	0.234
VPS -> PBA	0.479	0.478	0.000	0.436	0.518
VPS -> PBEN	0.381	0.381	-0.001	0.326	0.426
VPS -> PC	0.331	0.330	-0.001	0.286	0.375
VPS -> PCM	0.146	0.147	0.001	0.101	0.192
VPS -> REP	0.360	0.360	0.000	0.312	0.411
VPS -> SEPP	0.391	0.391	0.000	0.339	0.443
VPS -> TSM	0.306	0.306	0.000	0.260	0.356

VPS -> VISE	0.672	0.672	0.000	0.627	0.712

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Appendix 1.4: Inner Variance Inflation Factor (VIF) for Case 1

	BI
CA	2.752
CIG	2.443
FFA	1.980
IQ	3.509
IS	2.602
ISE	2.886
ISU	2.956
PBA	1.587
PBEN	2.833
PC	1.626
PCM	1.976
REP	3.459
SEPP	3.072
TSM	4.442
VISE	1.827
VPS	1.792

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Appendix 1.5: Effect Size (f^2) for Case 1

Predictor Constructs /Dependent Constructs	BI
CA	0.055
CIG	0.012
FFA	0.003
IQ	0.001
IS	0.000
ISE	0.005
ISU	0.001
PBA	0.003
PBEN	0.024
PC	0.016
PCM	0.012
REP	0.001
SEPP	0.007
TSM	0.000
VISE	0.004
VPS	0.004

Notes: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Appendix 1.6: Predictive Relevance (Q^2) and R^2 for Case 1

Endogenous Construct	SSO	SSE	Q^2 (=1-SSE/SSO)	Predictive Relevance	R^2
BI	9344	6166.323	0.34	$Q^2>0$	0.557

Notes: Behavioural Intention (BI)

Appendix 1.7: Outcome of the Structural Model Examination for Case 1

PLS Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Bias Corrected Confidence Interval		Remarks
CA -> BI***	0.259	0.257	0.030	8.525	0.000	0.200	0.317	Supported
CIG -> BI***	0.112	0.112	0.027	4.220	0.000	0.061	0.164	Supported
FFA -> BI^{NS}	0.051	0.051	0.030	1.702	0.089	-0.010	0.106	Unsupported
IQ -> BI^{NS}	0.043	0.044	0.032	1.330	0.184	-0.021	0.108	Unsupported
IS -> BI^{NS}	0.021	0.022	0.027	0.784	0.433	-0.034	0.075	Unsupported
ISE -> BI**	-0.080	-0.080	0.029	2.781	0.006	-0.134	-0.023	Supported
ISU -> BI^{NS}	0.033	0.033	0.028	1.186	0.236	-0.020	0.087	Unsupported
PBA -> BI*	-0.044	-0.042	0.020	2.228	0.026	-0.084	-0.005	Supported
PBEN -> BI***	0.175	0.176	0.032	5.417	0.000	0.114	0.239	Supported
PC -> BI***	0.109	0.108	0.021	5.308	0.000	0.069	0.151	Supported
PCM -> BI***	0.103	0.103	0.024	4.301	0.000	0.054	0.148	Supported
REP -> BI^{NS}	0.046	0.047	0.032	1.417	0.157	-0.019	0.102	Unsupported
SEPP -> BI***	0.098	0.097	0.029	3.353	0.001	0.041	0.158	Supported
TSM -> BI^{NS}	0.006	0.004	0.035	0.164	0.870	-0.057	0.072	Unsupported
VISE -> BI*	0.055	0.055	0.023	2.370	0.018	0.012	0.099	Supported
VPS -> BI**	-0.057	-0.057	0.022	2.606	0.009	-0.101	-0.015	Supported

Notes

a.* Significant at p <0.05 level.

b.** Significant at p <0.01 level.

c.*** Significant at p <0.001 level.

d.^{NS} Not supported

Notes 2: Government social media information quality (IQ), Trust in government social media agency (TSM), Informational support (IS), Confidence in Government (CIG), Perceived Critical Mass (PCM), Privacy Concern (PC), Infection Severity (ISE), Infection Susceptibility (ISU), Vaccine Infection Severity (VISE), Vaccine Perceived Susceptibility (VPS), Self-efficiency of Pandemic Prevention (SEPP), Response Efficiency of Protection (REP), Face to Face Avoidance (FFA), Perceived Benefits (PBEN), Perceived Barriers (PBBA), Cues to Action (CA), Behavioural Intention (BI)

Appendix 2.1: Questions for Interviews and Focus Group Session for Case 2

Interview Instrument Key Persons- Vaccination Programme		
Area/Objectives	Questions	Time
Introduction	*Interviewee's Information:* - Name: - Qualification: - Position in the school: - Working period in the school: - Work experience in this field/area:	5 Minutes
To develop strategic and tactical plans of preparedness in addressing the roll-out vaccination programme for COVID-19.	- How the strategies and tactics for the Vaccination Programme are developed. - Probe: o Emergent (tweak as things unfold) or pre-planned (strategic planning) o Who are involved (across different stages) o How different are our strategies and tactics compared to other nations? - Probe: o Are there changes across different waves? o How decisions are made on the planning, monitoring, and intervention strategies and tactics in terms of technology usage, management, and communication for PICK throughput completion. - Probe: o How the interventions are organised, coordinated, and communicated. - Probe: o identify the effectiveness of the strategies in the area of a) technology, b) Logistics and	60 Minutes

	scheduling, c) Execution and utilisation of resources in the form of PPV variations, d) Data management and analytics, e) supply and demand management of the vaccine, f) interventive scheduling to ensure throughput. - Probe: o what factors differentiate the speed and successful completion of PICK at various localities (local residents' willingness, facilities availability, geographical locations, management efficiency)	
To canvass/depict the project management, processes, protocols, and approaches in developing first- herd immunity, and then finally maximum population immunity across Malaysia in the context of the Vaccination Programme.	- How do you translate top management's aspirations into your portfolio? - Probe: o Details descriptions o Emergent (tweak as things unfold) or pre-planned (strategic planning) o Who are involved (across different steps) o How do you leverage data analytics from MySejahtera, PICK dashboard, and GitHub (or other analytics) to assist in the strategy?	45 Minutes
To explore capacity building across all stakeholders/actors in Malaysia's ecosystem to address the success of the Vaccination programme and readiness for a future similar pandemic.	- Probe: o Issues and challenges in developing capacity building • Specific to volunteers (*sukarelawan*) o States o Human resources o Infrastructure o Lesson learned on crisis management	45 Minutes

	○ View on inclusiveness, diversity, and agility throughout the process	

Appendix 3.1: Interview Instrument for Case 3

1. How was the financial performance of your business before the Covid-19 pandemic? (In the year 2018/2019)
2. How was the financial performance of your business during the Covid-19 pandemic? (In the year 2020)
3. A lot of businesses suffered during the pandemic. What strategies have you developed and implemented to ensure your business's survival?
4. What is your expectation regarding the financial performance of your business in the current year after almost 80% of Malaysians have been vaccinated?
5. Although most Malaysians will be vaccinated by the end of August the pandemic is not over yet. How do you ensure that people are safe to travel and enjoy their vacation?
6. How do plan to revive your business to the earlier financial position you had experienced before the pandemic?
7. What are the business challenges that you expect to emerge in the post-Covid-19 pandemic?
8. What are the strategic approaches that should be taken to address these challenges?
9. What are your expectations for the Malaysian tourism industry in the years to come?

Appendix 3.2: Survey Questionnaire for Case 3

Kajian Kes: Kesan Vaksinasi COVID-19 ke atas Perniagaan

1. Lokasi:
   - ☐ Bandar
   - ☐ Pinggir bandar
   - ☐ Luar bandar

2. Saiz perniagaan
   - ☐ Mikro
   - ☐ Kecil
   - ☐ Sederhana
   - ☐ Besar

3. Jenis hakmilik perniagaan:
   - ☐ Milikan tunggal
   - ☐ Perkongsian
   - ☐ Syarikat Sendirian Berhad
   - ☐ Syarikat Awam Berhad
   - ☐ Perbadanan Awam
   - ☐ Koperasi

4. Tahun penubuhan
   - ☐ Sebelum 1970
   - ☐ 1970 – 1979
   - ☐ 1980 – 1989
   - ☐ 1990 – 1999
   - ☐ 2000 – 2009
   - ☐ 2010 – 2019
   - ☐ 2020 dan selepasnya

5. Sektor perniagaan
   - ☐ Pertanian, perhutanan & perikanan
   - ☐ Pembuatan
   - ☐ Pembinaan
   - ☐ Hospital & Kesihatan
   - ☐Utiliti
   - ☐Perdagangan borong & runcit
   - ☐Pembaikan kenderaan bermotor & motosikal
   - ☐Pengangkutan & penyimpanan
   - ☐Perhotelan & Penginapan
   - ☐Perkhidmatan makanan & minuman
   - ☐Maklumat & komunikasi
   - ☐Bank, kewangan & insurans/takaful
   - ☐ Aktiviti hartanah
   - ☐ Kesenian, hiburan & rekreasi
   - ☐ Perlombongan & pengkuarian
   - ☐ Pendidikan
   - ☐ Lain-lain industri

6. Negeri
   - ☐ Johor
   - ☐ Kedah
   - ☐ Kelantan
   - ☐ Melaka
   - ☐ Negeri Sembilan
   - ☐ Pahang
   - ☐ Perak
   - ☐ Perlis
   - ☐ Pulau Pinang
   - ☐ Selangor
   - ☐ Terengganu
   - ☐ Sabah
   - ☐ Sarawak
   - ☐ Wilayah Persekutuan Kuala Lumpur
   - ☐ Wilayah Persekutuan Labuan
   - ☐ Wilayah Persekutuan Putrajaya

7. Bagaimana perniagaan / organisasi anda memastikan pekerja mendapatkan vaksin Covid-19? Sila tanda semua yang berkaitan.
   - ☐ Mengambil bahagian di program vaksinasi PIKAS
   - ☐ Mendaftarkan pekerja untuk vaksinasi
   - ☐ Mewajibkan vaksinasi
   - ☐ Tidak membenarkan pekerja yang tidak divaksin untuk datang bekerja
   - ☐ Program vaksinasi di tempat kerja
   - ☐ Mendidik pekerja tentang kepentingan vaksinasi dan penjagaan kesihatan
   - ☐ Memantau status vaksinasi pekerja
   - ☐ Tidak melakukan apa-apa
   - ☐ Lain-lain (Nyatakan: _____)

8. Bagaimana perniagaan / organisasi anda beroperasi semasa pandemik Covid-19? (dari Mac 2020 sehingga September 2021)
   - ☐ Beroperasi sepenuhnya di pejabat / lokasi pernigaan
   - ☐ Beroperasi sepenuhnya tetapi secara maya / telekerja
   - ☐ Hibrid (kombinasi di lokasi dan telekerja)
   - ☐ Tidak beroperasi lansung

9. Bagaimana perniagaan / organisasi anda beroperasi sekarang (dari Oktober 2021)?
   - ☐ Beroperasi sepenuhnya di pejabat / lokasi pernigaan
   - ☐ Beroperasi sepenuhnya tetapi secara maya / telekerja
   - ☐ Hibrid (kombinasi di lokasi dan telekerja)

10. Berapa lama masa yang diambil oleh perniagaan / organisasi anda untuk memulihkan operasi semasa pandemik (sebelum Oktober 2021)?
    - ☐ Kurang dari 30 hari
    - ☐ 31- 60 hari
    - ☐ 61 – 90 hari
    - ☐ Lebih dari 90 hari

11. Berapa lama tempoh masa yang diperlukan untuk pemulihan perniagaan seperti sedia kala selepas negara mencapai peratusan vaksinasi sebanyak 90% (selepas Oktober 2021)?
    - ☐ Kurang dari 30 hari
    - ☐ 31- 90 hari
    - ☐ 91 – 180 hari
    - ☐ Lebih dari 180 hari
    - ☐ Bercadang untuk menghentikan perniagan buat sementara waktu
    - ☐ Bercadang untuk menutup perniagaan
    - ☐ Bercadang untuk mengubah jenis perniagaan

12. Adakah perniagaan / organisasi anda mempunyai pelan perniagaan bagi menangani perkara luar jangka sebelum pandemik Covid-19?
    - ☐ Ya
    - ☐ Tidak

13. Adakah perniagaan / organisasi anda mengubah bentuk operasi atau perkhidmatan untuk melindungi perniagaan dari kesan pandemik Covid-19?
    - ☐ Ya
    - ☐ Tidak

14. Selepas berlakunya pandemik Covid-19, adakah perniagaan / organisasi anda mengeluarkan strategi pelan perniagaan bagi menangani perkara luar jangka?
    - ☐ Ya
    - ☐ Tidak
    - ☐ Akan diambil kira

15. Apakah cabaran utama yang dihadapi oleh perniagaan / organisasi anda **semasa pandemik** COVID-19? (Sebelum Oktober 2021)? Sila tanda semua yang berkaitan.
    - ☐ Aliran tunai untuk mengekalkan operasi
    - ☐ Pekerja tidak hadir kerana sakit atau kerana arahan kerajaan
    - ☐ Tiada bekalan bahan mentah (masalah pembekal atau penghantaran)
    - ☐ Kos bekalan yang sangat tinggi
    - ☐ Rakan kongsi perniagaan telah terjejas teruk dan tidak beroperasi
    - ☐ Tiada atau kurang pelanggan dan permintaan

    ☐ Lain-lain (nyatakan: _____)

16. Apakah cabaran utama yang dihadapi oleh syarikat anda **selepas negara mencapai peratusan vaksinasi sebanyak 90%** (selepas Oktober 2021)? Sila tanda semua yang berkaitan.
    - ☐ Aliran tunai untuk mengekalkan operasi
    - ☐ Pekerja tidak hadir kerana sakit atau kerana arahan kerajaan
    - ☐ Tiada bekalan bahan mentah (masalah pembekal atau penghantaran)
    - ☐ Kos bekalan yang sangat tinggi
    - ☐ Rakan kongsi perniagaan telah terjejas teruk dan tidak beroperasi
    - ☐ Tiada atau kurang pelanggan dan permintaan
    - ☐ Permintaan yang sangat tinggi
    - ☐ Pematuhan SOP yang ketat

    ☐ Lain-lain (nyatakan: _____)

17. Bagaimana pandemik Covid-19 memberi kesan ke atas keuntungan pada tahun 2020, jika dibandingkan dengan tahun 2019?
    - ☐ Berkurang sehingga 25 peratus
    - ☐ Berkurang sebanyak 25 – 50 peratus
    - ☐ Berkurang lebih dari 50 peratus
    - ☐ Meningkat sehingga 25 peratus
    - ☐ Meningkat sebanyak 25 – 50 peratus
    - ☐ Meningkat lebih 50 peratus

18. Bagaimana vaksinasi (capaian peratusan vaksinasi sebanyak 90%) memberi kesan ke atas unjuran keuntungan pada tahun 2021, jika dibandingkan dengan tahun 2020?
    - ☐ Berkurang sehingga 25 peratus
    - ☐ Berkurang sebanyak 25 – 50 peratus
    - ☐ Meningkat sehingga 25 peratus
    - ☐ Meningkat sebanyak 25 – 50 peratus

¨ Berkurang lebih dari 50 peratus ☐ Meningkat lebih 50 peratus

19. Apakah **langkah penjimatan kos** yang telah diambil atau di dalam perancangan?
Pilih semua yang berkaitan.

☐ Mengurangkan pekerja / membekukan pengambilan
☐ Mengurangkan gaji pekerja
☐ Tidak memberi kenaikan gaji atau bonus tahunan
☐ Membuang pekerja
☐ Melaksanakan cuti wajib atau cuti tanpa gaji
☐Mengurangkan kos pembangunan / latihan pekerja
☐ Mengurangkan kos operasi
☐ Mengurangkan kos sewaan
☐ Mengurangkan kos pinjaman
☐ Tiada langkah penjimatan kos yang diambil
☐ Lain-lain (nyatakan:

20. Apakah **strategi peningkatan keuntungan** yang dilakukan sekarang (selepas Oktober 2021)?
Pilih semua yang berkaitan.

☐ Menawarkan produk atau perkhidmatan baru
☐ Mengurangkan harga produk atau perkhidmatan
☐ Menukar syarat pembayaran (seperti mewujudkan pelan pembayaran kepada pembekal)
☐ Menukar saluran pengedaran (seperti pembelian dalam talian)
☐ Mempelbagaikan pasaran (seperti beroperasi di lokasi lain atau mendapatkan pelanggan baru)
☐ Mengubah perjanjian rantaian bekalan (seperti mendapatkan pembekal baru, berunding dengan pembekal)
☐ Mewujudkan perkongsian dengan perusahaan lain
☐ Membangunkan rancangan kesetiaan pelanggan (customer loyalty)
☐ Membuat perancangan perniagaan jangka panjang berdasarkan pengurusan risiko
☐ Menggajikan bakat baru
☐ Tidak membuat strategi
☐ Lain-lain (nyatakan: _____)

Dalam tempoh tiga bulan akan datang, bagaimana setiap perkara berikut dijangka berubah untuk perniagaan/ organisasi anda?		Meningkat	Tiada perubahan	Menurun	Tidak berkaitan	Tidak tahu
1.	Bilangan pekerja	☐	☐	☐	☐	☐
2.	Jawatan kosong	☐	☐	☐	☐	☐
3.	Penjualan produk atau perkhidmatan	☐	☐	☐	☐	☐
4.	Harga jualan produk atau perkhidmatan	☐	☐	☐	☐	☐
5.	Permintaan produk atau perkhidmatan	☐	☐	☐	☐	☐
6.	Import	☐	☐	☐	☐	☐
7.	Eksport	☐	☐	☐	☐	☐
8.	Keuntungan	☐	☐	☐	☐	☐
9.	Rizab tunai	☐	☐	☐	☐	☐
10.	Perbelanjaan operasi	☐	☐	☐	☐	☐
11.	Perbelanjaan latihan pekerja	☐	☐	☐	☐	☐
12.	Perbelanjaan pemasaran dan iklan	☐	☐	☐	☐	☐
13.	Perluasan perniagaan	☐	☐	☐	☐	☐
14.	Perubahan model perniagaan berbentuk digital	☐	☐	☐	☐	☐
15.	Acara persendirian (in-person events)	☐	☐	☐	☐	☐
16.	Polisi pekerja untuk keselamatan dan kesihatan awam	☐	☐	☐	☐	☐
17.	Bekerja di luar pejabat (di mana-mana lokasi)	☐	☐	☐	☐	☐
18.	Peningkatan produktiviti	☐	☐	☐	☐	☐
19.	Kos kesihatan pekerja	☐	☐	☐	☐	☐
20.	Penggunaan Internet dan jalur lebar	☐	☐	☐	☐	☐

Kajian Kes: Kesan Vaksinasi Covid-19 ke atas Masyarakat

==========

1. Saya telah lengkap 2 dos vaksinasi COVID-19.
   ☐ Ya ☐ Tidak

1a. Jenis vaksin diterima untuk 2 dos.
   ☐ Pfizer-BioNTech ☐ Sinovac
   ☐ AstraZeneca ☐ CanSino

1b. Saya telah menerima dos penggalak.
   ☐ Ya ☐ Tidak

2. Jantina:
   ☐Lelaki ☐ Perempuan

3. Tempat tinggal sekarang:
   ☐ Bandar
   ☐ Pinggir bandar
   ☐ Luar bandar

4. Umur (tahun):
   ☐ 18 - 29 ☐ 50 - 59
   ☐ 30 - 39 ☐ 60 dan ke atas
   ☐ 40 - 49

5. Status pekerjaan:
   ☐ Kakitangan kerajaan ☐ Pelajar
   ☐ Kakitangan swasta ☐ Surirumah
   ☐ Bekerja sendiri ☐ Tidak mempunyai pekerjaan
   ☐ Bersara/pencen

6. Industri:
   ☐ Pertanian, perhutanan & perikanan ☐Pembaikan kenderaan bermotor & motosikal
   ☐ Pembuatan ☐Pengangkutan & penyimpanan
   ☐ Pembinaan ☐Perhotelan & Penginapan
   ☐ Hospital & Kesihatan ☐Perkhidmatan makanan & minuman
   ☐Utiliti ☐Maklumat & komunikasi
   ☐Perdagangan borong & runcit ☐Bank, kewangan & insurans/takaful
   ☐ Aktiviti hartanah ☐ Pendidikan
   ☐ Kesenian, hiburan & rekreasi ☐ Lain-lain industri
   ☐ Perlombongan & pengkuarian ☐ Tidak berkaitan

7. Pendapatan isi rumah:
   ☐ Kurang dari RM2,500 ☐ RM4,850 – RM5,879 ☐ RM10,960– RM15,039
   ☐ RM2,501 – RM3,169 ☐ RM5,880 – RM7,099 ☐ RM15,040– RM15,879
   ☐ RM3,170 – RM3,969 ☐ RM7,100 – RM8,699 ☐ RM15,880 dan ke atas
   ☐ RM3,970 – RM4,849 ☐ RM8,700 – RM10,959

8. Adakah ada ahli keluarga terdekat anda (isteri/suami/anak/ibubapa/adik beradik) pernah dijangkiti Covid-19?
   ☐Ya ☐ Tidak

9. Adakah ada rakan anda pernah dijangkiti Covid-19?
   ☐Ya ☐ Tidak

10. Adakah ada di antara ahli keluarga atau rakan anda yang meninggal dunia kerana jangkitan COVID-19?
   ☐Ya ☐ Tidak

Tandakan penerimaan anda ke atas perkara-perkara berikut:		Ya	Tidak	Mungkin
1.	Vaksin Covid-19 berkesan untuk meningkatkan kualiti hidup.	☐	☐	☐
2.	Vaksin Covid-19 berkesan untuk meneruskan kelangsungan hidup.	☐	☐	☐
3.	Vaksin Covid-19 adalah untuk keselamatan diri.	☐	☐	☐
4.	Vaksin Covid-19 adalah untuk keselamatan orang lain.	☐	☐	☐

Selepas menerima vaksinasi: **Untuk tempoh 6 bulan ke atas, saya lebih yakin untuk melakukan perkara-perkara berikut**:		Ya	Tidak	Mungkin	Tidak berkaitan
1.	Keluar bekerja (atau kembali ke pejabat)	☐	☐	☐	☐
2.	Menggunakan pengangkutan awam	☐	☐	☐	☐
3.	Bercuti bersama keluarga di dalam negara.	☐	☐	☐	☐
4.	Bercuti bersama keluarga di luar negara.	☐	☐	☐	☐
5.	Bercuti bersama rakan di dalam negara.	☐	☐	☐	☐
6.	Bercuti bersama rakan di luar negara.	☐	☐	☐	☐
7.	Mengunjungi pusat beli belah atau pasaraya.	☐	☐	☐	☐
8.	Mengunjungi kedai atau pasar.	☐	☐	☐	☐
9.	Makan di kedai atau restoran.	☐	☐	☐	☐
10.	Bersukan dan beriadah.	☐	☐	☐	☐
11.	Menonton wayang.	☐	☐	☐	☐
12.	Keluar bersama rakan atau keluarga.	☐	☐	☐	☐
13.	Balik kampung/ menziarahi saudara mara/ rakan.	☐	☐	☐	☐
14.	Menghadiri majlis keraian atau perayaan.	☐	☐	☐	☐
15.	Mengunjungi tempat ibadat.	☐	☐	☐	☐
16.	Membenarkan anak untuk ke sekolah.	☐	☐	☐	☐
17.	Menghantar anak ke pusat asuhan.	☐	☐	☐	☐
18.	Kembali ke institusi pengajian tinggi.	☐	☐	☐	☐
19.	Menjalankan latihan industri.	☐	☐	☐	☐

Sila nyatakan respon anda ke atas penyataan berikut:		Sangat benar	Benar	Sedikit benar	Agak benar	Tidak sama sekali
1.	Saya merasa tidak selesa untuk menjalani kehidupan norma baharu seperti sebelum pandemik Covid-19.	☐	☐	☐	☐	☐
2.	Saya berasa tidak selesa untuk berinteraksi secara fizikal seperti yang saya lakukan sebelum pandemik Covid-19.	☐	☐	☐	☐	☐
3.	Saya berasa tidak selesa untuk bekerja secara fizikal seperti sebelum pandemik Covid-19.	☐	☐	☐	☐	☐
4.	Saya bimbang akan dijangkiti Covid-19.	☐	☐	☐	☐	☐
5.	Saya bimbang tidak dapat melindungi keluarga dari dijangkiti Covid-19.	☐	☐	☐	☐	☐
6.	Saya bimbang sistem kesihatan di negara ini tidak dapat melindungi keluarga saya dari dijangkiti Covid-19	☐	☐	☐	☐	☐
7.	Saya bimbang langkah penjagaan kesihatan asas (seperti mencuci tangan) tidak cukup untuk mengelakkan saya dari dijangkiti Covid-19	☐	☐	☐	☐	☐
8.	Saya bimbang penjarakan sosial tidak cukup untuk mengelakkan saya dari dijangkiti Covid-19	☐	☐	☐	☐	☐
9.	Saya bimbang tidak dapat melindungi keluarga dari dijangkiti Covid-19.	☐	☐	☐	☐	☐

Penyataan berikut adalah berkaitan dengan persepsi ke atas penggunaan MySejahtera.		Tidak sama sekali	Agak benar	Sedikit benar	Benar	Sangat benar
1.	MySejahtera membantu mengurangkan risiko saya dijangkiti COVID-19.	☐	☐	☐	☐	☐

2.	MySejahtera membantu saya meneruskan aktiviti mengikut norma baharu.	¨	☐	☐	☐	☐
3.	MySejahtera membantu saya untuk mengekalkan aktiviti norma baharu jika adanya pandemik yang sama pada masa hadapan.	☐	☐	☐	☐	☐
4.	MySejahtera telah membantu mengurangkan penyebaran COVID-19.	☐	☐	☐	☐	☐
5.	MySejahtera akan terus membantu mengurangkan penyebaran COVID-19	☐	☐	☐	☐	☐
6.	MySejahtera membantu saya untuk lebih peka terhadap Covid-19.	☐	☐	☐	☐	☐

Penyataan berikut adalah berkaitan dengan aktiviti melancong dalam negara. Sila jawab soalan berikut jika anda telah pergi melancong di dalam negara		Ya	Tidak	Mungkin
1.	Aktiviti pelancongan dalam negara setelah lengkap dos vaksin adalah satu tindakan yang wajar dibenarkan.	☐	☐	☐
2.	Aktiviti pelancongan dalam negara adalah suatu perkara yang diperlukan untuk berehat dan melepaskan tekanan.	☐	☐	☐
3.	Kebanyakan orang-orang yang penting bagi saya bersetuju dengan tindakan saya pergi melancong setelah lengkap dua dos.	☐	☐	☐
4.	Saya mempunyai sumber yang mencukupi, masa dan peluang untuk melancong dalam negara.	☐	☐	☐
5.	Saya mampu untuk mengikuti SOP yang ditetapkan ketika melancong dalam negara.	☐	☐	☐
6.	Terdapat kebarangkalian yang tinggi untuk mendapat jangkitan Covid-19 semasa aktiviti melancong.	☐	☐	☐
7.	Terdapat kebarangkalian yang tinggi orang awam tidak mematuhi SOP yang telah dikuatkuasakan.	☐	☐	☐
8.	Terdapat kebarangkalian yang tinggi destinasi/tempat penginapan pilihan tidak terjaga keselamatan dan kebersihannya.	☐	☐	☐
9.	Penduduk setempat di kawasan pelancongan menerima baik pembukaan aktiviti pelancongan.	☐	☐	☐

Appendix 3.3: Sample to Population Ratio

State	Population ('000)	Percentage	Sample size
Selangor	6,555	20.08	693
Sabah	3,833	11.74	405
Johor	3,794	11.62	401
Sarawak	2,822	8.64	298
Perak	2,501	7.66	264
Kedah	2,194	6.72	232
Kelantan	1,929	5.91	204
Pulau Pinang	1,774	5.43	187
WP Kuala Lumpur	1,747	5.35	185
Pahang	1,685	5.16	178
Terengganu	1,275	3.91	135
Negeri Sembilan	1,129	3.46	119
Melaka	938	2.87	99
Perlis	255	0.78	27
WP Putrajaya	116	0.36	12
WP Labuan	100	0.31	11
Total	32,647	100	3450

Source: Statista (2021)[1]

([1]https://www.statista.com/statistics/1040670/malaysia-population-distribution-by-state/, viewed on August 27, 2021).

Appendix 3.4: Comparisons Between Groups for Case 3

Booster status and social wellbeing

A chi-square of independence was performed to examine the relation between groups and social wellbeing, and also booster status and social wellbeing. The results are shown in the following tables.

Crosstab

			quality of life			
			Yes	No	Maybe	Total
Booster Status	Yes	Count	1221	79	531	1831
		Expected Count	1161.0	102.2	567.8	1831.0
		% within Booster Status	66.7%	4.3%	29.0%	100.0%
	No	Count	290	54	208	552
		Expected Count	350.0	30.8	171.2	552.0
		% within Booster Status	52.5%	9.8%	37.7%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	46.418[a]	2	0.000
Likelihood Ratio	43.768	2	0.000
Linear-by-Linear Association	26.328	1	0.000
N of Valid Cases	2383		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.81.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	0.140	0.000
	Cramer's V	0.140	0.000
N of Valid Cases		2383	

Based on the results, the relation between the variables is significant, X^2 (2, N = 2383) = 4.6.418, $p < 0.001$. The respondents with complete booster have a higher agreement that vaccination is important for improving the quality of life.

Crosstab

			survival			
			Yes	No	Maybe	Total
Booster Status	Yes	Count	1155	138	538	1831
		Expected Count	1081.1	158.3	591.6	1831.0
		% within Booster Status	63.1%	7.5%	29.4%	100.0%
		% within survival	82.1%	67.0%	69.9%	76.8%
	No	Count	252	68	232	552
		Expected Count	325.9	47.7	178.4	552.0
		% within Booster Status	45.7%	12.3%	42.0%	100.0%
		% within survival	17.9%	33.0%	30.1%	23.2%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	54.030[a]	2	<.001
Likelihood Ratio	53.202	2	<.001
Linear-by-Linear Association	45.535	1	<.001
N of Valid Cases	2383		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 47.72.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.151	<.001
	Cramer's V	.151	<.001
N of Valid Cases		2383	

Based on the results, the relation between the variables is significant, X^2 (2, N = 2383) = 54.030, p < 0.001. The respondents with complete booster have a higher agreement that vaccination is important for survival during the pandemic.

Crosstab

			personal safety			
			Yes	No	Maybe	Total
Booster Status	Yes	Count	1390	104	337	1831
		Expected Count	1333.9	122.2	375.0	1831.0
		% within Booster Status	75.9%	5.7%	18.4%	100.0%
		% within personal safety	80.1%	65.4%	69.1%	76.8%
	No	Count	346	55	151	552
		Expected Count	402.1	36.8	113.0	552.0
		% within Booster Status	62.7%	10.0%	27.4%	100.0%
		% within personal safety	19.9%	34.6%	30.9%	23.2%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	38.451[a]	2	<.001
Likelihood Ratio	36.674	2	<.001

Linear-by-Linear Association	31.659	1	<.001
N of Valid Cases	2383		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 36.83.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.127	<.001
	Cramer's V	.127	<.001
N of Valid Cases		2383	

Based on the results, the relation between the variables is significant, X^2 (2, N = 2,383) = 38.451, p < 0.001. The respondents with complete booster have a higher agreement that vaccination is important for personal safety and health.

Crosstab

			safety of others			
			Yes	No	Maybe	Total
Booster Status	Yes	Count	1348	109	374	1831
		Expected Count	1290.1	128.3	412.6	1831.0
		% within Booster Status	73.6%	6.0%	20.4%	100.0%
		% within safety of others	80.3%	65.3%	69.6%	76.8%
	No	Count	331	58	163	552
		Expected Count	388.9	38.7	124.4	552.0
		% within Booster Status	60.0%	10.5%	29.5%	100.0%
		% within safety of others	19.7%	34.7%	30.4%	23.2%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	39.377[a]	2	<.001
Likelihood Ratio	37.706	2	<.001
Linear-by-Linear Association	31.363	1	<.001
N of Valid Cases	2383		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 38.68.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.129	<.001
	Cramer's V	.129	<.001
N of Valid Cases		2383	

Based on the results, the relation between the variables is significant, X^2 (2, N = 2,383) =

39.377, p < 0.001. The respondents with complete booster have a higher agreement that vaccination is important for health and safety of others. In conclusion, respondents with booster status perceived COVID-19 vaccination is important to improve the social wellbeing.

Gender and Social Wellbeing

A chi-square of independence was performed to examine the relation between **gender** and social wellbeing. The results are shown in the following tables.

Crosstab

			quality of life			
			Yes	No	Maybe	Total
Gender	Male	Count	824	81	368	1273
		Expected Count	805.3	74.4	393.2	1273.0
		% within Gender	64.7%	6.4%	28.9%	100.0%
	Female	Count	1394	124	715	2233
		Expected Count	1412.7	130.6	689.8	2233.0
		% within Gender	62.4%	5.6%	32.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.130[a]	2	0.127
Likelihood Ratio	4.142	2	0.126
Linear-by-Linear Association	2.839	1	0.092
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 74.43.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	0.034	0.127
	Cramer's V	0.034	0.127

Based on the results, the relation between the variables is not significant, X^2 (2, N = 3506) = 4.130, p > 0.05. Males and females are not significantly difference in their perception that vaccination is important for improving the quality of life.

Crosstab

			survival			
			Yes	No	Maybe	Total
Gender	Male	Count	780	110	383	1273
		Expected Count	775.9	99.9	397.2	1273.0
		% within Gender	61.3%	8.6%	30.1%	100.0%
	Female	Count	1357	165	711	2233
		Expected Count	1361.1	175.1	696.8	2233.0
		% within Gender	60.8%	7.4%	31.8%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.453[a]	2	0.293
Likelihood Ratio	2.436	2	0.296
Linear-by-Linear Association	0.495	1	0.482
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 99.85.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	0.026	0.293
	Cramer's V	0.026	0.293
N of Valid Cases		3506	

Based on the results, the relation between the variables is not significant, X^2 (2, N = 3506) = 2.453, p > 0.05. Males and females are not significantly difference in their perception that vaccination is important for survival during the pandemic.

Crosstab

			personal safety			
			Yes	No	Maybe	Total
Gender	Male	Count	912	98	263	1273
		Expected Count	957.5	76.2	239.3	1273.0
		% within Gender	71.6%	7.7%	20.7%	100.0%
	Female	Count	1725	112	396	2233
		Expected Count	1679.5	133.8	419.7	2233.0
		% within Gender	77.3%	5.0%	17.7%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.825[a]	2	0.000
Likelihood Ratio	16.492	2	0.000
Linear-by-Linear Association	9.494	1	0.002
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 76.25.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	0.069	0.000
	Cramer's V	0.069	0.000
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (2, N = 3506) = 16.825, p < 0.001. Females were more likely to believe COVID-19 vaccination is important for personal health safety.

Crosstab

			safety of others			
			Yes	No	Maybe	Total
Gender	Male	Count	887	99	287	1273
		Expected Count	928.4	85.0	259.6	1273.0
		% within Gender	69.7%	7.8%	22.5%	100.0%
	Female	Count	1670	135	428	2233
		Expected Count	1628.6	149.0	455.4	2233.0
		% within Gender	74.8%	6.0%	19.2%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.080[a]	2	0.004
Likelihood Ratio	10.962	2	0.004
Linear-by-Linear Association	8.884	1	0.003
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 84.96.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	0.056	0.004
	Cramer's V	0.056	0.004
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (2, N = 3506) = 11.080, p < 0.001. Females were more likely to believe COVID-19 vaccination is important for health safety of others.

Residency and Social Wellbeing

A chi-square of independence was performed to examine the relation between **residency** and social wellbeing. The results are shown in the following tables.

Residency and quality of life

Crosstab

			quality of life			
			Yes	No	Maybe	Total
Living area	Urban	Count	1554	140	758	2452
		Expected Count	1551.2	143.4	757.4	2452.0
		% within Living area	63.4%	5.7%	30.9%	100.0%
		% within quality of life	70.1%	68.3%	70.0%	69.9%
	Suburban	Count	256	30	153	439
		Expected Count	277.7	25.7	135.6	439.0
		% within Living area	58.3%	6.8%	34.9%	100.0%
		% within quality of life	11.5%	14.6%	14.1%	12.5%
	Rural	Count	408	35	172	615
		Expected Count	389.1	36.0	190.0	615.0
		% within Living area	66.3%	5.7%	28.0%	100.0%
		% within quality of life	18.4%	17.1%	15.9%	17.5%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.393[a]	4	.117
Likelihood Ratio	7.354	4	.118
Linear-by-Linear Association	.683	1	.408
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 25.67.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.046	.117
	Cramer's V	.032	.117
N of Valid Cases		3506	

Based on the results, the relation between the variables is not significant, X^2 (4, N = 3506) = 7.393, p > 0.05.

Residency and survival

Crosstab

			survival			
			Yes	No	Maybe	Total
Living area	Urban	Count	1528	166	758	2452
		Expected Count	1494.6	192.3	765.1	2452.0
		% within Living area	62.3%	6.8%	30.9%	100.0%
		% within survival	71.5%	60.4%	69.3%	69.9%
	Suburban	Count	243	57	139	439
		Expected Count	267.6	34.4	137.0	439.0
		% within Living area	55.4%	13.0%	31.7%	100.0%
		% within survival	11.4%	20.7%	12.7%	12.5%
	Rural	Count	366	52	197	615
		Expected Count	374.9	48.2	191.9	615.0
		% within Living area	59.5%	8.5%	32.0%	100.0%
		% within survival	17.1%	18.9%	18.0%	17.5%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	22.133[a]	4	<.001
Likelihood Ratio	19.906	4	<.001
Linear-by-Linear Association	1.694	1	.193
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 34.43.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.079	<.001
	Cramer's V	.056	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (4, N = 3506) = 22.133, p < 0.001. The respondents who live in urban area have a higher believe COVID-19 vaccination is important for survival during the pandemic.

Residency and personal safety

Crosstab

			personal safety			
			Yes	No	Maybe	Total
Living area	Urban	Count	1887	113	452	2452
		Expected Count	1844.2	146.9	460.9	2452.0
		% within Living area	77.0%	4.6%	18.4%	100.0%
		% within personal safety	71.6%	53.8%	68.6%	69.9%
	Suburban	Count	304	54	81	439
		Expected Count	330.2	26.3	82.5	439.0
		% within Living area	69.2%	12.3%	18.5%	100.0%
		% within personal safety	11.5%	25.7%	12.3%	12.5%
	Rural	Count	446	43	126	615
		Expected Count	462.6	36.8	115.6	615.0
		% within Living area	72.5%	7.0%	20.5%	100.0%
		% within personal safety	16.9%	20.5%	19.1%	17.5%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	42.829[a]	4	<.001
Likelihood Ratio	36.605	4	<.001
Linear-by-Linear Association	4.721	1	.030
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 26.29.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.111	<.001
	Cramer's V	.078	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (4, N = 3506) = 42.829, p < 0.001. The respondents who live in urban area have a higher believe COVID-19 vaccination is important for personal health and safety during the pandemic.

Residency and others' safety

Crosstab

			safety of others			
			Yes	No	Maybe	Total
Living area	Urban	Count	1851	128	473	2452
		Expected Count	1788.3	163.7	500.1	2452.0
		% within Living area	75.5%	5.2%	19.3%	100.0%
		% within safety of others	72.4%	54.7%	66.2%	69.9%
	Suburban	Count	294	50	95	439
		Expected Count	320.2	29.3	89.5	439.0
		% within Living area	67.0%	11.4%	21.6%	100.0%
		% within safety of others	11.5%	21.4%	13.3%	12.5%
	Rural	Count	412	56	147	615
		Expected Count	448.5	41.0	125.4	615.0
		% within Living area	67.0%	9.1%	23.9%	100.0%
		% within safety of others	16.1%	23.9%	20.6%	17.5%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	40.663[a]	4	<.001
Likelihood Ratio	38.099	4	<.001
Linear-by-Linear Association	15.804	1	<.001
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 29.30.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.108	<.001
	Cramer's V	.076	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (4, N = 3506) = 40.663, p < 0.001. The respondents who live in urban area have a higher believe COVID-19 vaccination is important for others' safety and health during the pandemic.

Income and Social Wellbeing

A chi-square of independence was performed to examine the relation between **household income** and social wellbeing. The results are shown in the following tables.

Income and quality of life

Crosstab

			quality of life			
			Yes	No	Maybe	Total
Income Category	B40	Count	1472	112	729	2313
		Expected Count	1463.3	135.2	714.5	2313.0
		% within Income Category	63.6%	4.8%	31.5%	100.0%
		% within quality of life	66.4%	54.6%	67.3%	66.0%
	M40	Count	508	65	244	817
		Expected Count	516.9	47.8	252.4	817.0
		% within Income Category	62.2%	8.0%	29.9%	100.0%
		% within quality of life	22.9%	31.7%	22.5%	23.3%
	T20	Count	238	28	110	376
		Expected Count	237.9	22.0	116.1	376.0
		% within Income Category	63.3%	7.4%	29.3%	100.0%
		% within quality of life	10.7%	13.7%	10.2%	10.7%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.956[a]	4	.011
Likelihood Ratio	12.446	4	.014
Linear-by-Linear Association	.107	1	.743
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.99.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.061	.011
	Cramer's V	.043	.011
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (4, N = 3506) = 12.956, $p < 0.05$.

Income and survival

Crosstab

			survival			
			Yes	No	Maybe	Total
Income Category	B40	Count	1367	184	762	2313
		Expected Count	1409.8	181.4	721.7	2313.0
		% within Income Category	59.1%	8.0%	32.9%	100.0%
		% within survival	64.0%	66.9%	69.7%	66.0%
	M40	Count	519	65	233	817
		Expected Count	498.0	64.1	254.9	817.0
		% within Income Category	63.5%	8.0%	28.5%	100.0%
		% within survival	24.3%	23.6%	21.3%	23.3%
	T20	Count	251	26	99	376
		Expected Count	229.2	29.5	117.3	376.0
		% within Income Category	66.8%	6.9%	26.3%	100.0%
		% within survival	11.7%	9.5%	9.0%	10.7%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.724[a]	4	.020
Likelihood Ratio	11.857	4	.018
Linear-by-Linear Association	11.259	1	<.001
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 29.49.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.058	.020
	Cramer's V	.041	.020
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (4, N = 3506) = 111.724, p < 0.05. The T20 group has a higher believe that COVID-19 vaccination is important for survival during the pandemic.

Income and personal safety

Crosstab

			personal safety			
			Yes	No	Maybe	Total
Income Category	B40	Count	1710	139	464	2313
		Expected Count	1739.7	138.5	434.8	2313.0
		% within Income Category	73.9%	6.0%	20.1%	100.0%
		% within personal safety	64.8%	66.2%	70.4%	66.0%
	M40	Count	629	49	139	817
		Expected Count	614.5	48.9	153.6	817.0
		% within Income Category	77.0%	6.0%	17.0%	100.0%
		% within personal safety	23.9%	23.3%	21.1%	23.3%
	T20	Count	298	22	56	376
		Expected Count	282.8	22.5	70.7	376.0
		% within Income Category	79.3%	5.9%	14.9%	100.0%
		% within personal safety	11.3%	10.5%	8.5%	10.7%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.074[a]	4	.089
Likelihood Ratio	8.300	4	.081
Linear-by-Linear Association	7.833	1	.005
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.52.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.048	.089
	Cramer's V	.034	.089
N of Valid Cases		3506	

Based on the results, the relation between the variables is not significant, X^2 (4, N = 3506) = 8.074, $p < 0.05$.

Income and others' safety

Crosstab

			safety of others			
			Yes	No	Maybe	Total
Income Category	B40	Count	1658	146	509	2313
		Expected Count	1686.9	154.4	471.7	2313.0
		% within Income Category	71.7%	6.3%	22.0%	100.0%
		% within safety of others	64.8%	62.4%	71.2%	66.0%
	M40	Count	610	56	151	817
		Expected Count	595.9	54.5	166.6	817.0
		% within Income Category	74.7%	6.9%	18.5%	100.0%
		% within safety of others	23.9%	23.9%	21.1%	23.3%
	T20	Count	289	32	55	376
		Expected Count	274.2	25.1	76.7	376.0
		% within Income Category	76.9%	8.5%	14.6%	100.0%
		% within safety of others	11.3%	13.7%	7.7%	10.7%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.564[a]	4	.006
Likelihood Ratio	15.054	4	.005
Linear-by-Linear Association	9.905	1	.002
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 25.10.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.064	.006
	Cramer's V	.046	.006
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (4, N = 3506) = 12.956, $p < 0.05$. The T20 group has a higher believe that COVID-19 vaccination is important for the safety and health of others.

Age and Social Wellbeing

Age and quality of life

Crosstab

			quality of life			
			Yes	No	Maybe	Total
Age Category	18 - 29	Count	891	34	399	1324
		Expected Count	837.6	77.4	409.0	1324.0
		% within Age Category	67.3%	2.6%	30.1%	100.0%
		% within quality of life	40.2%	16.6%	36.8%	37.8%
	30 - 39	Count	550	67	264	881
		Expected Count	557.3	51.5	272.1	881.0
		% within Age Category	62.4%	7.6%	30.0%	100.0%
		% within quality of life	24.8%	32.7%	24.4%	25.1%
	40 - 49	Count	473	69	248	790
		Expected Count	499.8	46.2	244.0	790.0
		% within Age Category	59.9%	8.7%	31.4%	100.0%
		% within quality of life	21.3%	33.7%	22.9%	22.5%
	50 - 59	Count	217	26	130	373
		Expected Count	236.0	21.8	115.2	373.0
		% within Age Category	58.2%	7.0%	34.9%	100.0%
		% within quality of life	9.8%	12.7%	12.0%	10.6%
	60 and above	Count	87	9	42	138
		Expected Count	87.3	8.1	42.6	138.0
		% within Age Category	63.0%	6.5%	30.4%	100.0%
		% within quality of life	3.9%	4.4%	3.9%	3.9%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	50.097[a]	8	<.001
Likelihood Ratio	54.599	8	<.001
Linear-by-Linear Association	6.511	1	.011
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.07.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.120	<.001
	Cramer's V	.085	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (8, N = 3506) = 50.097, p < 0.001. The respondents in the age group of 18 to 29 years old has a higher perception that COVID-19 vaccination is important for improving the quality of life.

Age and survival

Crosstab

			survival			
			Yes	No	Maybe	Total
Age Category	18 - 29	Count	845	74	405	1324
		Expected Count	807.0	103.9	413.1	1324.0
		% within Age Category	63.8%	5.6%	30.6%	100.0%
		% within survival	39.5%	26.9%	37.0%	37.8%
	30 - 39	Count	506	106	269	881
		Expected Count	537.0	69.1	274.9	881.0
		% within Age Category	57.4%	12.0%	30.5%	100.0%
		% within survival	23.7%	38.5%	24.6%	25.1%
	40 - 49	Count	485	62	243	790
		Expected Count	481.5	62.0	246.5	790.0
		% within Age Category	61.4%	7.8%	30.8%	100.0%
		% within survival	22.7%	22.5%	22.2%	22.5%
	50 - 59	Count	218	25	130	373
		Expected Count	227.4	29.3	116.4	373.0
		% within Age Category	58.4%	6.7%	34.9%	100.0%
		% within survival	10.2%	9.1%	11.9%	10.6%
	60 and above	Count	83	8	47	138
		Expected Count	84.1	10.8	43.1	138.0
		% within Age Category	60.1%	5.8%	34.1%	100.0%
		% within survival	3.9%	2.9%	4.3%	3.9%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	35.928[a]	8	<.001
Likelihood Ratio	34.154	8	<.001
Linear-by-Linear Association	2.545	1	.111
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.82.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.101	<.001
	Cramer's V	.072	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (8, N = 3506) =35.928, p < 0.001. The respondents in the age group of 18 to 29 years old has a higher perception that COVID-19 vaccination is important for survival during the pandemic as compared to the respondents in the age group of 30 to 39 years old.

Age and personal safety

Crosstab

			personal safety			
			Yes	No	Maybe	Total
Age Category	18 - 29	Count	1066	43	215	1324
		Expected Count	995.8	79.3	248.9	1324.0
		% within Age Category	80.5%	3.2%	16.2%	100.0%
		% within personal safety	40.4%	20.5%	32.6%	37.8%
	30 - 39	Count	605	91	185	881
		Expected Count	662.6	52.8	165.6	881.0
		% within Age Category	68.7%	10.3%	21.0%	100.0%
		% within personal safety	22.9%	43.3%	28.1%	25.1%
	40 - 49	Count	585	51	154	790
		Expected Count	594.2	47.3	148.5	790.0
		% within Age Category	74.1%	6.5%	19.5%	100.0%
		% within personal safety	22.2%	24.3%	23.4%	22.5%
	50 - 59	Count	276	17	80	373
		Expected Count	280.5	22.3	70.1	373.0
		% within Age Category	74.0%	4.6%	21.4%	100.0%
		% within personal safety	10.5%	8.1%	12.1%	10.6%
	60 and above	Count	105	8	25	138
		Expected Count	103.8	8.3	25.9	138.0
		% within Age Category	76.1%	5.8%	18.1%	100.0%
		% within personal safety	4.0%	3.8%	3.8%	3.9%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	64.591[a]	8	<.001
Likelihood Ratio	63.185	8	<.001
Linear-by-Linear Association	6.765	1	.009
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.27.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.136	<.001
	Cramer's V	.096	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (8, N = 3506) =64.591, p < 0.001. The respondents in the age group of 18 to 29 years old has a higher perception that COVID-19 vaccination is important for personal health and safety during the pandemic as compared to the respondents in the age group of 30 to 39 years old.

Age and others' safety

Crosstab

			safety of others			
			Yes	No	Maybe	Total
Age Category	18 - 29	Count	1046	53	225	1324
		Expected Count	965.6	88.4	270.0	1324.0
		% within Age Category	79.0%	4.0%	17.0%	100.0%
		% within safety of others	40.9%	22.6%	31.5%	37.8%
	30 - 39	Count	586	83	212	881
		Expected Count	642.5	58.8	179.7	881.0
		% within Age Category	66.5%	9.4%	24.1%	100.0%
		% within safety of others	22.9%	35.5%	29.7%	25.1%
	40 - 49	Count	567	61	162	790
		Expected Count	576.2	52.7	161.1	790.0
		% within Age Category	71.8%	7.7%	20.5%	100.0%
		% within safety of others	22.2%	26.1%	22.7%	22.5%
	50 - 59	Count	262	24	87	373
		Expected Count	272.0	24.9	76.1	373.0
		% within Age Category	70.2%	6.4%	23.3%	100.0%
		% within safety of others	10.2%	10.3%	12.2%	10.6%
	60 and above	Count	96	13	29	138
		Expected Count	100.6	9.2	28.1	138.0
		% within Age Category	69.6%	9.4%	21.0%	100.0%
		% within safety of others	3.8%	5.6%	4.1%	3.9%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	54.323[a]	8	<.001
Likelihood Ratio	55.381	8	<.001
Linear-by-Linear Association	12.074	1	<.001
N of Valid Cases	3506		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.21.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.124	<.001
	Cramer's V	.088	<.001
N of Valid Cases		3506	

Based on the results, the relation between the variables is significant, X^2 (8, N = 3506) =54.323, p < 0.001. The respondents in the age group of 18 to 29 years old has a higher perception that COVID-19 vaccination is important for others' survival during the pandemic as compared to the respondents in the age group of 30 to 39 years old.

Booster Status and Psychological Wellbeing

An independent sample t-test was conducted to compare the degree of cave syndrome, COVID-19 stress and contact tracing stress between respondents with booster and non-booster conditions. The results are displayed in the following tables.

	Booster Status	Mean	Std. Deviation	Std. Error Mean
Cave	Yes	3.2867	1.09301	0.02554
	No	3.1914	1.10882	0.04719
Stress	Yes	2.8084	1.06029	0.02478
	No	2.7494	1.06177	0.04519
Trust	Yes	3.4048	0.95209	0.02225
	No	3.1830	1.03835	0.04420

	t-test for Equality of Means							
			Significance				95% Confidence Interval of the Difference	
	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Cave	1.776	897.904	0.038	0.076	0.09530	0.05366	-0.01002	0.20062
Stress	1.145	907.411	0.126	0.253	0.05899	0.05154	-0.04216	0.16014
Trust	4.696	2381	0.000	0.000	0.22182	0.04723	0.12920	0.31444

Based on the results, for one-sided p-value, there was a significant difference for the case syndrome between respondents with complete booster (M=3.286, SD = 1.093) and incomplete booster (M=3.191, SD = 1.108); t(897.904) = 1.776, p > 0.05. The results suggest booster status does have an effect on cave syndrome. Respondents who took the booster are more braved in facing the case syndrome, compared to those who did not take the booster. In other words, they feel less uncomfortable living in a new normal, and conducting in-person interaction. Next, the result for COVID-19 stress also shows there was no significant difference between complete booster (M=2.808, SD = 1.060) and incomplete booster (M=2.749, SD = 1.061); t(907.411) = 0.253, p > 0.05. However, the result for contact tracing trust is significant between complete booster (M=3.404, SD = 0.952) and incomplete booster (M=3.183, SD = 1.0383); t(2381) = 4.696, p < 0.001. in conclusion, booster works as an intervention to live in new normal.

Gender and Psychological Wellbeing

An independent sample t-test was conducted to compare the degree of cave syndrome, COVID-19 stress and contact tracing stress between males and females. The results are displayed in the following tables.

Gender		Mean	Std. Deviation	Std. Error Mean
Cave	Male	3.2771	1.14899	0.03803
	Female	3.2470	1.06504	0.02707
Stress	Male	2.9496	1.08650	0.03596
	Female	2.6847	1.03393	0.02628
Trust	Male	3.4124	1.00510	0.03326
	Female	3.3214	0.95685	0.02432

	t-test for Equality of Means							
			Significance				95% Confidence Interval of the Difference	
	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Cave	0.658	2459	0.255	0.511	0.03012	0.04577	-0.05964	0.11988
Stress	5.947	1837.370	0.000	0.000	0.26487	0.04454	0.17752	0.35222
Trust	2.208	1837.962	0.014	0.027	0.09099	0.04121	0.01018	0.17181

Based on the results, there was no significant difference for the case syndrome between males (M=3.277, SD = 1.148) and females (M=3.247, SD = 1.065); t(2459) = 0.658, p > 0.05. Next, the result for COVID-19 stress shows there was a significant difference between males (M=2.949, SD = 1.086) and females (M=2.684, SD = 1.033); t(1837.370) = 5.947, p < 0.001. Females were more stress in facing COVID-19, compared to males. Likewise, the result for differences of contact tracing trust is significant between males (M=3.412 SD = 1.005) and females (M=3.321, SD = 0.956); t (1837.962) = 2.208, p < 0.001. It suggests males have a higher degree of agreeing that MySejahtera is a trusted application for contact tracing, for resuming the new normal, and it helps to create more awareness of COVID-19.

Residency and Psychological Wellbeing

In assessing how differences in the residency area affect the degree of cave syndrome, COVID-19 stress and contact tracing stress, a one-way ANOVA test was run. The results are displayed in the following tables.

		Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound
Trust	Urban	3.3353	0.96264	0.02310	3.2900	3.3806
	Suburban	3.4233	0.98522	0.06075	3.3037	3.5429
	Rural	3.3912	1.01821	0.04742	3.2980	3.4844
Cave	Urban	3.2606	1.09292	0.02622	3.2092	3.3120
	Suburban	3.4943	1.05322	0.06494	3.3664	3.6222
	Rural	3.1142	1.11401	0.05188	3.0123	3.2162
Stress	Urban	2.7901	1.04461	0.02506	2.7409	2.8392
	Suburban	3.0918	1.14144	0.07038	2.9532	3.2304
	Rural	2.5799	1.03292	0.04811	2.4854	2.6745

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Trust	Between Groups	2.508	2	1.254	1.317	0.268
	Within Groups	2339.932	2458	0.952		
	Total	2342.441	2460			
Cave	Between Groups	24.223	2	12.112	10.143	0.000
	Within Groups	2935.092	2458	1.194		
	Total	2959.315	2460			
Stress	Between Groups	44.179	2	22.090	19.915	0.000
	Within Groups	2726.478	2458	1.109		
	Total	2770.657	2460			

The results show there is a statistically significant main effect of residency group on cave syndrome $F\ (2, 2458) = 10.143$, $p < 0.001$. There is also a statistically significant main effect of residency group on COVID-19 stress $F(2, 2458) = 19.915$, $p < 0.001$. However, there is no statistically significant main effect of residency group on contact tracing trust $F\ (2, 2458) = 1.317$, $p > 0.05$.

The post-hoc test results are shown in the following table.

Multiple Comparisons

Games-Howell

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Trust	Urban	Suburban	-0.08807	0.06499	0.366	-0.2411	0.0649
		Rural	-0.05593	0.05275	0.539	-0.1798	0.0680
	Suburban	Urban	0.08807	0.06499	0.366	-0.0649	0.2411
		Rural	0.03214	0.07707	0.909	-0.1490	0.2133
	Rural	Urban	0.05593	0.05275	0.539	-0.0680	0.1798
		Suburban	-0.03214	0.07707	0.909	-0.2133	0.1490
Cave	Urban	Suburban	-.23369*	0.07004	0.003	-0.3985	-0.0688
		Rural	.14636*	0.05814	0.032	0.0098	0.2829
	Suburban	Urban	.23369*	0.07004	0.003	0.0688	0.3985
		Rural	.38005*	0.08313	0.000	0.1847	0.5754
	Rural	Urban	-.14636*	0.05814	0.032	-0.2829	-0.0098
		Suburban	-.38005*	0.08313	0.000	-0.5754	-0.1847
Stress	Urban	Suburban	-.30176*	0.07471	0.000	-0.4777	-0.1259
		Rural	.21013*	0.05425	0.000	0.0827	0.3375
	Suburban	Urban	.30176*	0.07471	0.000	0.1259	0.4777
		Rural	.51189*	0.08525	0.000	0.3115	0.7123
	Rural	Urban	-.21013*	0.05425	0.000	-0.3375	-0.0827
		Suburban	-.51189*	0.08525	0.000	-0.7123	-0.3115

*. The mean difference is significant at the 0.05 level.

In comparing the cave syndrome, urban and suburban respondents differed significantly at $p < 0.05$, and also between suburban and rural ($p < 0.001$). Urban respondents suffered a higher cave syndrome compared to those living in suburban. Next, the difference between urban and suburban for COVID-19 stress was also significant at $p < 0.001$. Comparing among the groups, those residing in rural area have the highest level of COVID-19 stress.

Income Category and Psychological Wellbeing

In assessing how differences in the household income affect the degree of cave syndrome, COVID-19 stress and contact tracing stress, a one-way ANOVA test was run. The results are displayed in the following tables.

		Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound
Trust	B40	3.3723	0.93132	0.02185	3.3295	3.4152
	M40	3.3535	1.09900	0.05064	3.2540	3.4530
	T20	3.1801	1.06069	0.08041	3.0214	3.3388
Cave	B40	3.2260	1.07128	0.02514	3.1767	3.2753
	M40	3.3050	1.16414	0.05364	3.1996	3.4104
	T20	3.4674	1.15020	0.08720	3.2953	3.6395
Stress	B40	2.7594	1.03741	0.02434	2.7117	2.8072
	M40	2.8603	1.13543	0.05232	2.7575	2.9631
	T20	2.8193	1.09473	0.08299	2.6554	2.9831

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Trust	Between Groups	5.871	2	2.936	3.088	0.046
	Within Groups	2336.570	2458	0.951		
Cave	Between Groups	10.538	2	5.269	4.392	0.012
	Within Groups	2948.777	2458	1.200		
Stress	Between Groups	4.053	2	2.026	1.800	0.165
	Within Groups	2766.605	2458	1.126		

The results show there is a statistically significant main effect of income category on cave syndrome $F(2, 2458) = 4.392$, $p < 0.05$. However, there is no statistically significant main effect of income category on COVID-19 stress $F(2, 2458) = 1.800$, $p > 0.05$. On the other hand, there is a statistically significant main effect of income category on contact tracing trust $F(2, 2458) = 3.088$, $p < 0.05$.

The post-hoc test results are shown in the following table.

Post Hoc Tests

Multiple Comparisons

Games-Howell

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Trust	B40	M40	0.01884	0.05515	0.938	-0.1107	0.1484
		T20	0.19226	0.08333	0.057	-0.0045	0.3890
	M40	B40	-0.01884	0.05515	0.938	-0.1484	0.1107
		T20	0.17343	0.09503	0.163	-0.0503	0.3972
	T20	B40	-0.19226	0.08333	0.057	-0.3890	0.0045
		M40	-0.17343	0.09503	0.163	-0.3972	0.0503
Cave	B40	M40	-0.07907	0.05924	0.376	-0.2182	0.0601
		T20	-.24148*	0.09075	0.023	-0.4557	-0.0272
	M40	B40	0.07907	0.05924	0.376	-0.0601	0.2182
		T20	-0.16241	0.10237	0.253	-0.4035	0.0787
	T20	B40	.24148*	0.09075	0.023	0.0272	0.4557
		M40	0.16241	0.10237	0.253	-0.0787	0.4035
Stress	B40	M40	-0.10088	0.05770	0.188	-0.2364	0.0347
		T20	-0.05984	0.08649	0.769	-0.2640	0.1444
	M40	B40	0.10088	0.05770	0.188	-0.0347	0.2364
		T20	0.04104	0.09811	0.908	-0.1900	0.2721
	T20	B40	0.05984	0.08649	0.769	-0.1444	0.2640
		M40	-0.04104	0.09811	0.908	-0.2721	0.1900

*. The mean difference is significant at the 0.05 level.

Based on the results, the B40 group has the highest level of agreement contact tracing plays a role as a device in assisting to live in new normal and to be more aware of COVID-19 pandemic. In making the comparison between cave syndrome, the B40 group feels more unease with the pandemic condition, as compared to the T20 group ($p < 0.05$). In conclusion, household income plays a role in the psychological wellbeing.

Age Category and Psychological Wellbeing

In assessing how differences in the age category affect the degree of cave syndrome, COVID-19 stress and contact tracing stress, a one-way ANOVA test was run. The results are displayed in the following tables.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
Trust	18 - 29	979	3.4147	0.91167	0.02914	3.3575	3.4719
	30 - 39	615	3.2954	0.95203	0.03839	3.2200	3.3708
	40 - 49	514	3.2740	1.05962	0.04674	3.1822	3.3658
	50 - 59	246	3.3841	1.04546	0.06666	3.2529	3.5154

	60 and above	107	3.4766	1.05718	0.10220	3.2740	3.6793
Cave	18 - 29	979	3.3517	1.07538	0.03437	3.2843	3.4192
	30 - 39	615	3.2618	1.05372	0.04249	3.1783	3.3452
	40 - 49	514	3.0992	1.13954	0.05026	3.0005	3.1980
	50 - 59	246	3.3388	1.12887	0.07197	3.1970	3.4805
	60 and above	107	2.9595	1.13058	0.10930	2.7428	3.1762
Stress	18 - 29	979	2.6940	1.05594	0.03375	2.6277	2.7602
	30 - 39	615	2.9352	1.04075	0.04197	2.8528	3.0176
	40 - 49	514	2.7681	1.05850	0.04669	2.6764	2.8598
	50 - 59	246	2.9276	1.10722	0.07059	2.7886	3.0667
	60 and above	107	2.4607	0.97910	0.09465	2.2731	2.6484

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Trust	Between Groups	10.840	4	2.710	2.855	0.022
	Within Groups	2331.601	2456	0.949		
Cave	Between Groups	32.704	4	8.176	6.861	0.000
	Within Groups	2926.611	2456	1.192		
Stress	Between Groups	38.379	4	9.595	8.625	0.000
	Within Groups	2732.279	2456	1.112		

The results show there is a statistically significant main effect of age category on cave syndrome $F(4, 2460) = 6.817$, $p < 0.001$. There is also statistically significant main effect of age category on COVID-19 stress $F(4, 2456) = 8.625$, $p < 0.001$, and contact tracing trust $F(4, 2456) = 2.855$, $p < 0.05$.

The post-hoc test results are shown in the following table.

Post Hoc Tests

Multiple Comparisons

Games-Howell

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Trust	18 - 29	30 - 39	0.11932	0.04819	0.097	-0.0123	0.2510
		40 - 49	0.14071	0.05508	0.080	-0.0098	0.2912
		50 - 59	0.03056	0.07275	0.993	-0.1689	0.2301
		60 and above	-0.06193	0.10627	0.977	-0.3561	0.2323
	30 - 39	18 - 29	-0.11932	0.04819	0.097	-0.2510	0.0123
		40 - 49	0.02140	0.06048	0.997	-0.1439	0.1867
		50 - 59	-0.08875	0.07692	0.778	-0.2995	0.1220
		60 and above	-0.18124	0.10917	0.462	-0.4830	0.1205
	40 - 49	18 - 29	-0.14071	0.05508	0.080	-0.2912	0.0098
		30 - 39	-0.02140	0.06048	0.997	-0.1867	0.1439
		50 - 59	-0.11015	0.08141	0.658	-0.3330	0.1127
		60 and above	-0.20264	0.11238	0.376	-0.5129	0.1076
	50 - 59	18 - 29	-0.03056	0.07275	0.993	-0.2301	0.1689
		30 - 39	0.08875	0.07692	0.778	-0.1220	0.2995
		40 - 49	0.11015	0.08141	0.658	-0.1127	0.3330
		60 and above	-0.09249	0.12202	0.942	-0.4284	0.2434
	60 and above	18 - 29	0.06193	0.10627	0.977	-0.2323	0.3561
		30 - 39	0.18124	0.10917	0.462	-0.1205	0.4830
		40 - 49	0.20264	0.11238	0.376	-0.1076	0.5129
		50 - 59	0.09249	0.12202	0.942	-0.2434	0.4284
Cave	18 - 29	30 - 39	0.08993	0.05465	0.468	-0.0593	0.2392
		40 - 49	.25250*	0.06089	0.000	0.0861	0.4189
		50 - 59	0.01297	0.07976	1.000	-0.2057	0.2316
		60 and above	.39222*	0.11457	0.007	0.0752	0.7093
	30 - 39	18 - 29	-0.08993	0.05465	0.468	-0.2392	0.0593
		40 - 49	0.16257	0.06582	0.098	-0.0173	0.3424
		50 - 59	-0.07696	0.08358	0.889	-0.3059	0.1520
		60 and above	0.30229	0.11727	0.080	-0.0218	0.6264
	40 - 49	18 - 29	-.25250*	0.06089	0.000	-0.4189	-0.0861
		30 - 39	-0.16257	0.06582	0.098	-0.3424	0.0173
		50 - 59	-0.23953	0.08779	0.051	-0.4799	0.0008
		60 and above	0.13972	0.12030	0.773	-0.1924	0.4718
	50 - 59	18 - 29	-0.01297	0.07976	1.000	-0.2316	0.2057

		30 - 39	0.07696	0.08358	0.889	-0.1520	0.3059
		40 - 49	0.23953	0.08779	0.051	-0.0008	0.4799
		60 and above	.37925*	0.13087	0.034	0.0190	0.7395
	60 and above	18 - 29	-.39222*	0.11457	0.007	-0.7093	-0.0752
		30 - 39	-0.30229	0.11727	0.080	-0.6264	0.0218
		40 - 49	-0.13972	0.12030	0.773	-0.4718	0.1924
		50 - 59	-.37925*	0.13087	0.034	-0.7395	-0.0190
Stress	18 - 29	30 - 39	-.24123*	0.05385	0.000	-0.3883	-0.0941
		40 - 49	-0.07412	0.05761	0.700	-0.2315	0.0833
		50 - 59	-.23367*	0.07825	0.025	-0.4482	-0.0192
		60 and above	0.23323	0.10049	0.145	-0.0446	0.5111
	30 - 39	18 - 29	.24123*	0.05385	0.000	0.0941	0.3883
		40 - 49	0.16711	0.06278	0.060	-0.0044	0.3386
		50 - 59	0.00756	0.08213	1.000	-0.2174	0.2325
		60 and above	.47446*	0.10354	0.000	0.1886	0.7603
	40 - 49	18 - 29	0.07412	0.05761	0.700	-0.0833	0.2315
		30 - 39	-0.16711	0.06278	0.060	-0.3386	0.0044
		50 - 59	-0.15955	0.08464	0.327	-0.3913	0.0722
		60 and above	.30735*	0.10554	0.033	0.0162	0.5985
	50 - 59	18 - 29	.23367*	0.07825	0.025	0.0192	0.4482
		30 - 39	-0.00756	0.08213	1.000	-0.2325	0.2174
		40 - 49	0.15955	0.08464	0.327	-0.0722	0.3913
		60 and above	.46689*	0.11808	0.001	0.1422	0.7916
	60 and above	18 - 29	-0.23323	0.10049	0.145	-0.5111	0.0446
		30 - 39	-.47446*	0.10354	0.000	-0.7603	-0.1886
		40 - 49	-.30735*	0.10554	0.033	-0.5985	-0.0162
		50 - 59	-.46689*	0.11808	0.001	-0.7916	-0.1422

*. The mean difference is significant at the 0.05 level.

Based on the results, the age group 40 – 49 years old and 60 years and above have a greater effect on both cave syndrome and COVID-19 stress. Likewise, those in the age group of 18 – 29 years old also suffer a higher level of cave syndrome.

Working Category and Cave Syndrome

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Government Officer	646	3.3473	1.12308	0.04419	3.2605	3.4340
Private Organisation Employee	589	3.2915	1.07931	0.04447	3.2041	3.3788
Self-employed	234	3.0826	1.16858	0.07639	2.9321	3.2331
Pensioner	57	3.1462	1.08565	0.14380	2.8581	3.4343
Student	572	3.3054	1.07420	0.04491	3.2171	3.3936
Housewife	278	3.0755	1.02412	0.06142	2.9546	3.1965
Not working	85	3.1882	1.10488	0.11984	2.9499	3.4266
Total	2461	3.2582	1.09680	0.02211	3.2148	3.3015

ANOVA

Cave

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	24.668	6	4.111	3.438	0.002
Within Groups	2934.647	2454	1.196		
Total	2959.315	2460			

The results show there is a statistically significant main effect of working category on cave syndrome $F(6, 2461) = 4.111$, $p < 0.05$. Housewives are perceived to have a higher level of cave syndrome as compared to others. On the other hand, government officers are perceived to have the lowest level of cave syndrome as compared to other groups of working categories.

Working Category and COVID-19 Stress

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound
Government Officer	646	2.9560	1.12735	0.04435	2.8689	3.0431
Private Organisation Employee	589	2.9049	1.07105	0.04413	2.8182	2.9916
Self-employed	234	2.6071	1.05611	0.06904	2.4710	2.7431
Pensioner	57	2.9246	1.01740	0.13476	2.6546	3.1945
Student	572	2.6142	1.01837	0.04258	2.5305	2.6978
Housewife	278	2.6604	0.91231	0.05472	2.5527	2.7681
Not working	85	2.5482	0.93968	0.10192	2.3456	2.7509
Total	2461	2.7830	1.06127	0.02139	2.7410	2.8249

ANOVA

Stress

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	61.651	6	10.275	9.308	0.000
Within Groups	2709.006	2454	1.104		
Total	2770.657	2460			

The results show there is a statistically significant main effect of working category on COVID-19 stress $F(6, 2461) = 10.275$, $p < 0.001$. The respondent who are not employed are perceived to have a higher level of COVID-19 stress, followed by self-employed and students. On the other hand, government officers are perceived to have a lower level of COVID-19 stress.

Working category and contact tracing trust

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound
Government Officer	646	3.3971	1.05700	0.04159	3.3154	3.4787
Private Organisation Employee	589	3.3497	0.93512	0.03853	3.2741	3.4254
Self-employed	234	3.3625	0.98546	0.06442	3.2356	3.4895
Pensioner	57	3.5673	1.00537	0.13316	3.3005	3.8340
Student	572	3.3942	0.92232	0.03856	3.3185	3.4700
Housewife	278	3.1301	0.95337	0.05718	3.0175	3.2427
Not working	85	3.3843	0.90305	0.09795	3.1895	3.5791
Total	2461	3.3551	0.97581	0.01967	3.3166	3.3937

ANOVA

Trust

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18.755	6	3.126	3.301	0.003
Within Groups	2323.686	2454	0.947		
Total	2342.441	2460			

The results show there is a statistically significant main effect of working category on COVID-19 contact tracing application $F(6, 2461) = 18.755$, $p < 0.05$. Government officers are perceived to have a higher level of trust on the contact tracing while housewives have a lower trust.

Appendix 4.1: Research Instrument for Case 4

A. QUESTIONS FOR LOGISTICS PROVIDER

Existing processes and procedures in place to maintain/preserve the integrity of the COVID-19 vaccines from the airport terminal to the respective vaccinees.

1. What is the first process that needs to be done once the COVID-19 vaccine arrives in Malaysia?
2. How many types of transportation are used to transport the vaccines to vaccine centres?
3. Where does the COVID-19 vaccines get transported once it arrives at the airport terminal?
4. How many phases are there in managing the COVID-19 transportation to vaccine centres?
5. How are the COVID-19 vaccines being managed to ensure storage temperature requirements?
6. Is there any indicator used to monitor the quality of vaccines during the transportation?
7. Is there any training developed and provided to people who are handling the distribution of the vaccines? Does the training cater to the different roles?

Issues and challenges in the cold chain logistics COVID-19 vaccines in Malaysia.

1. What are the types of challenges faced in managing the logistics management (cold chain) of the COVID-19 vaccines?
    - Poor temperature management
    - Low levels of technology
    - Insufficient skills and knowledge
    - Management capacity
    - Inadequate infrastructure
    - Unstable electricity and power supply
    - Poor road conditions
    - Last-mile delivery

2. What steps have been planned and carried out to overcome those challenges?

3. Do you think that the cold chain facilities are sufficient to support the distribution process throughout Malaysia?

4. Is there any training developed and provided to people who are handling the distribution of the vaccines? Does the training cater to the different roles?

5. How do you manage the collaboration between your company and MOH to ensure effective distribution of vaccines is achieved?

B. QUESTIONS FOR PHARMACEUTICAL PROVIDER

General Overview

1. What is your company's role in the vaccine role out?

Challenges

2. In general, what are the challenges that your company faced in carrying out the roles in the vaccine roll-out?
3. How does the dynamic COVID-19 vaccine programme affect the development of COVID-19 vaccine?
4. What other requirements are needed to improve the development of COVID-19 vaccine?
5. How do you increase your credibility and reputation?

Process

6. How do you ensure the quality is maintained and complied with good manufacturing/distribution practice of COVID-19 vaccines?
7. Do you outsource the non-core activities to external parties, if yes, how do you manage the selection process, and coordination with them?

Collaboration and Coordination

8. Do you receive any funding from the private/public sector?
9. How are the high-level of coordination at national, state and district levels being managed for effective cooperation and collaboration among the parties involved in the COVID-19 vaccination roll-out programme and your company?

Strategic Management and Demand Planning

10. How does the uncertainty surrounding the COVID-19 affects the clinical development of the vaccines?
11. How do you determine the price of the vaccines?

C. QUESTIONS FOR VMS and PhIS

1. What does "tray of vaccine" mean?
2. How does serialization occur?
3. How is block chain technology used for commissioning?
4. How does the approval process by NPRA occur before each tray of vaccine is released? Is it recorded in a system?
5. How are data from the PSVs reconciled with the Vaccines Management System (VMS) and Pharmacy Information System (PhIS)?
6. What reports are produced and how do they look like?

Appendix 4.2: List of Interviews for Case 4

NO	NAME OF ORGANIZATION	LOCATION	INTERVIEWEE
1.	PPV INTEGRASI	UM, Kuala Lumpur	Dr. Razzi
2.	PPV AZ	World Trade Centre Kl (WTCKL), Kl	St1: Ms. Li Sha, Nurhanisah St2: Dato' Mohan, Ms. Jiha St3: Dr. Siti Hasmah & Ms. Diana
3.	PPV AZ	Dewan Gemilang, UKM, Bangi, Selangor.	Mr. Izzat, Qualitas
4.	PPV HS (HOSPITAL SWASTA)/ PPV ACC (PUSAT JAGAAN AMBULATORI	KPJ Tawakkal Specialist Hospital	Ms. Rehan, Chief Nursing Officer (Matron) Tawakkal Hospital & Operational
5.	PPVIPT	Pusat Perubatan MSU	Dr. Fadli
6.	PSV	UITM Puncak Alam, Selangor.	Dr. Aimi Nazri
7.	PPV GP (GENERAL PRACTITIONER/PENGAMAL/KLINIK PERUBATAN AM SWASTA)/PPV KP (KLINIK PAKAR)	Klinik Siti Prima Saujana, Kajang, Selangor.	Ms.Farhana, Supervisor
8.	93 ARMED FORCES MEDICAL & DENTAL DEPOT, MINISTRY OF DEFENSE.	93 Armed Forces Medical & Dental Depot, Ministry Of Defense, Jalan Padang Tembak, 50634 Kuala Lumpur.	LT. KOL. Nur Hidayah, Assistant Commanding Officer (2ic)
9.	ZUELLIG PHARMA SDN. BHD.	15, Persiaran Pasak Bumi, Seksyen U8, Perindustrian Bukit Jelutong.	1. Ms. Naniwati Md Jani, Senior Manager, Quality - Services & Branches. 2. Mr. Pang Kim Sun, Director, Client & Customer Experience and Digital Transformation
10.	DUOPHARMA BIOTECH BERHAD	Lot 2599, Jalan Seruling 59, Kawasan 3, Taman Klang Jaya, 41200 Klang, Selangor	1.Wan Amir-Jeffery Wan Abdul Majid, Chief Operating Officer 2. Leon Cruz A/L Francis Cruz, Head of Production 3.Ashwin Thevarayan A/L Valliyappan, Asst. Manager/Pharmacist, Manufacturing Compliance. 4. Loh Jang Sing, Head of Franchise, Renal Care Franchise,

			Ethical Specialty Business. 5.Seri Azalina Binti Mohd Ghazalli, Manager Halal And Government Relations
11.	PHARMACY POLICY & STRATEGIC PLANNING DIVISION, PHARMACEUTICAL SERVICES PROGRAMME	Lot 36, Jln Profesor Diraja Ungku Aziz, Pjs 13, 46200 Petaling Jaya, Selangor.	Mr. Mohd Azuwan Bin Mohd Zubir, Ketua Penolong Pengarah Kanan, Bahagian Dasar & Perancangan Strategik Farmasi, KKM
12.	PHARMACY POLICY & STRATEGIC PLANNING DIVISION, PHARMACEUTICAL SERVICES PROGRAMME	Lot 36, Jln Profesor Diraja Ungku Aziz, Pjs 13, 46200 Petaling Jaya, Selangor.	Ms. Nur'ain Shuhaila Binti Shohaimi, Timbalan Pengarah, Bahagian Dasar & Perancangan Strategik Farmasi, KKM
13.	MOSTI	C5, Pusat Pentadbiran Kerajaan Persekutuan, Presint 1, 62000 Putrajaya, Wilayah Persekutuan Putrajaya.	Ts Dr. Mohd Nor Azman Bin Hassan (Timbalan Ketua Setiausaha (Pembangunan Teknologi, Pengkomersialan dan Perkhidmatan STI)
14.	MIMOS	MIMOS Berhad, Technology Park Malaysia, 57000 Kuala Lumpur	Kang Siong Ng, Senior Manager, MIMOS
15.	PHARMANIAGA LOGISTICS SDN. BHD.	No. 7, Lorong Keluli 1b, Kawasan Perindustrian Bukit Raja Selatan, Seksyen 7, 40000 Shah Alam, Selangor	Mr. Johan Jaafar, General Manager, Pharmaniaga Logistics Sdn. Bhd.
16.	QUEEN ELIZABETH HOSPITAL, KOTA KINABALU, SABAH	Queen Elizabeth Hospital, Kota Kinabalu, Sabah	1.Ms. Law Sok Chong, Store Pharmacy Officer, Kota Kinabalu, Sabah. 2. Dr. Avinash K. Chand, Chief OSH, Queen Elizabeth Hospital, Kota Kinabalu, Sabah
17.	HOSPITAL UMUM SARAWAK	Hospital Umum Sarawak	1.Ms. Law Kah Ee, Pharmacy Officer UF48, Unit Farmasi Logisitk. 2. Dr. Catherine (Infection Control Unit)

Appendix 5.1 : List of Steering and Technical Committee Members

STEERING COMMITTEE

1. Ts. Dr. Nagulendran a/l Kangayatkarasu - Chairperson
   Timbalan Ketua Setiausaha
   Perancangan dan Pembudayaan Sains
   Kementerian Sains, Teknologi dan Inovasi

2. Shahrizal bin Shahrudin
   Timbalan Setiausaha Bahagian
   Bahagian Data Strategik & Foresight Teknologi
   Kementerian Sains, Teknologi dan Inovasi

3. Dr. Asmawi Noor Saarani
   Pengarah
   Bahagian Perancangan Strategik
   Kementerian Perdagangan dan Industri

4. Nur'Ain Shuhaila Shohaimi
   Timbalan Pengarah
   Bahagian Dasar & Perancangan Strategi Farmasi
   Cawangan Dasar Farmasi
   Kementerian Kesihatan Malaysia

5. Dr. Muhammad Firdaus bin Ujang
   Pakar Perubatan Kesihatan Awam
   Bahagian Pembangunan Kesihatan Keluarga
   Kementerian Kesihatan Malaysia

6. Bibi Faridha binti Mohd Salleh
   Ketua Penolong Pengarah Kanan
   Bahagian Dasar & Perancangan Strategik Farmasi
   Kementerian Kesihatan Malaysia

7. Hasniza Zaidan
   Ketua Penolong Pengarah Kanan
   Bahagian Regulatori Farmasi
   Kementerian Kesihatan Malaysia

8. Mastura binti Zulkifley
   Ketua Penolong Setiausaha
   Kementerian Pelancongan dan Kebudayaan Malaysia
   Bahagian Dasar Pelancongan dan Hubungan

9. Parimala Ramachandaran
   Ketua Penolong Pengarah Kanan
   Bahagian Perancangan Strategik
   Kementerian Perdagangan dan Industri

10. Riyanti binti Saari
    Pengarah
    Bahagian Metodologi dan Penyelidikan
    Jabatan Perangkaan Malaysia

11. Siti Muslihani binti Abdul Ghani
    Ketua Penolong Setiausaha Kanan
    Bahagian Perancangan Strategik
    Kementerian Sains, Teknologi dan Inovasi

12. Mohammad Fuad bin Rahman
    Ketua Penolong Setiausaha Kanan
    Bahagian Pembudayaan dan Perkhidmatan STI
    Kementerian Sains, Teknologi dan Inovasi

13. Ho Yun Shiang
    Ketua Penolong Setiausaha Kanan
    Bahagian Data Strategik & Foresight Teknologi

14. Mohd Azuwan bin Mohd Zubir
    Ketua Penolong Pengarah Kanan
    Bahagian Dasar & Perancangan Strategi Farmasi
    Cawangan Dasar Farmasi
    Kementerian Kesihatan Malaysia

15. Hasniza binti Zaidan
    Ketua Penolong Pengarah Kanan
    Bahagian Regulatori Farmasi
    Kementerian Kesihatan Malaysia

16. Rizmi bin Ahmad Shapiei
    Ketua Penolong Setiausaha
    Bahagian Pemindahan Teknologi dan Pengkomersialan R&D
    Kementerian Sains, Teknologi dan Inovasi

17. Chan Foh Ching
    Ketua Penolong Setiausaha
    Bahagian Antarabangsa
    Kementerian Sains, Teknologi dan Inovasi

18. Khairolnizam Saad
    Ketua Penolong Setiausaha Kanan
    Bahagian Dasar Pelancongan dan Hubungan
    Kementerian Pelancongan dan Kebudayaan Malaysia

19. Azila Azlina binti Che Wahab
    Ketua Penolong Setiausaha
    Bahagian Kewangan
    Kementerian Sains, Teknologi dan Inovasi

20. Yadupriya Devi a/p Satinarayanan
    Penolong Setiasusaha
    Bahagian Kewangan
    Kementerian Sains, Teknologi dan Inovasi

21. Nazeera binti Mohamad
    Penolong Setiausaha, MASTIC
    Bahagian Data Strategik dan Foresight Teknologi
    Kementerian Sains, Teknologi dan Inovasi

TECHNICAL COMMITTEE

1. Anita Bahari - Chairperson
   Setiausaha Bahagian
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   Kementerian Sains, Teknologi dan Inovasi

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