

THE DEVELOPMENT OF SCENARIO PLANNING TOOLKIT TO
ENHANCE SPECTRUM MANAGEMENT STRATEGY IN MALAYSIA

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SPECTRUM MANAGEMENT STRATEGY IN MALAYSIA

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DEDICATION

In the memory of my late father, Haji Kamarudin Shaari, who passed away peacefully on the night of 22 May 2012. Thanks for all your love, patience and sacrifices for me. Your deep love of your children imbued in us a strong sense of intimacy and affection.

May Allah have mercy on you and place your soul among those of the believers.

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ABSTRACT

The increasing reliance on radiocommunication-based technologies and the immense opportunities for social and economic development highlights the need for efficient use of radio spectrum. Technological advancement has incessantly unlocked a plethora of applications and services that have spurred the increasing use and demand for the scarce spectrum resources. The increase in demand for wireless broadband capacity is anticipated to result in continued pressures for additional spectrum; however, the magnitude and timing of these requirements are difficult to be predicted with certainty. With the rapid development of the telecommunications landscape, particularly the wireless broadband industry, the role and tasks of the Malaysian Communications and Multimedia Commission (MCMC) in managing the country's strategic spectrum resources have become increasingly complex. This research aims to investigate the required tools, framework, and knowledge to support the formulation of spectrum policies, outlooks, and programmes in managing the radio spectrum in Malaysia. The proposed intervention is developing and using the Scenario Planning Toolkit, which serves as a practical guide for spectrum managers to carry out their functions. The Scenario Planning and Strategic Foresight theories were used to underlie the model framework for the study. By using interviews, surveys and observation with a total of 20 respondents taking part in this analysis, a mixed-method approach was applied. Thematic analysis and the Social Sciences Statistical Package (SPSS) were then used to interpret and analyse the findings. The data analysis demonstrated that the intervention positively impacted MCMC in the perspective of MCMC officers' mental models, individual and organisational learning, decision-making process and strategic planning process. Future researchers are recommended to further investigate scenario-based planning in the spectrum management areas. In addition, this research will also be useful for policymakers to plan and implement other strategic management strategies in the regulatory body or public sector.

ABSTRAK

Penggunaan teknologi komunikasi tanpa wayar dan manfaatnya kepada pembangunan sosial dan ekonomi meningkatkan keperluan untuk menguruskan sumber radio spektrum secara efisien dan cekap. Kemajuan teknologi komunikasi tanpa wayar telah mendorong peningkatan penggunaan dan permintaan sumber radio spektrum yang terhad. Peranan dan tugas Suruhanjaya Komunikasi dan Multimedia Malaysia (MCMC) untuk memastikan sumber radio spektrum digunakan secara optimum menjadi semakin kompleks selaras dengan perkembangan pesat industri telekomunikasi, terutamanya perkhidmatan jalur lebar tanpa wayar. Objektif kajian ini adalah untuk mengkaji rangka kerja dan perancangan strategik yang diperlukan untuk menyokong penggubalan dasar dan ranga kerja yang berkesan bagi menguruskan sumber spectrum di Malaysia. Teori Perancangan Senario dan Teori Strategik Berpandangan Jauh digunakan untuk sebagai rangka kerja model untuk kajian. Intervensi yang dijalankan melalui kitaran 1 termasuk pembangunan rangka kerja perancangan senario yang berfungsi sebagai panduan praktikal untuk pengurus spektrum menjalankan tugas merancang dan mengurus sumber spektrum. Melalui kitaran 2, rangka kerja perancangan senario digunakan bagi mengenal pasti teknologi internet tanpa wayar yang terkini dilaksanakan di Malaysia. Dengan menggunakan temu bual, tinjauan dan pemerhatian dengan seramai 20 orang responden yang mengambil bahagian dalam analisis ini, pendekatan kaedah campuran telah digunakan. Analisis Tematik dan Pakej Statistik Sains Sosial (SPSS) kemudiannya digunakan untuk menafsir dan menganalisis dapatan. Analisis data menunjukkan bahawa intervensi memberi impak positif dalam perspektif model mental, pembelajaran individu dan organisasi, proses membuat keputusan dan proses perancangan strategik. Penyelidik disyorkan untuk menjalankan kajian lebih lanjut berkenaan perancangan berasaskan senario dalam bidang pengurusan spektrum. Selain itu, kajian ini juga berguna kepada penggubal dasar sebagai panduan untuk merancang dan melaksanakan strategi pengurusan strategik lain dalam badan kawal selia atau sektor awam.

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LIST OF ABBREVIATIONS

CAGR	-	Compound Annual Growth Rate
CAPEX	-	Capital Expenditures
CMA	-	Communications and Multimedia Act 1998
DTH	-	Direct-to-Home
EBITDA	-	Earnings before Interest, Taxes, Depreciation and Amortization
FWA		Fixed Wireless Access
HSBB	-	High-Speed Broadband
IMT	-	International Mobile Telecommunications
IPTV	-	Internet Protocol television
ITU	-	International Telecommunication Union
JENDELA	-	Jalanan Digital Negara
MCMC	-	Malaysian Communications and Multimedia Commission
MCMCA	-	Malaysian Communications and Multimedia Commission Act 1998
NBI	-	National Broadband Initiative Plan
WLAN	-	Wireless Local Area Networks

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter provides an arena to describe why the research is required and why an investigation is necessary. It begins by introducing the micro-turn in the study of strategy that places emphasis on collecting experiences and human intervention. The research, built on the prevalence of an action research paradigm and motivated by an aspiration to deconstruct the dynamics of specific contexts, provides insight into how spectrum managers construe and practise spectrum planning in the organisation.

This research stresses the importance of providing novel insights on strategy formulation, strategy frameworks, and strategy structure to establish a more sound foundation for developing radio spectrum planning strategies, particularly wireless broadband services. Limited information is known about how strategic planning and strategic foresight emerge and evolve within Malaysian regulatory bodies. Three research questions are deliberately chosen to act as the vehicle for addressing the research topic and finally achieving the study objectives. Further, the researcher's role in this research project is described, and the chapter concludes with an explanation of the research's significance towards both theory and practice.

1.2 Case Company and Industry

Radio spectrum is a valuable and scarce natural resource that can be used to enhance societal and economic development by providing a means of communication. Technological advancement has unlocked a plethora of applications and services that have spurred the increasing use and demand for spectrum resources. Radio spectrum is greatly employed in various services such as mobile broadband, broadcasting,

aeronautical and maritime radiocommunications, meteorological monitoring, amateur radio and satellite systems. The increasing reliance on radiocommunication-based technologies and the immense opportunities for social and economic development highlights the need for efficient use of radio spectrum and spectrum planning strategies.

The COVID-19 pandemic has reinforced the dependency for better digital technology and infrastructure nationwide and for the digital divide between urban and rural areas to be bridged swiftly. Concurrently, the significance of reliable digital technology and networks has never been timelier, particularly with the rapid deployment of 5G networks worldwide. These circumstances have become more apparent in the perspective of the radio spectrum, an increasingly valuable natural resource in the digital age. The ever-growing demand for better digital network infrastructure and ecosystem requires optimum radio spectrum use and a robust spectrum planning strategy. Growing demand necessitates efficient radio spectrum utilisation and the implementation of an effective spectrum planning strategy.

The government or regulatory body could attain the efficient use of radio spectrum resources by regulating, planning and coordinating spectrum use by establishing national spectrum management and framework. The ability of each country to maximise the benefits of the radio spectrum resources rely on the spectrum management activities that encourage the deployment of radiocommunication services and minimise the radio frequency interference.

The responsibility of spectrum management at the national level can be taken by the government, in the context of a ministry, or by an autonomous regulator functioning under a legislative mandate or policy guidelines. In Malaysia, this task is borne by the Malaysian Communications and Multimedia Commission (“MCMC”). MCMC was established pursuant to the Malaysian Communications and Multimedia Commission Act 1998 (“MCMCA”) as a regulator for the communications and multimedia industry in Malaysia. As of June 2021, MCMC has a work strength of 891 employees and has 21 offices throughout Malaysia, including the headquarter, regional, state and branch offices. MCMC is responsible for regulating the country's

communications and multimedia industry and is the only regulatory body responsible for this sector. MCMC also regulates the postal sector and the convergent broadcasting and telecommunications industries.

As an independent regulator, MCMC is responsible to the Minister and accorded all its functions under the Communications and Multimedia Act 1998 (“CMA”). Among the powers and functions of MCMC are to advise the Minister on all matters concerning the national policy objectives, supervise and monitor communications and multimedia activities, encourage and promote self-regulation, and promote and maintain the integrity of all persons licensed or authorised under the CMA.

For over 20 years, MCMC has played an essential custodian role in managing the country’s radio spectrum resource. MCMC is tasked to regulate the use of radio spectrum under the CMA and the relevant subsidiary legislation such as the Communications and Multimedia (Spectrum) Regulations 2000 (“Spectrum Regulations”). Within the spectrum management framework, MCMC is entrusted to manage radio spectrum resources to support a range of radiocommunication services across Malaysia, and it must ensure that the radio spectrum resource is used optimally. In the context of MCMC, optimal utilisation means maximising the benefits that the Rakyat, businesses, and other organisations derive from spectrum use and achieving full societal and economic value from the spectrum resources.

The core functions of spectrum management undertaken by MCMC can be categorised into four main areas: spectrum planning, spectrum assignment, spectrum coordination, and spectrum monitoring. MCMC is tasked to make available and assign radio spectrum, develop and administer the rules and regulations governing radio frequency, and represent Malaysia's interests in the international platform. Spectrum management initiatives complement MCMC's larger activities and tasks that facilitate the provision of wireless communications, such as regulating the fixed telecommunications infrastructure that connects wireless networks.

One of the main aspects of spectrum management is spectrum planning, which is the focus of this research. The spectrum planning process managed and regulated by MCMC involves developing plans and establishing the direction for policy formulation, taking into account technology advancement and social, economic, and political influences. The spectrum planning process also includes the identification of spectrum for future use, the consideration of spectrum allocation methods and principles, and the identification of the relevant spectrum conditions to create a conducive regulatory environment.

MCMC has specific responsibilities for the use of radio spectrum in Malaysia, in addition to a number of other tasks that need to be properly regulated. Along with spectrum management duties, MCMC engages in a myriad of different regulatory responsibilities, all of which are critical to realising the full advantages of wireless communication in Malaysia. The spectrum management activities are identified and implemented through the spectrum planning process to harness technology development that will support the national policy objectives and targets. With the growing demand for radio spectrum, spectrum planning strategies are required to chart the key trends of technological developments to assess the current use and estimate the future spectrum requirement in Malaysia.

1.2.1 PEST Analysis

The external environmental analysis was conducted to assess and inform the organisational strategy formulation. PEST method is an analytical and widely used tool for evaluating strategic risk by identifying and defining the changes and implications of the external environment on the organisation's leading strategy (Sammut-Bonnici & Galea, 2015). The analysis examines the environmental setting of the telecommunications sector in which MCMC is presently operating. The analysis explores critical elements that influence MCMC's duties as a regulator. The assessment examines the political, economic, social and technological aspects explicitly impacting the telecommunications industry, particularly the wireless broadband services.

1.2.1.1 Political Factor

MCMC has an influence on and is influenced by the political environment in which it functions. The policy-making landscape in which MCMC functions is rapidly changing, with the government establishing a direction for its objectives in the telecommunication sector. Malaysia's political landscape MCMC operates in is an environment in which substantial political emphasis has recently been drawn to the actions and practises of regulators at both the national and international levels. The government has accorded guidance to regulators (and government entities in a broad sense) through the publication of a number of public statements, reports, and overarching policy strategy documents.

The conclusion of the 11th Malaysia Plan in 2020 signifies the end of Vision 2020 policy. The 12th Malaysia Plan includes measures and actions to protect national security and sovereignty, critical for long-term socio-economic growth. The 12th Malaysia Plan is developed upon three core principles: resetting the economy, enhancing security, well-being, inclusiveness, and improving sustainability. Four catalytic enablers support these principles, concentrating on cultivating potential talent, driving technology development and innovation, and increasing connectivity and infrastructure.

As a progression of Vision 2020, the Government established Shared Prosperity Vision 2030 (“SPV 2030”), a blueprint released in 2020 which seeks to provide a decent quality of life for all Malaysians by 2030. As the future economy signifies the requirement to transform policies, regulations, technologies, resources, and industry trends to remain relevant and fulfil economic growth, SPV 2030 prioritises exploration in new fields such as digital economy, automation, fintech, AI and blockchain.

The introduction of MyDIGITAL Economy Blueprint in February 2021 establishes the digital economy's strategy and lays the groundwork for driving digitalisation throughout the country. The blueprint is designed to highlight the efforts and initiatives that would be implemented up to 2030 to establish a digital nation,

therefore accomplishing the Government's aspirations to effectively transition Malaysia into a digitally-driven, high-income country and regional leader in the digital economy. The Blueprint maps the digital sector's impact on the Malaysian economy and sets the basis for extensive digitalisation, including bridging the digital divide. MyDIGITAL is intended to complement existing national policies, including the 12th Malaysia Plan and SPV 2030.

The changes in government priorities and agenda have a significant impact on the telecommunication landscape in Malaysia, particularly the wireless broadband industry. The national digital infrastructure plan, or Jalinan Digital Negara (“JENDELA”), was introduced in June 2020 as part of the 12th Malaysia Plan and was developed to provide more extensive broadband coverage and a higher quality of broadband experience for the public. It expands and strengthens the preceding blueprints of the National Fiberisation and Connectivity Plan (2019-2023) and the Communications and Multimedia Action Plan (2016-2020). Through JENDELA, the industry collaborates with the government to accelerate Malaysia's transformation to a high-income digital society by deploying extensive mobile, fibre, and fixed wireless connections, paving the path for 5G networks.

JENDELA Phase 1 began in September 2020 and is planned to conclude by 2022. The first phase includes increasing 4G mobile broadband coverage from 91.8% to 96.9% in the populated area, increasing average mobile broadband speeds from 25Mbps to 35Mbps, and providing gigabit access to 7.5 million premises by the end of 2022. Phase 1 also sees the progressive phase-out of 3G networks through the end of 2021 and the spectrum migration to allow for a more efficient 4G network rollout while also laying the foundation for 5G networks.

JENDELA Phase 2 (after 2022) intends to close the digital divide by adopting technologies such as Fixed Wireless Access (“FWA”) and preparing the roadmap for the full implementation of 5G. In the second phase of JENDELA, the transition to 5G would be expedited once a strong foundation is established in Phase 1, in accordance with the 12th Malaysia Plan. Furthermore, the adoption of other technologies such as satellite broadband and FWA will be regarded to ensure that the public has access to

broadband networks across the nation, particularly in underserved areas with difficult geographical conditions. The cost of providing fibre connectivity and infrastructure development is very high. These measures are being taken to achieve inclusive and sustainable growth centred on digitalisation across all levels of society.

The future success of the telecommunications industry in Malaysia in comparison to other ASEAN or Asia-Pacific countries will be significantly reliant on future investments. Given the imperative of supporting the smart digital economy and the demand from businesses and consumers for the high quality of broadband services, political expectations for telecommunication industry achievement are high. On the other hand, Malaysia is a small developing country in terms of population demographics and density and a high-cost environment for infrastructure systems and hence has low fixed infrastructure competition levels. Achievement realisation will be a challenging task for policymakers and industry players. The role of MCMC in terms of spectrum management will be critical in the coming years as consumer demand for voice and data services on wireless broadband grows.

1.2.1.2 Economic Factor

The telecommunication sector has shown remarkable resilience in the face of a challenging and unforeseen market condition induced by a confluence of substantial demand and new trends caused by the COVID-19 pandemic. The pandemic spurred technological adoption, as citizens were required to work from home, learn and make transactions online. As a result of the increased demand for connectivity during the movement control order (“MCO”), market sentiment remained favourable for the telecommunication sector's prospects.

Additionally, some government measures, such as stimulus packages and plans to develop digital infrastructure for improved connection, mitigated the pandemic's effect on this industry. As a consequence, the market capitalisation of the telecommunications industry increased by 0.3% to RM134.42 billion in 2020. The

telecommunication sector would account for 7.9%, or RM1,817.29 billion, of Bursa Malaysia's total market capitalization in 2020, a marginal fall of 0.5 percentage points.

Malaysia's telecommunication industry's revenue was RM46.64 billion in 2020, down 4.1% from RM48.62 billion in 2019, with the telecoms sector leading the way, followed by the broadcasting sector. In the wake of the pandemic, the postal and courier industry saw revenue increase, boosted by e-commerce as customers changed their spending patterns from physical to online purchases. Malaysia's overall telecom service revenue will increase from RM35 billion in 2020 to RM36.1 billion in 2025, representing a 2.5% compound annual growth rate (“CAGR”), mainly due to growth in fixed broadband, mobile data, and pay-TV service revenues.

Revenues from mobile data services will expand at a CAGR of 2.9% between 2020 and 2025, going from RM9.6 billion in 2020 to RM 15billion in 2025, due to rising mobile internet subscribers and rising data average revenue per unit (“ARPU”). Additionally, the development will be spurred by the proliferation of 4G services and the deployment of 5G networks throughout the projection period, underpinned by the JENDELA strategic plan (GlobalData, 2021).

Fixed broadband service revenues would increase at the highest CAGR of 10.1% between 2020 and 2025, growing to RM 7billion in 2025 from RM 6.8billion in 2020, attributed to high fixed wireless access and fibre-optic subscribers throughout the projection period. Pay-TV service revenues would grow by 2% per year from RM4.6 billion in 2020 to RM5 billion in 2025 due to the rapid growth of Direct-to-Home (“DTH”) and Internet Protocol television (“IPTV”) subscribers throughout the projected period (GlobalData, 2021).

In 2020, overall telecom's capital expenditure grew by 3% to RM4.75 billion (from RM4.61 billion in 2019), as network operators invested more in infrastructure upgrades to meet growing data needs. Around 76% of the total CAPEX was spent on network-related expenses. The telecoms industry earned a Return On Assets (ROA) of 6.5% in 2020, a slight improvement from 6.3% in 2019. This indicates that the industry is fairly efficient at generating profits from its assets.

1.2.1.3 Social Factor

Malaysia is a mobile-first nation, with a mobile broadband penetration rate of 123% in 2019 compared to a fixed broadband penetration rate of 9%. The average Malaysian has at least one method of connecting to the internet and prefers to do so via mobile broadband. According to reports, 82% of inhabited areas had 4G services in 2019. Malaysian urban residents have expedited their embrace of digital technology, particularly platforms such as Lazada and Grab. Many people depended on streaming video sites like Netflix and Tonton to pass the time while confined to their homes during the COVID-19 pandemic.

Due to the MCO limitation in 2020-2021, broadband capacity demand shifted abruptly from commercial to residential areas. Broadband traffic demand in residential areas grew by 50 to 70%, prompting network congestion and a 40% decrease in broadband speed. As a result, the number of complaints about network quality and coverage surged up to 70%. Network operators raced to reconfigure their resources, infrastructure and networks to deal with the disruption.

1.2.1.4 Technological Factor

Wireless broadband has advanced substantially in the recent decade. The world moves to 5G, as the latest digital telecommunication will revolutionise the interaction between machines and people. Malaysia will see an immense proliferation of industry applications and an enhanced delivery optimisation for numerous industries such as automotive, agriculture, healthcare, manufacturing, education, entertainment, and many others due to 5G technology.

The COVID-19 crisis has exacerbated people's reliance on broadband services, particularly for learning and working from home. This has resulted in mobile-to-fixed broadband substitution since fixed broadband provides more capacity, more steady speeds, and greater dependability than mobile broadband, especially for bandwidth-intensive applications such as streaming content and virtual meetings. Total broadband

subscribers in Malaysia decreased by 2.7% to 42.19 million in 2020 due to decreasing mobile broadband subscriptions.

Mobile broadband subscribers declined by 3.9% to 38.84 million in 2020, while fixed broadband subscriptions increased by 13.6% to 3.35 million. As the MCO constrained people's movements, many chose to remain at home, culminating in a customer switch to fixed broadband. Furthermore, within the first stage of the MCO, the daily free 1GB of data offered by the government stimulus package resulted in the underutilisation of their mobile data subscriptions. Subscribers downgraded their mobile subscription plans or reduced their multiple SIM card subscriptions to lower their expenditures amid the economic crisis caused by the epidemic. This resulted in a 3.9% decrease in mobile broadband subscribers to 38.84 million, as shown in Figure 1.1. In parallel with the reduction in mobile cellular subscriptions, the penetration rate per 100 people decreases to 118.7%.

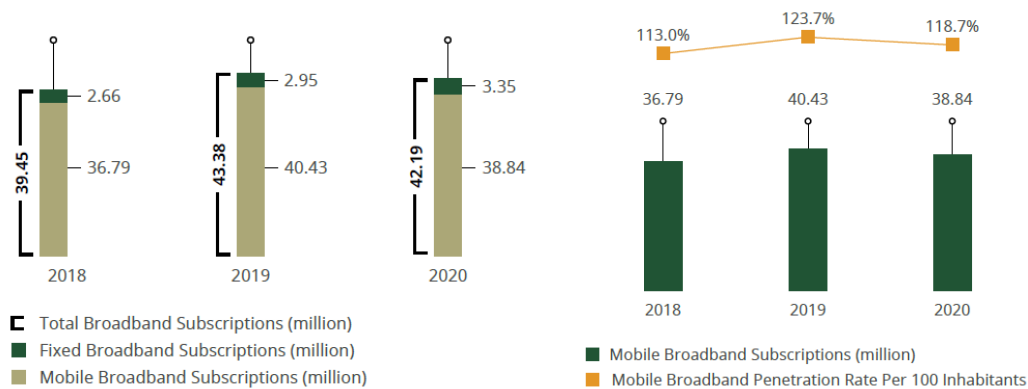


Figure 1.1 Broadband Subscriptions in Malaysia

Malaysia has 43 million mobile cellular/broadband subscribers in 2020, accounting for a 0.9% of total Asia-Pacific (“APAC”) mobile subscriptions. Malaysian mobile providers will gain a total of 1.6 million users throughout the predicted period, increasing the country's total mobile subscriptions to 44.6 million by 2025.

Smartphones will remain the leading device category in Malaysia during the projected period, despite a fall in subscriber share from 92.2% in 2020 to 88.5% in 2025. The decrease in phone subscriptions is attributed to the increasing market share

of Machine-to-Machine (“M2M”)/Internet of Things (“IoT”) and linked data devices. GlobalData (2020) predicted that the M2M/IoT subscription share would rise from 6% in 2020 to 9% in 2025, owing to potential prospects in portfolio management, telemetry, fleet tracking, surveillance systems, mobile payment, and other domains.

In 2020, 4G subscribers were accounted for 72% of all mobile subscribers. Over the projected timeframe, 4G will be the dominating mobile technology, with a subscription share of 82.7% in 2025. The government's JENDELA initiative, which aims to improve 4G network coverage, will accelerate the increase in 4G subscribers. The Malaysian government has established a new special purpose entity to develop 5G technology in Malaysia, allowing existing mobile operators to redirect CAPEX on improving 4G services while reducing the requirement to invest in 5G networks and infrastructures.

1.3 Problem Statement

The environment in which MCMC operate is always changing. The transformation has a profound impact on MCMC, as well as on how they manage change. How MCMC responds to dynamic changes reflects its ability to respond effectively to unpredictable and unforeseeable external and internal influences.

Administering public organisations and policymakers, particularly regulatory bodies, is a mammoth task. It incorporates values, organisational structures, public interests, political decisions, individual perspectives, and organisational goals that sometimes conflict with stakeholders. It can be challenging for MCMC to meet all managerial, political, and constitutional needs since emphasising one aspect are bound to raise stakeholders' criticism. While this may be discouraging in some ways, it also makes the regulatory body challenging yet fascinating (Rosenbloom, 1998).

The grand opportunity of strategic planning in the regulatory body is that it will facilitate it to manage the interaction and interconnectivity of various internal and external organisational factors to improve people's quality of life and promote public

value. In a moral and fundamental sense, the governmental commitment to advance the public interest (public value) separates public organisations from private businesses since the public sector ultimately serves a higher purpose.

As radio spectrum is scarce, regulators who govern spectrum resources are pressured to recognise and address a substantial demand in spectrum use and a diverse range of prospective applications and services. New frameworks and models are emerging that include tools to support radio spectrum managers in coordinating and managing tradeoffs and making informed decisions about the emergent spectrum use applications. Countries that do not adapt to industry changes may lose the economic potential of the spectrum because the resources are tied by legacy systems that make it challenging, if not impossible, to facilitate new technologies or critical services in a timely and effective manner.

Strategic resources must be managed efficiently and effectively by the regulator to reap the greatest benefits of the resources. Planning the development of radiocommunication services in advance of their requirement is part of efficient and effective spectrum management; this may include widening the coverage of existing services, improving the performance of existing services, and introducing new services and applications.

As with other economic resources, MCMC is often confronted with supply and demand issues pertaining to the radio spectrum resources. Without a new paradigm that enables MCMC to foresee and manage conflicting interests, MCMC will risk the safety and protection of the spectrum users, potential technology development, and the advantages of broadening the sources of income. Suboptimal spectrum use may heighten the threat of radio frequency interference, making it more challenging for spectrum users to use the same spectrum, reduce the advantages of economies of scale, and impede the introduction of new and developing technologies, all of which can have a negative impact on numerous economic and societal benefits.

Wireless broadband is one of the radiocommunication services managed and governed by MCMC. Wireless broadband has increasingly become the predominant

technology to access the internet, whereby mobile broadband subscriptions has reached 43.38 million and accounted for a 131.7% penetration rate per 100 inhabitants in 2019 (MCMC, 2020). The transition to 5G technology can be seen as the next indispensable step in the digital revolution. As the evolution of mobile technology is no longer revolves around the notion of greater speed, 5G technology and beyond accelerate the digital transformation of various industries and unleash new waves of innovation.

Spectrum planning for wireless broadband service has been a vital issue for MCMC for many years. In realising the national aspirations, the right foundation for wireless broadband deployment through the appropriate spectrum planning needs to be established so that Malaysia can leverage both the technological advancements and economic benefits that wireless broadband services can deliver. Robust and comprehensive spectrum planning tools are needed to ensure that growth in wireless broadband can continue to be supported and that good service quality is maintained for the subscribers.

With the rapid development of the telecommunications landscape, particularly the wireless broadband industry, the role of spectrum managers and the tasks to manage the spectrum has become increasingly complex. When there are competing interests for spectrum use, the radio spectrum managers need to establish and decide on spectrum uses that would best serve the national and public interest. However, no single theory or model states how to efficiently manage and plan the spectrum resource (ITU, 2015). Regulators, particularly the spectrum managers, always work on a long-time horizon; hence, it is difficult to assess whether the decisions or policy is correct.

Addressing the spectrum regulatory challenges effectively requires a new set of strategies and skillset in the spectrum planning process. The lack of robust and comprehensive tools and frameworks hinders the spectrum managers from developing strategic planning associated with the spectrum allocation, formulating spectrum-related policy, and assessing the priority work items. With the steep technological learning curve, the spectrum manager needs to acquire the relevant skills and competencies to understand the market needs and technology development.

The environment MCMC operates has become increasingly dynamic, complex, and unprecedented. MCMC may consider changing its strategy formulation and implementation actions in light of the uncertainty to re-align them in a way that maximises the potential value generation. The management of MCMC depends on their radio spectrum managers to help them comprehend the options, possibilities, and implications that uncertainty brings as they attempt to deal with a more unpredictable and dynamic industry. Organisational failures have been caused mainly by an inability to recognise change early on. Only organisations that can effectively examine the world with a shared mental model, leading to innovation, can attain long-term success.

The lack of common understanding and knowledge transfer between the radio spectrum managers would also pose a challenge for MCMC to develop spectrum allocation strategies and carry out its function. The spectrum managers' knowledge, expertise, and agility need to be enhanced to ensure that strategic planning concerning the use of radio spectrum can be achieved. There are also challenges for the radio spectrum managers in getting an accurate perspective and analysing data to make the decision.

The effectiveness of a spectrum planning strategy or framework cannot easily be identified; however, it shall address the country's needs and safeguard the national and public interests in accommodating the spectrum users. Information driven approach through the assessment of the current level of spectrum use, the technological trend, the practice and the experience of other countries may provide the guidance and principles for the regulator to govern the spectrum use to benefit the country.

1.3.1 Problem Diagnosis

The issues of spectrum planning complexity are discussed using Fishbone (Ishikawa) diagram as shown in Figure 1.2 below to diagnose the root cause of the problem. According to Suárez and Rodríguez (2019), Fishbone (Ishikawa) diagram illustrates the sources of specific effects being investigated. It allows plausible causes

of an issue to be detailed and guides the problem solver to potential causes of the problem.

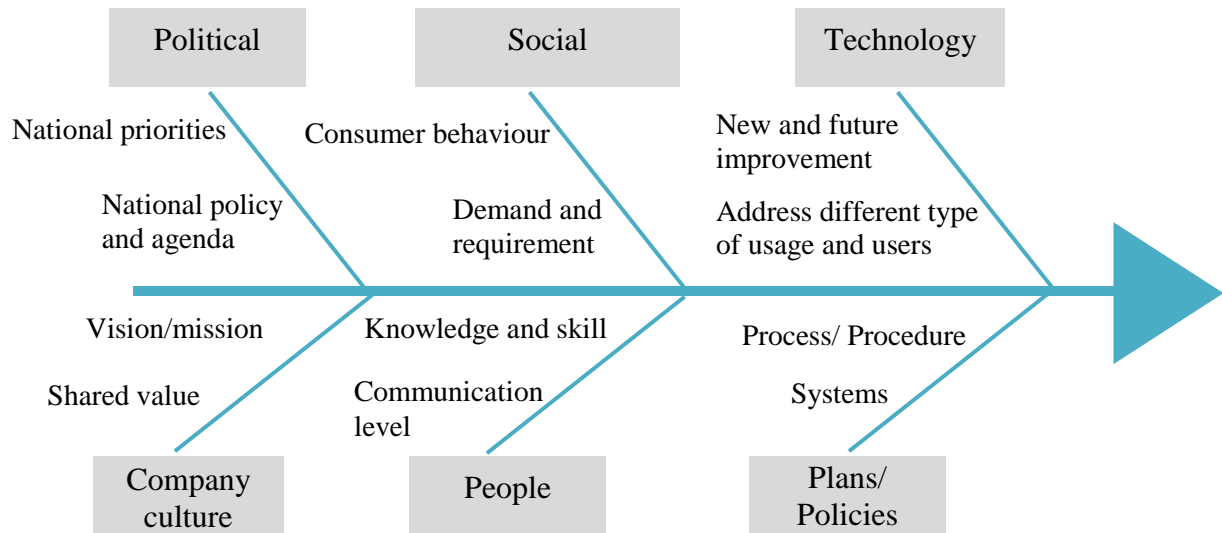


Figure 1.2 Internal and External Factors Influencing Spectrum Planning Strategy

According to Volkery and Ribeiro (2009), among the critical factors in the success of strategic planning include the skills and experience of those carrying out the strategic planning process, the level of involvement of the employees in the strategic planning exercise, the institutional context such as the employees’ understanding of the provisions, rules, regulations and policies. Other factors also include selecting appropriate and attainable goals for the strategic planning exercise, the flexibility of the planning method and the robustness of the application of the planning method.

Based on Figure 1.2, one factor that leads to the complexity of spectrum planning is the underlying process and procedure. The lack of extensive and detailed tools would hinder the spectrum managers from effectively conducting strategic planning. The traditional strategic formulation approaches are inflexible to accommodate unforeseen changes or multiple potential scenarios. The rigid strategic process may also lead to inconsistent application of strategic tools due to its lack of clarity.

Furthermore, spectrum managers need to adapt to trends and uncertainties due to the dynamic and uncertain environments. However, the employees' lack of skill and knowledge in facilitating changes may hinder effective strategic planning. The inefficient knowledge transfer would hamper the information to be transferred quickly among the staff. The unclear expectations or objectives would result in ineffective goal setting and strategy formulation. Additionally, ambiguous feedback of the developed strategic plan would result in inefficient implementation and monitoring.

The spectrum management in Malaysia, particularly in the wireless broadband industry, is influenced by several external factors such as a change in national priority and agenda, the shift in telecommunication market players, unprecedented circumstances such as the COVID-19 pandemic, which warranted better wireless broadband services. The uncertainties of future spectrum use require the spectrum managers to predict possible future scenarios to adapt swiftly to the changes. In terms of planning, a weak inflexible strategy and unclear goals would hamper the strategic formulation process. In addition, the adoption of inappropriate methodology to formulate strategic planning would cause the inability of the spectrum managers to monitor and rectify imminent issues.

1.3.2 Theoretical Gaps

Based on the search conducted on the Web Science website using the keywords scenario planning and organisation, a total of 31 records were retrieved in the telecommunications research topic, as shown in Figure 3.1 below. The majority of records belong under other research field classifications and are therefore irrelevant and unrelated to this study. In this respect, it is anticipated that the study would assist future researchers in gaining a better understanding of the impact of scenario planning in the strategic management and policy-making processes to enhance the organisation's performance.



Figure 1.3 Records on Related Journals in Web Science Website

Further analysis of the Web of Science reveals that the United States, England, Italy, Brazil, China and India have the highest number of research publications, as shown in Figure 1.4 below. According to the database, Malaysia produced 13 publications; however, very limited publications are associated with business management, telecommunications, or strategic management.

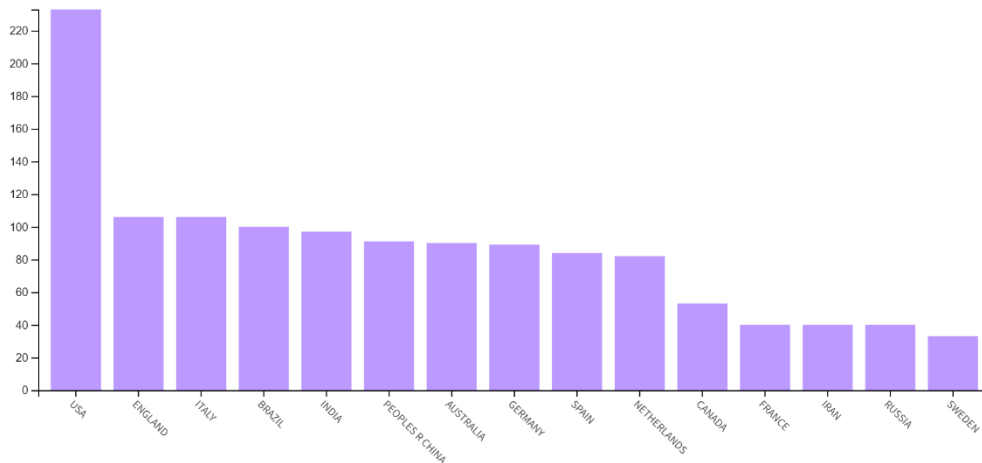


Figure 1.4 Records on Related Journals According to Country

The majority of the literature on strategic planning originates in Western and developed countries, particularly the United States. The resultant models may not always be appropriate to developing nations (Haines, 1988), including Malaysia,

raising concerns regarding American management theories and practices' acceptability and effectiveness for developing countries (Gelfand et al., 2007). As a result, researchers have been challenged to study indigenous management approaches (Tung and Aycan, 2008; Scott-Jackson, 2008). This underscores the strategic management's 'overwhelming regional bias' in synthesised assessments (Pettigrew et al., 2002).

Therefore, it is vital to examine how other developing countries' findings apply to strategic planning in other regions (Kotha and Nair, 1995). Although much is known about strategic planning approaches in Western nations, relatively little is known about their equivalent in Malaysia's public sector.

1.3.3 Practical Gaps

Strategic planning presents unique challenges in the public sector and regulatory bodies compared to the private sector. The strategic planning process in regulatory bodies is a complex task as it demands taking into account the features of public sector organisations, their external settings, and the legislative boundaries of public organisation mandates (Bryson, 2004).

The succeeding issues have been identified in the public sector that affects the planning process: decision-making constraints due to political, economic, and regulatory environment (Foster, 1990); objective dispute and uncertainty, where various stakeholders have different goals and priorities, culminating in conflicting and ambivalent targets (Banfield, 1975); and cultural fit, where the bureaucratic nature of public organisations develops a culture that lessens risk and impedes innovation (Banfield, 1975). These issues highlight the need of investigating the strategic planning and policy-making process, which would be the focus of this research.

Most of the discussion concerning strategic planning has centred on its application and usage in for-profit organisations. Incorporating private-sector strategic planning methods and techniques into public organisations involves the examination of disparities in the objectives and environment in which planning occurs. These

variances impact not only the strategy implementation and operation but also on its fundamental concept and realisation. Several gaps in literature have been identified, including the relationship between scenario planning and organisation performance, the degree to which a formal planning process is practised at the departmental level, and the impact of organisational characteristics on the quality of strategic plan tools and documents. Numerous specific practical gaps were identified in line with the research context, such as the impact of scenario-based planning in managing economic resources, the relationship between scenario planning and spectrum management and the quality of the Scenario Planning Toolkit produced through this research.

The theoretical and practical gaps discussed above are the driving forces behind this research, which seeks to enhance the effectiveness of the spectrum management strategy within MCMC and establish the foundation for future research on scenario planning in Malaysia's public sector setting.

1.4 Research Questions

Research questions are essential because they can help define the scope of the research, ensuring that the investigation remains focused on the subject under research (Punch, 1998). Research questions and objectives are complementary, as it is only through the resolution of the research questions that the research objectives will be achieved. Thus, the research questions and objectives should be read concurrently, as the aforementioned will guide the latter. With that rationale, the following are the research questions for this research:

- i. What are the issues and challenges experienced by the radio spectrum managers in formulating policies, developing allocation plans and principles and establishing future spectrum requirements?

- ii. What constitutes a robust and quality planning tools and frameworks to equip the radio spectrum managers in analysing strategy formulation and development in spectrum planning?
- iii. What are the impacts of the Scenario Planning Toolkit in facilitating radio spectrum managers in carrying out their functions and undertaking strategic positioning against the internal and external environments?

1.5 Research Objectives

The primary goal of this research is to gain better knowledge of organisational processes, precisely how spectrum managers construe and use strategic management principles in the workplace. This research also aims to unravel how key actors in the MCMC consider the key drivers and uncertainties in spectrum management, how strategy is developed through a scenario planning process, and how various factors within the organisation's internal and external circle influenced the multiple natures and attributes of strategy. Thus, the following specific research objectives are pursued:

- i. To investigate the issues and challenges experienced by the spectrum managers in formulating policies, developing allocation plans and principles and establishing future spectrum requirements;
- ii. To ascertain the quality and efficacy of the Scenario Planning Toolkit produced in facilitating spectrum managers in carrying out their functions and undertaking strategic positioning against the internal and external environments; and
- iii. To elucidate and recommend an integrated tool and learning process that integrates scenario-based methods to equip the spectrum managers in approaching strategy formulation and analysing various approaches

to and perspectives on spectrum planning strategy development with resilience-related capabilities.

1.6 Researcher's Role

In this research, the researcher plays a dual role as both researcher and implementer of the proposed project. At the beginning of the project, the researcher explains the proposed project, including outlining the objectives, proposed intervention and required information from the participant. During this stage, consent from the relevant spectrum managers will be sought on the proposed project, and mutual understanding will be developed between the researcher and the participants. The researcher becomes the project manager who manages the overall deliverable of the research and tasks to learn and implement a new solution to address the spectrum planning process issues.

The researcher acts as the change agent and problem solver through the proposed intervention through this action research. The researcher needs to plan the activities that need to be undertaken and become a process facilitator throughout the project. The researcher is responsible for communicating and collaborating with the participant in the research activities. Where appropriate, the researcher also transfers and exploits the participant's information and knowledge. By carefully diagnosing the issues surrounding the spectrum planning process, the researcher acts as a problem solver by identifying solutions that may be addressed. Through the reflection process, the researcher will assess the strength and shortcomings of the proposed solutions and carry out a new action research cycle to improve the spectrum planning process.

The researcher develops a series of interview questions through the interview process and conducts the interview sessions accordingly based on the research design. On the other hand, the researcher makes appropriate field observations and records the data through observation. The researcher's role in the qualitative data is to assess the thoughts and feelings of the participants. This process would enable the understanding of the connotation of the participants when they provide responses or describe their

experiences. One of the most critical roles is safeguarding the participants' information and data. The method to protect the data will be conveyed to the participants before the interview or observation begin. The researcher seeks guidance from the expert on the interview protocols before embarking on this study.

The collected data from the qualitative data will be coded and analysed to synthesise the emerging patterns and themes. In qualitative data collection, the researcher must monitor and reduce bias attributed to the researcher's previous knowledge and experience on the subject matter. During the reflection, the researcher would be required to reflect upon the findings and articulate the researcher's position and recommendation.

In the quantitative data collection, the researcher measures the relationship between the identified variables and their correlation. Through a survey, the researcher selects and orients the participants. The researcher needs to build a good relationship with the participants and provide the intended responses. Similar to qualitative research, the researcher's role includes analysing the data and reflecting on the findings.

Throughout the research, the researcher is responsible for maintaining its ethical conduct while maintaining the participants' interests and participating organisation.

1.7 Research Ethics

According to Lund Research (2012), there are some ethical principles to consider when conducting research. The research ethics shall emphasise the need to do good, benefit others, and not harm or non-maleficence. In practice, the researcher shall obtain informed consent from the potential research participants and associated organisations. The researcher shall also lessen the risk of threats or harm to the research participants. This includes protecting the participants' anonymity and confidentiality. Additionally, the researcher shall also prevent fraudulent or deceptive practices.

Finally, the researcher shall provide the relevant options to the participants if they decide to relinquish their participation in the study.

The research will be conducted in compliance with the above principles. Additionally, the researcher shall also comply with all provisions, regulations, guidelines and practices stipulated by the government and MCMC.

1.8 Significance of the Research

This research adopts both phenomenological-interpretivism and logical-positivism paradigms, stressing the importance of scenario analysis in assessing environments and making strategic decisions. It offers an encouraging perspective to evaluate situations by analysing them in their particular setting and interpreting it from research participants' views. As this study investigates how main tasks in strategic planning are performed in the regulatory body, it gives beneficial insights to public organisations about strategies to managing with the intricacies and fabric of multiple layers of influences in their environment.

1.8.1 Significance to Theory

While there was literature published on strategic planning, especially in the private sector, researchers and practitioners have paid less attention to the scenario planning process and its factors in public organisations and regulatory bodies. The research will contribute to the understanding of effective strategic tools by venturing into relatively undiscovered areas, such as the impact of organizational attributes on the Scenario Planning Toolkit produced, the determinants of scenario planning document quality, and the correlation between the formality of scenario planning and the strategic implementation and policy-making process.

Most academic research on strategic planning has been conducted in developed countries such as the United States, Australia, Canada, and China. A limited study has been conducted on the strategic management of scenario planning in the public sector settings in Malaysia. The research would be the first study in analysing the implementation of scenario planning in managing economic resources in Malaysia, and it is intended to pave the way for future research into other regulatory sectors or industries.

1.8.2 Significance to Practice

The outcomes of this research will be valuable for regulatory bodies and government policymakers as it evaluates the framework for strategic planning and the efficacy of scenario-based planning within Malaysia's regulatory body. The findings are expected to serve as a foundation for future developments. Additionally, the project will provide an assessment framework for evaluating the process of strategic planning formulation that telecommunication regulators may readily adopt.

The toolkit produced in this research project would guide national spectrum managers and stakeholders in developing a clear understanding of the technical, economic and social environments to enable the provision of wireless broadband in the country. As the custodian of national resources, spectrum managers need to respond timely, make spectrum management decisions, identify priorities and activities that address these needs.

As spectrum is the backbone for developing a transformative digital ecosystem, every spectrum manager needs a clear understanding of the technology development, market trend, and wireless broadband ecosystem to inform the planning of future spectrum use and assess the current level of spectrum use. It takes a broad view of technology and spectrum uses informing the regulators on the planning, allocation and spectrum procedures.

This research is an essential contribution to the literature for academic and spectrum management practice. It is envisaged that this action research may provide the basis for further investigation in other areas of spectrum management.

1.9 Definitions of Terms

Efficient Use of Spectrum: Spectrum is a scarce resource; the goal of spectrum regulation should be to ensure the spectrum is assigned to those who can use them efficiently (Marcus et al., 2005).

Radio Spectrum: The part of the electromagnetic spectrum with frequencies from 3 Hz to 420 THz (CMA, 1998).

Scenario: Alternative futures in which today's actions may be executed (Hiltunen, 2009).

Scenario Planning: A method of asserting control in an uncertain environment by recognising future assumptions and choosing how the organisation will respond (Hiltunen, 2009).

Spectrum Management: A spectrum management approach consists of several governing rules for the allocation of radio spectrum frequency bands to specific services and the assignment of radio spectrum usage rights to different spectrum users (Freyens, 2009).

Spectrum Planning: Spectrum planning give the direction and cohesiveness for policy formation, so facilitating future steps toward optimum spectrum utilisation and providing a favourable regulatory environment (ITU, 2015).

Strategic Foresight: The fundamentals of researching, forecasting, and creating the future in order to assist in the development and use of collective

intelligence in a systematic and systemic manner to foresee changes Hines and Bishops (2006).

Strategic Planning: A process through which organisations define their future vision as well as their goals and objectives for the company Lengenick-Hall, Beck, and Lengenick-Hall (2011).

Strategic Management: The planning, monitoring, analysis, and evaluation of all essentials required by an organisation to accomplish its goals and objectives (Argueta et al. 2016).

Toolkit for Organisation: The tools and models for enabling action along with the associated organizational specific embedded routines (Kerr et. al., 2011).

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