

BORANG GSP 2024

Kod Rujukan: (Diisi oleh PJI)	
RIG	
Bukti Kolaborasi	

(Diisi oleh PJI)

**BORANG PERMOHONAN
GERAN SEMARAK PENYELIDIKAN (GSP) 2024**

**Bahagian Penyelidikan & Jaringan Industri (PJI)
UiTM CAWANGAN PERLIS**

A	TITLE OF PROPOSED RESEARCH: <i>Tajuk penyelidikan yang dicadangkan :</i> Water Safety Awareness and Crisis Communication Preparedness: A Study Among Outdoor Education Participants In Malaysia
B	DETAILS OF RESEARCHER / MAKLUMAT PENYELIDIK
B(i)	Name of Project Leader: ELLAIL AIN MOHD AZNAN IC / Passport Number: 890908-14-6526 <i>Nama Ketua Projek:</i> <i>No. Kad Pengenalan/ Pasport:</i>
B(iii)	Faculty/School/Centre/Unit (Please provide full address): FAKULTI SAINS SUKAN DAN REKREASI UiTM CAWANGAN PERLIS 02600 ARAU PERLIS <i>Fakulti/Jabatan /Pusat/Unit (Sila nyatakan)</i>
B(iv)	Office Telephone No.: 04-9882710 Handphone No.: 016-7729153 <i>No. Telefon Pejabat:</i> <i>No. Telefon Bimbit:</i> - -
B(v)	E-mail Address: ellailain@uitm.edu.my <i>Alamat e-mel:</i>
B(vi)	Date of first appointment with this University: 10.8.2015 <i>Tarikh mula berkhidmat dengan Universiti ini:</i>

C	RESEARCH INFORMATION / MAKLUMAT PENYELIDIKAN																														
C(i)	Research Domain (Please tick (✓)): <i>Domain Penyelidikan (Sila tanda (✓)):</i> A. Pure and Applied Sciences (Sains Tulen dan gunaan) <table border="0"> <tr> <td>☐ Chemistry (Kimia)</td> <td>☐ Physic (Fizik)</td> <td>☐ Biology (Biologi)</td> </tr> <tr> <td>☐ Biochemistry (Biokimia)</td> <td>☐ Materials Science (Sains Bahan)</td> <td>☐ Mathematics and Statistics (Matematik dan Statistik)</td> </tr> <tr> <td>☐ Materials Science (Sains Bahan)</td> <td></td> <td></td> </tr> </table> B. Social Sciences (Sains Sosial) <table border="0"> <tr> <td>☐ Anthropology (Antropologi)</td> <td>☐ Psychology (Psikologi)</td> <td>☐ Sociology (Sosiologi)</td> </tr> <tr> <td>☐ Political Science (Sains Politik)</td> <td>☐ Business and Management (Pengurusan dan Perniagaan)</td> <td>☐ Geography (Geografi)</td> </tr> <tr> <td>☐ Economic (Ekonomi)</td> <td>☐ Human Ecology (Ekologi Manusia)</td> <td>☐ Communication (Komunikasi)</td> </tr> </table> C. Arts and Applied Arts (Sastera dan Sastera Ikhtisas) <table border="0"> <tr> <td>☐ Language and Linguistic (Bahasa dan Linguistik)</td> <td>☐ Literature (Kesusasteraan)</td> <td>☐ Religion (Agama)</td> </tr> <tr> <td>☐ Philosophy (Falsafah)</td> <td>☐ Civilization (Tamadun)</td> <td>☐ History (Sejarah)</td> </tr> <tr> <td>☐ Art (Seni)</td> <td>☐ Culture (Budaya)</td> <td>☐ Education (Pendidikan)</td> </tr> <tr> <td>☐ Policies and Law (Dasar dan Undang-undang)</td> <td>☐ Built Environment (Alam Bina-Aspek Kemanusiaan)</td> <td>☐ Environment (Alam Sekitar-Aspek Kemanusiaan)</td> </tr> </table>	☐ Chemistry (Kimia)	☐ Physic (Fizik)	☐ Biology (Biologi)	☐ Biochemistry (Biokimia)	☐ Materials Science (Sains Bahan)	☐ Mathematics and Statistics (Matematik dan Statistik)	☐ Materials Science (Sains Bahan)			☐ Anthropology (Antropologi)	☐ Psychology (Psikologi)	☐ Sociology (Sosiologi)	☐ Political Science (Sains Politik)	☐ Business and Management (Pengurusan dan Perniagaan)	☐ Geography (Geografi)	☐ Economic (Ekonomi)	☐ Human Ecology (Ekologi Manusia)	☐ Communication (Komunikasi)	☐ Language and Linguistic (Bahasa dan Linguistik)	☐ Literature (Kesusasteraan)	☐ Religion (Agama)	☐ Philosophy (Falsafah)	☐ Civilization (Tamadun)	☐ History (Sejarah)	☐ Art (Seni)	☐ Culture (Budaya)	☐ Education (Pendidikan)	☐ Policies and Law (Dasar dan Undang-undang)	☐ Built Environment (Alam Bina-Aspek Kemanusiaan)	☐ Environment (Alam Sekitar-Aspek Kemanusiaan)
☐ Chemistry (Kimia)	☐ Physic (Fizik)	☐ Biology (Biologi)																													
☐ Biochemistry (Biokimia)	☐ Materials Science (Sains Bahan)	☐ Mathematics and Statistics (Matematik dan Statistik)																													
☐ Materials Science (Sains Bahan)																															
☐ Anthropology (Antropologi)	☐ Psychology (Psikologi)	☐ Sociology (Sosiologi)																													
☐ Political Science (Sains Politik)	☐ Business and Management (Pengurusan dan Perniagaan)	☐ Geography (Geografi)																													
☐ Economic (Ekonomi)	☐ Human Ecology (Ekologi Manusia)	☐ Communication (Komunikasi)																													
☐ Language and Linguistic (Bahasa dan Linguistik)	☐ Literature (Kesusasteraan)	☐ Religion (Agama)																													
☐ Philosophy (Falsafah)	☐ Civilization (Tamadun)	☐ History (Sejarah)																													
☐ Art (Seni)	☐ Culture (Budaya)	☐ Education (Pendidikan)																													
☐ Policies and Law (Dasar dan Undang-undang)	☐ Built Environment (Alam Bina-Aspek Kemanusiaan)	☐ Environment (Alam Sekitar-Aspek Kemanusiaan)																													

D. Natural Sciences and National Heritage (*Sains Tabii dan Warisan Negara*)

☐ Environment
(*Alam Sekitar*)

☐ Forestry
(*Perhutanan*)

☐ Agriculture
(*Pertanian*)

☐ Marine
(*Marin*)

☐ Archaeology
(*Arkeologi*)

☐ Geoscience
(*Geosains*)

☐ Ethnography
(*Etnografi*)

☐ Built Environment
(Heritage Aspect)
Alam Bina (Aspek Warisan)

☐ Culture
(*Budaya*)

☐ Biodiversity
(*Kepelbagaian Biologi*)

E. Information and Communication Technology (*Teknologi Maklumat dan Komunikasi*)

☐ Software and Information System
(*Perisian dan Sistem Maklumat*)

☐ Soft Computing
(*Pengkomputeran Lembut*)

☐ Computer Networking
(*Rangkaian Komputer*)

☐ Information Security
(*Keselamatan Maklumat*)

☐ Multimedia
(*Multimedia*)

☐ Computer Engineering
(*Kejuruteraan Komputer*)

☐ Computer Science
(*Sains Komputer*)

F. Health Sciences (*Sains Kesihatan*)

☐ Basic Medical Sciences
(*Sains Perubatan Asas*)

☐ Pharmacy
(*Farmasi*)

☐ Pharmacology
(*Farmakologi*)

☐ Medical Microbiology
(*Mikrobiologi Perubatan*)

☐ Parasitology
(*Parasitologi*)

☐ Pathology
(*Pathologi*)

☐ Community Medical Prevention
(*Perubatan Pencegahan Masyarakat*)

☐ Clinical Surgical
(*Klinikal Surgikal*)

☐ Clinical Medical
(*Klinikal Medikal*)

☐ Associate Health Science
(*Sains Kesihatan Bersekutu*)

☐ Dental
(*Pergigian*)

☐ Nursing Science
(*Sains Kejururawatan*)

C(ii)	Location of Research: <i>Tempat penyelidikan dijalankan:</i> UiTM Shah Alam UiTM Seremban 3 Campus UiTM Jengka Campus UiTM Samarahan Campus UiTM Arau Campus																																		
C(iii)	Duration of this research (Maximum 24 months): <i>Tempoh masa penyelidikan ini (Maksimum 24 bulan):</i> Duration: 2 year <i>Tempoh :</i> From : 1 Jan 2025 <i>Dari :</i> To : 31 Dec 2026 <i>Hingga :</i>																																		
C(iv)	Other Researchers: <i>Ahli-ahli penyelidik yang lain:</i> <table border="1" data-bbox="201 1050 1555 1793"> <thead> <tr> <th data-bbox="201 1050 269 1239">Bil</th><th data-bbox="269 1050 574 1239">Name Nama</th><th data-bbox="574 1050 867 1239">IC / Staff Number: No. Kad Pengenalan/ No. Pekerja:</th><th data-bbox="867 1050 1235 1239">University / Industry / Agency Fakulti/ P.Pengajian/ Pusat/Unit</th><th data-bbox="1235 1050 1555 1239">Academic Qualification/ Designation Tahap Kelayakan Akademik/Jawatan</th></tr> </thead> <tbody> <tr> <td data-bbox="201 1239 269 1350">1.</td><td data-bbox="269 1239 574 1350">Dr. Ellail Ain Mohd Aznan</td><td data-bbox="574 1239 867 1350">324663</td><td data-bbox="867 1239 1235 1350">Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis</td><td data-bbox="1235 1239 1555 1350">PhD. Sports Coaching (Risk Management)</td></tr> <tr> <td data-bbox="201 1350 269 1467">2.</td><td data-bbox="269 1350 574 1467">Assoc. Prof. Dr. Ahmad Fikri Mohd Kassim</td><td data-bbox="574 1350 867 1467">203658</td><td data-bbox="867 1350 1235 1467">Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis</td><td data-bbox="1235 1350 1555 1467">PhD. Sports Coaching (Leadership)</td></tr> <tr> <td data-bbox="201 1467 269 1579">3.</td><td data-bbox="269 1467 574 1579">Dr. Mohamad Firdaus Ahmad</td><td data-bbox="574 1467 867 1579">334080</td><td data-bbox="867 1467 1235 1579">Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Seremban</td><td data-bbox="1235 1467 1555 1579">PhD. Sports Management (Human Resources)</td></tr> <tr> <td data-bbox="201 1579 269 1690">4.</td><td data-bbox="269 1579 574 1690">Mr. Mohd Khairulanwar Md Yusof</td><td data-bbox="574 1579 867 1690">323884</td><td data-bbox="867 1579 1235 1690">Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis</td><td data-bbox="1235 1579 1555 1690">Msc. Of Education (Sports Management)</td></tr> <tr> <td data-bbox="201 1690 269 1793">5.</td><td data-bbox="269 1690 574 1793">Mr. Mohd Najmi Nuji</td><td data-bbox="574 1690 867 1793">323907</td><td data-bbox="867 1690 1235 1793">Fakulti Komunikasi dan Pengajian Media, UiTM Shah Alam</td><td data-bbox="1235 1690 1555 1793">Msc. Social Science (Communication Management)</td></tr> </tbody> </table>					Bil	Name Nama	IC / Staff Number: No. Kad Pengenalan/ No. Pekerja:	University / Industry / Agency Fakulti/ P.Pengajian/ Pusat/Unit	Academic Qualification/ Designation Tahap Kelayakan Akademik/Jawatan	1.	Dr. Ellail Ain Mohd Aznan	324663	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis	PhD. Sports Coaching (Risk Management)	2.	Assoc. Prof. Dr. Ahmad Fikri Mohd Kassim	203658	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis	PhD. Sports Coaching (Leadership)	3.	Dr. Mohamad Firdaus Ahmad	334080	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Seremban	PhD. Sports Management (Human Resources)	4.	Mr. Mohd Khairulanwar Md Yusof	323884	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis	Msc. Of Education (Sports Management)	5.	Mr. Mohd Najmi Nuji	323907	Fakulti Komunikasi dan Pengajian Media, UiTM Shah Alam	Msc. Social Science (Communication Management)
Bil	Name Nama	IC / Staff Number: No. Kad Pengenalan/ No. Pekerja:	University / Industry / Agency Fakulti/ P.Pengajian/ Pusat/Unit	Academic Qualification/ Designation Tahap Kelayakan Akademik/Jawatan																															
1.	Dr. Ellail Ain Mohd Aznan	324663	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis	PhD. Sports Coaching (Risk Management)																															
2.	Assoc. Prof. Dr. Ahmad Fikri Mohd Kassim	203658	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis	PhD. Sports Coaching (Leadership)																															
3.	Dr. Mohamad Firdaus Ahmad	334080	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Seremban	PhD. Sports Management (Human Resources)																															
4.	Mr. Mohd Khairulanwar Md Yusof	323884	Fakulti Sains Sukan dan Rekreasi, UiTM Cawangan Perlis	Msc. Of Education (Sports Management)																															
5.	Mr. Mohd Najmi Nuji	323907	Fakulti Komunikasi dan Pengajian Media, UiTM Shah Alam	Msc. Social Science (Communication Management)																															
C(vi)	Please provide information on academic publications that has been published by the project leader for the last five (5) years. (Example: Journals, Books, Chapters in books, etc) <i>Sila kemukakan maklumat berkaitan penerbitan akademik yang telah diterbitkan oleh ketua penyelidik dalam tempoh lima (5) tahun terakhir. (Contoh: Jurnal, buku, bab dalam buku, dll)</i>																																		

	Title of publication <i>Tajuk penerbitan</i>	Name of journals/books <i>Nama jurnal/buku</i>	Year published <i>Tahun diterbitkan</i>
	An Associative Study: Evaluating Perceived Risk Management and Risk Perception in Physical Activity Among University Students	Jurnal Intelek	2024
	Association between service quality and motivation to engage with sports facilities: a study among university students	Malaysian Journal of Sport Science and Recreation	2024
	The Accessibility for People with Disability at Sports Complex Stadium Tuanku Syed Putra	Jurnal Sains Sukan & Pendidikan Jasmani	2024
	Factors that influence domestic tourists' decision to visit nature-based tourism destinations in the northern region of Malaysia	Jurnal Intelek	2024
	Effective communication and group cohesiveness in the outdoor recreation program curriculum	Jurnal Intelek	2024
	Examining motivation to participate in hiking activity among Perlis community	Jurnal Intelek	2024
	Assessing perceived risk management and satisfaction in university student's sports facility experience: A cross-sectional study	Jurnal Sains Sukan & Pendidikan Jasmani	2023
	Exploring the Role of Human Resource Management Practice: A Study of Employees' Perceptions at Johor State Sports Council	The Environmental and Social Management Journal	2023
	Association between communication barriers and cohesion in sports among team athletes	SEARCH Journal of Media and Communication Research (SEARCH)	2022
	UITM's Student Knowledge, Attitude and Practice Towards Mental Health	Jurnal Sains Sukan & Pendidikan Jasmani	2022
	Accessibility of fitness facilities and physical activity participation: a comparison of disabled athletes and disabled people	Jurnal Intelek	2022
	Exploring human resource management practices and employability: a study on sports graduates in Malaysia	Hong Kong Journal of Social Sciences	2022

	Motivation learning achievement in open distance learning (ODL) environment: skills, beliefs, self-direction and interaction of university students	Jurnal Intelek	2022
	Factors influencing spectator attendance in sports: a comparison between Kedah FA and Johor Darul Takzim fans (JDT FC)	Jurnal Intelek	2022
	The awareness of hydration knowledge on gender differences among UiTM Perlis athletes	Jurnal Sains Sukan & Pendidikan Jasmani	2021
	Managing quality for job performance: is paternalistic leadership behavior an alternative to influence trust?	Jurnal Intelek	2021
	An investigation of fitness analysis and risk analysis: a systematic review	Jurnal Intelek	2021
	Perceptions of coaching behaviour and its impact on managerial of university team sports performance	Jurnal Intelek	2020
	Accessibility Dimensions (Factors) of Parks and Playgrounds	Enhancing Health and Sports Performance by Design: Proceedings of the 2019 Movement, Health & Exercise (MoHE) and International Sports Science Conference (ISSC)	2020
	The relationship between job satisfaction and social skill	Jurnal Intelek	2019
C(vii)	Executive Summary of Research Proposal (maximum 300 words) (Please include the problem statement, objectives, research methodology, expected output/outcomes/implication, and significance of output from the research project) <i>Ringkasan Cadangan Eksekutif Penyelidikan (maksimum 300 patah perkataan)</i> <i>(Meliputi pernyataan masalah, objektif, kaedah penyelidikan, jangkaan hasil penyelidikan/implikasi dan kepentingan output projek penyelidikan)</i> This study explores the dire correlations between water safety awareness and crisis communication management in water-based outdoor activities especially in Malaysia. The latest issue reported of the drowning case in Sungai Kampar Perak during white water rafting activity is one of a current issue related to the relevancy of this study which highlighted on the importance on understanding the water safety awareness and crisis communication preparedness. The main objective of this study is to assess the level of water safety awareness among outdoor education participants in Malaysia, to evaluate the preparedness of participants in participating in water-based activity, to identify the level of understanding on safety protocols and crisis communication strategies during crises. This study also aims to develop a framework in enhancing water-safety education and crisis communication practices in outdoor education program. This study is notably relevant as outdoor education is increasingly incorporated into Malaysia's education and tourism sectors. However, there is still a significant gap of a structured water safety awareness and as well as crisis communication application and training designed to local environmental conditions as well as the participants demographic profiles. This study will be using questionnaire to measure the water safety awareness and as well as the understanding of crisis communication preparedness for water-based activity among outdoor education participants for Outdoor Education Program aged 18 and above.		

	The results are analysed using statistical methods to identify knowledge gaps, particularly between the water safety awareness and as well as the preparedness for water-based activity. By addressing the gap, this study will provide an insight for the policymakers, outdoor educations, safety practitioners and as well as outdoor recreation operators in implementing a structural water-safe activity and well-developed crisis communication plan and strategies for a crisis.
C(viii)	Detailed proposal of research project: <i>Cadangan maklumat penyelidikan secara terperinci:</i> (a) Research background including: / <i>Latarbelakang penyelidikan termasuk:</i> i) Problem Statement / <i>Pernyataan Masalah</i> Crisis communication is one of the crucial elements in ensuring the public safety (Sellnow & Seeger, 2021). Crisis communication can also be reflected as one of the elements that helps in mitigating and minimizing the risk and damage from a crisis (Coombs, 2020; Sellnow & Seeger, 2021). Crisis communication can be best described as a tool to manage crisis from becoming worst (Heath & Dan O' Hair, 2020). Though crisis communication had been proven to be important, yet the usage and application of crisis communication has always been related to any natural disaster or any crisis that related to public safety (Wodak, 2021; Seeger, Reynolds & Sellnow, 2020). Miles and Shipway (2020) mentioned that limited research had been focusing on the importance of crisis communication in sports and recreational setting. To add more discussion on this, most of the study were focusing on the public and little were conducted among the school students (Hidayat, Anisti & Wibawa, 2020). However, there is no study developed focusing on the preparedness of crisis communication for water activities among the participants and educators of water safety (Odimayomi et.al, 2021; Mehta, Weeks & Tyquin, 2020). Hence this study is developed to evaluate the understanding of preparedness of participants for crisis communication during water-related emergencies. Additionally, the numbers of participants for outdoor activities recreational activities had been increasing and this led to a higher number of risk exposure (Jackson et.al, 2021; Fagerholm, Eilola & Arki, 2021). Nonetheless, the most popular activities engaged is water activities (Pham, 2020). Water activities had a clear range of risk especially due to drowning, slipping and as well as reaction to allergies (Aziz, Ahmad & Mokhtar, 2021; World Health Organization, 2021). The knowledge of water safety can be very significant due to the higher number of engagements in water activities (Araiza-Alba et.al, 2021). Previous study had already discussed on water safety awareness and how it can be significant especially in handling the way of act due to flood and as well as natural disaster (Yin et.al, 2021; Santoro et.al, 2022). However, no study had been discussing on the level of water safety awareness while engaging in water activities or water sport activities (Araiza-Alba et.al, 2021), hence this study will be assessing the level of water safety awareness among participants in outdoor education programs. Instantly, a clear instruction on engagement of activities must be developed and a clear message should be disseminated when crises arise in outdoor recreational activities (Harrison et.al, 2022; Edwards et.al, 2021). Coleman (2020) stated that crisis may be minimized and mitigated through a clear and well-prepared plan that communicated efficiently. Though, most of the crisis communication were developed and prepared to communicate with the public in reducing the panic and level of anxiety among public (Anwar, Malik, Raees & Anwar, 2020; Wang, Hao & Platt, 2021). Crisis communication can help in reducing the gap between the public and crisis occurred, however, poor crisis communication can lead to a worst-case scenario that might be influencing the public safety, organization's reputation and brand image (Christensen & Lægreid, 2020; Sawlha, 2020; Glamuzina & Šantić, 2021). Though the significance of crisis communication is well discussed in previous studies, only few were focusing on the relationship between water safety and the effectiveness crisis communication (Sellnow & Seeger, 2021), hence, this study will be focusing on analysing the relationship between water safety awareness, outdoor education practices, and crisis communication effectiveness. ii) Hypothesis / <i>Hipotesis</i> HA1 - There is a significant relationship between water safety awareness and crisis communication preparedness understanding among outdoor education participants in Malaysia. HO1 - There is no significant relationship between water safety awareness and crisis communication preparedness understanding among outdoor education participants in Malaysia.

iii) **Research Questions / Persoalan Penyelidikan**

RQ1: What is the level of water safety awareness among participants and educators in outdoor education programs in Malaysia?

RQ2: What is the level of understanding of crisis communication preparedness among outdoor education participants during water-related emergencies?

RQ3: Is there any relationship between water safety awareness and understanding of crisis communication preparedness?

iv) **Literature Reviews / Kajian Literatur**

Outdoor Recreation

Outdoor recreation includes a wide range of activities conducted in natural settings, such as hiking, camping, fishing, biking, wildlife viewing. It offers a wide range of activities that allow individuals to enjoy the natural world, stay active, and connect with the great outdoors. Visiting natural settings and being outside are widely acknowledged as important for improving human health and well-being, enhancing social connections, reconnecting people with their natural and cultural heritage, generating revenue for preservation, supporting local economies, fostering local or cultural identity, and developing conservation awareness (Winter et al., 2020). That is why these activities are often enjoyed for their health and well-being benefits, as well as for the opportunity to connect with nature and escape from the hustle and bustle of urban life. Furthermore, prior theory suggests that it is particularly nature-based physical recreation (e.g., hiking, cross-country skiing, canoeing)—reflecting attempts to enjoy, observe, and exercise in nature without substantial technological mediation or alteration of the environment (Wolsko et al., 2019).

Outdoor Education

Outdoor education refers to the organized use of outdoor spaces and environments as settings for teaching and learning. This educational approach emphasizes experiential learning, where participants engage directly with nature to develop skills, knowledge, and values. It fosters personal growth, environmental stewardship, teamwork, and problem-solving abilities. Through activities such as hiking, camping, orienteering, and water sports, outdoor education not only enhances physical fitness but also promotes a deeper understanding of natural ecosystems and the importance of environmental conservation.

Outdoor education is a pedagogical approach that involves learning in, for, and about the outdoors. It integrates experiential learning, environmental education, and adventure-based activities to foster personal growth, social development, and environmental stewardship. Outdoor education emphasizes the development of practical skills, critical thinking, and a connection to nature, making it a holistic educational experience that goes beyond the traditional classroom setting (Priest & Gass, 2017).

In recent years, outdoor education has gained attention for its positive impact on students' physical, emotional, and cognitive development. Studies have shown that engaging with nature

through outdoor activities can enhance well-being, reduce stress, and improve academic performance (Beames, Higgins, & Nicol, 2012).

Moreover, outdoor education plays a crucial role in environmental education by fostering a sense of responsibility and care for the natural world. By experiencing nature firsthand, students are more likely to develop an appreciation for the environment and adopt sustainable behaviours. (Ewert & Sibthorp, 2014).

Water Safety

Water safety is a critical aspect of public health and education, particularly in regions with extensive water bodies and recreational areas. As populations increasingly engage in aquatic activities, the need for robust water safety measures has become more pressing. According to the World Health Organization (2020), drowning remains one of the leading causes of unintentional injury-related deaths worldwide, with over 236,000 fatalities annually. This

statistic underscores the importance of promoting water safety awareness and education across various demographics, particularly in communities that frequently engage in water-related activities.

Educational initiatives, such as outdoor education programs, play a vital role in enhancing water safety awareness. These programs often integrate practical skills training with theoretical knowledge, aiming to equip participants with the tools necessary to prevent water-related accidents. Research by Moran and Willcox (2019) highlights that comprehensive water safety education significantly reduces the risk of drowning, particularly when programs are tailored to the specific needs of local communities and environmental contexts.

Water safety education is fundamental in preventing drowning and other water-related accidents. Research indicates that targeted educational programs can significantly reduce the risk of drowning, particularly among children and young adults. For example, Moran et al. (2020) highlight that water safety education tailored to specific age groups and settings is essential in reducing incidents of drowning, particularly in recreational areas. The study emphasizes that early education and continuous reinforcement of water safety principles can instill lifelong safety habits.

Crisis Communication Preparedness

Crisis communication preparedness involves planning, strategizing, and implementing communication protocols that ensure effective dissemination of information during emergencies. Effective crisis communication is critical for minimizing the impact of crises on organizations, communities, and individuals. According to Coombs (2019), the key to successful crisis communication lies in pre-crisis planning, where organizations identify potential threats and develop response strategies to manage information flow during crises.

The importance of crisis communication preparedness has been highlighted in numerous studies, emphasizing that proactive planning can significantly reduce the adverse effects of a crisis. A study by Liu et al. (2020) found that organizations with well-prepared communication plans are more resilient and can maintain public trust even during crises. This preparedness allows for quick, coordinated responses that can mitigate misinformation and manage public perception effectively.

Despite its importance, organizations often face challenges in crisis communication preparedness. One significant challenge is the unpredictability of crises, which can strain even the most comprehensive communication plans. As Wenzel et al. (2022) argue, crises are often dynamic, requiring organizations to adapt their communication strategies rapidly. Another challenge is ensuring that all stakeholders receive timely and accurate information, which is complicated by the proliferation of social media and the 24-hour news cycle (Austin et al., 2017).

v) Related References / Rujukan berkaitan

Anwar, A., Malik, M., Raees, V., & Anwar, A. (2020). Role of mass media and public health communications in the COVID-19 pandemic. *Cureus*, 12(9).

Araiza-Alba, P., Keane, T., Matthews, B., Simpson, K., Strugnell, G., Chen, W. S., & Kaufman, J. (2021). The potential of 360-degree virtual reality videos to teach water-safety skills to children. *Computers & Education*, 163, 104096.

Aziz, N. A., Ahmad, A. N., & Mokhtar, M. D. (2021). Potential risks of accident and injury during water activities among visitors at recreational forests. *The Malaysian Forester*, 84(2), 296-312.

Beames, S., Higgins, P., & Nicol, R. (2012). *Learning outside the classroom: Theory and guidelines for practice*. Routledge.

Christensen, T., & Lægreid, P. (2020). The coronavirus crisis—crisis communication, meaning-making, and reputation management. *International public management journal*, 23(5), 713-729.

Coleman, A. (2020). *Crisis communication strategies: How to prepare in advance, respond effectively and recover in full*. Kogan Page Publishers.

Coombs, W. T. (2019). *Ongoing Crisis Communication: Planning, Managing, and Responding (5th ed.)*. Sage Publications.

- Coombs, W. T. (2020). Conceptualizing crisis communication. In *Handbook of risk and crisis communication* (pp. 99-118). Routledge.
- Edwards, A. L., Sellnow, T. L., Sellnow, D. D., Iverson, J., Parrish, A., & Dritz, S. (2021). Communities of practice as purveyors of instructional communication during crises. *Communication Education*, 70(1), 49-70.
- Ewert, A., & Sibthorp, J. (2014). *Outdoor adventure education: Foundations, theory, and research*. Human Kinetics.
- Fagerholm, N., Eilola, S., & Arki, V. (2021). Outdoor recreation and nature's contribution to well-being in a pandemic situation-Case Turku, Finland. *Urban Forestry & Urban Greening*, 64, 127257.
- Farizan, N. H., Sutan, R., Hod, R., & KC Mani, K. (2020). Development and validation of a health educational booklet: A parent's role in water safety and drowning prevention. *Journal of health research*, 34(3), 233-246.
- Glamuzina, M., & Šantić, M. (2021). Strategic approach towards crisis communication and crisis management–proactive crisis communication strategies for successful change management. *Researching economic development and entrepreneurship in transition economies*, 181.
- Harrison, D. L., Scruggs, C. J., Hendrick, M. L., Caraway, J. K., Morales, B., Jones, J. M., ... & Zajchowski, C. A. (2022). Contemporary issues, opportunities, and resources for the US outdoor recreation profession. *Journal of Outdoor Recreation and Tourism*, 39, 100560.
- Haupt, B. (2021). The use of crisis communication strategies in emergency management. *Journal of Homeland Security and Emergency Management*, 18(2), 125-150.
- Heath, R. L., & O'Hair, H. D. (2020). The significance of crisis and risk communication. In *Handbook of risk and crisis communication* (pp. 5-30). Routledge.
- Jackson, S. B., Stevenson, K. T., Larson, L. R., Peterson, M. N., & Seekamp, E. (2021). Outdoor activity participation improves adolescents' mental health and well-being during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 18(5), 2506.
- Lipperts, J. (2022). The implementation of Outdoor Education in Luxembourgish primary schools: How do Luxembourgish primary school teachers implement Outdoor Education and which factors influence their implementation of Outdoor Education?
- Liu, B. F., Austin, L., & Jin, Y. (2020). *Crisis Communication: Examining the Impact of Pre-Crisis Preparation on Organizational Resilience*. *Public Relations Review*, 46(5), 101881.
- Mehta, A. M., Weeks, C. S., & Tyquin, E. (2020). Towards preparedness for dam failure: An evidence base for risk communication for downstream communities. *International Journal of Disaster Risk Reduction*, 50, 101820.
- Moran, K., & Willcox, S. (2019). *Water safety education: Evaluating the effectiveness of community-based programs*. *International Journal of Aquatic Research and Education*, 11(2), 125-140. doi:10.25035/ijare.11.02.03
- Moran, K., Webber, J., & Stanley, T. (2020). *Water safety education and the promotion of drowning prevention*. *Journal of Safety Research*, 75, 45-56. <https://doi.org/10.1016/j.jsr.2020.04.003>
- Odimayomi, T. O., Proctor, C. R., Wang, Q. E., Sabbaghi, A., Peterson, K. S., Yu, D. J., ... & Whelton, A. J. (2021). Water safety attitudes, risk perception, experiences, and education for households impacted by the 2018 Camp Fire, California. *Natural Hazards*, 108(1), 947-975.
- Pham, T. T. T. (2020). Tourism in marine protected areas: Can it be considered as an alternative livelihood for local communities? *Marine Policy*, 115, 103891
- Priest, S., & Gass, M. A. (2017). *Effective leadership in adventure programming (3rd ed.)*. Human Kinetics.
- Santoro, S., Totaro, V., Lovreglio, R., Camarda, D., Iacobellis, V., & Fratino, U. (2022). Risk perception and knowledge of protective measures for flood risk planning. The case study of Brindisi (Puglia region). *Safety science*, 153, 105791.

Sawalha, I. H. (2020). After the crisis: Repairing a corporate image. *Journal of Business Strategy*, 41(6), 69-80.

Seeger, M. W., Reynolds, B., & Sellnow, T. L. (2020). Crisis and emergency risk communication in health contexts: Applying the CDC model to pandemic influenza. In *Handbook of risk and crisis communication* (pp. 493-506). Routledge.

Sellnow, T. L., & Seeger, M. W. (2021). *Theorizing crisis communication*. John Wiley & Sons.

Wang, Y., Hao, H., & Platt, L. S. (2021). Examining risk and crisis communications of government agencies and stakeholders during early-stages of COVID-19 on Twitter. *Computers in human behavior*, 114, 106568.

Wenzel, A., Krause, S., & Vogel, B. (2022). *Adapting to the Unexpected: Flexibility in Crisis Communication Plans. Journal of Crisis and Contingency Management*, 30(2), 182-194.

Austin, L., Fisher Liu, B., & Jin, Y. (2017). *Social Media and Crisis Communication: Explicating the Social-Mediated Crisis Communication Model. Communication Yearbook*, 41, 375-415

Wodak, R. (2021). Crisis communication and crisis management during COVID-19. *Global Discourse*, 11(3), 329-353.

World Health Organization. (2020). *Drowning*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/drowning>

World Health Organization. (2021). *Guidelines on recreational water quality. Volume 1: coastal and fresh waters*. World Health Organization.

Yin, Q., Ntim-Amo, G., Ran, R., Xu, D., Ansah, S., Hu, J., & Tang, H. (2021). Flood disaster risk perception and urban households' flood disaster preparedness: The case of Accra Metropolis in Ghana. *Water*, 13(17), 2328.

(b) Objective (s) of the Research

Objektif Penyelidikan

RO1: To assess the level of water safety awareness among participants and educators in outdoor education programs.

RO2: To evaluate the preparedness of participants and educators for crisis communication during water-related emergencies.

RO3: To analyse the relationship between water safety awareness, outdoor education practices, and crisis communication effectiveness.

(c) Methodology

Kaedah penyelidikan

Research Design

The study will be using a quantitative method a cross sectional, survey by questionnaire, this study will be adopting and adapting an established questionnaire to measure water safety awareness and crisis communication effectiveness among participants and educators in outdoor education programs.

Population and Sample:

Population: Participants involved in outdoor education programs in UiTM around Malaysia.

There are 5 campuses involved which is Shah Alam campus, Negeri Sembilan Campus, Pahang Campus, Perlis Campus and Sarawak Campus.

Sampling Method: Stratified random sampling to include different types of outdoor education programs (e.g., school camps, adventure tourism, water sports training).

Table below indicated the list UiTM Campus involved with the total population. Based on the total population, Krejcie and Morgan (1970) suggested that the most reliable number of samplings is (205). Additionally, a study by Suresh and Chandrashekar (2017) suggested that a total of 20% should be added and adequate to avoid missing data and withdrawal from the respondent, hence the total suggested sampling is (246).

Sampling Method: Stratified random sampling to include different types of outdoor education programs (e.g., school camps, adventure tourism, water sports training).

UiTM CAMPUS	PARTICIPANT OF OUTDOOR EDUCATION
UiTM SHAH ALAM	104
UiTM PERLIS	125
UiTM JENGKA	66
UiTM SEREMBAN 3	70
UiTM SAMARAHAN	70
TOTAL	435

Table 3.1									
Table for Determining Sample Size of a Known Population									
N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384
Note: N is Population Size; S is Sample Size					Source: Krejcie & Morgan, 1970				

Calculation: (S X 20%) = 204 x 0.2= 246 Respondents

Questionnaire Sections:

Data Collection Instrument:

This study will be using a survey by questionnaire, the instrumentation used will be adopted and adapted accordingly to measure water safety awareness and effective crisis communication strategies. This questionnaire will be consisting of 3 parts.

A: Demographic Information: Age, gender, role (participant or educator), educational background, and experience in outdoor activities.

B: Water Safety Awareness: 30 items adapted and adopted from Drowning Prevention and Water Safety Questionnaire (Farizan, Sutan, Hod & Mani, 2020)

C: Outdoor Education Practices: 19 items were adapted and adopted from The Implementation of Outdoor Education in Luxembourgish Primary Schools (Lipperts, 2022)

D: Crisis Communication Preparedness: 68 items were adapted and adopted from Crisis communication Strategies in Emergency Management (Haupt, 2021)

Data Collection Procedure:

Questionnaire Distribution: Online survey platform (e.g., Google Forms, SurveyMonkey) and paper-based questionnaires distributed during outdoor education programs.

Data Collection Period: 3 months to ensure a wide range of responses.

Data Analysis:

Descriptive Statistics: Frequency distribution, mean, and standard deviation for each section of the questionnaire.

Correlation Analysis: Pearson's correlation coefficient to determine the relationship between water safety awareness, outdoor education practices, and crisis communication preparedness.

Regression Analysis: Multiple regression to explore the predictive relationship between water safety awareness and crisis communication preparedness.

(d) Expected Results/Benefit
Jangkaan Hasil Penyelidikan

1. **Novel theories/New findings/Knowledge**

- Quantitative and qualitative data on the current state of water safety awareness and crisis communication preparedness among outdoor education participants, offering a baseline for future interventions.
- Identification of key deficiencies in current water safety protocols, emergency preparedness measures, and communication strategies during water-related incidents.
- Insights into how Malaysian participants' cultural background, educational exposure, and familiarity with local environments impact their safety awareness and crisis management skills.
- Guidelines for embedding water safety and crisis communication training into outdoor education curriculum, promoting proactive safety measures and preparedness.
- Policy-level suggestions for improving safety standards and crisis communication protocols in outdoor education programs, potentially influencing national safety guidelines and educational policies.

2. **Research Publications**

Journal of Adventure Education and Outdoor Learning (WOS indexed)

3. **Specific or Potential Grant Applications (please specify targeted grant application)**

FRGS 2025

4. **Number of PhD and Masters (by research) Students (if any)**

Master student (N = 1)

5. **Impact on Society, Economy and Nation**

Impact on Society

Enhanced Public Safety by promoting water safety awareness and crisis communication skills, the study contributes to reducing water-related accidents and fatalities, fostering a culture of safety in outdoor activities.

Improved Education by integrating in outdoor education programs, empowering participants with critical life skills in risk assessment and emergency response.

Impact on the Economy

Boost to Tourism and Recreation by improving safety standards, the study enhances confidence in outdoor recreation and adventure tourism, which are significant contributors to Malaysia's economy.

Impact on the Nation

Policy Development, this study provides evidence-based recommendations for formulating national policies on water safety and crisis communication, aligning with Malaysia's broader safety and educational goals.

Alignment with National Agendas, by supporting national initiatives such as *Tahun Melawat Malaysia* by ensuring safer environments for both local and international participants, promoting inclusivity and economic growth. By addressing critical gaps in water

(e) Research activity & Milestone

Aktiviti penyelidikan & Carta perbatuan

Research Activity and Milestone

	1/1/2025	1/2/2025	1/3/2025	1/4/2025	1/5/2025	1/6/2025	1/7/2025	1/8/2025	1/9/2025	1/10/2025	1/11/2025	1/12/2025
ETHICAL APPROVAL AND PREPARATION PILOT STUDY	3 MONTHS											
DATA COLLECTION				1 MONTH								
DATA ANALYSIS					4 MONTHS							
REPORT WRITING									1 MONTH			
JOURNAL PAPER WRITING										3 MONTHS		
										3 MONTHS		

D

BUDGET /BELANJAWAN

	Please indicate your estimated budget for this research and details of expenditure according to the guidelines attached. <i>Sila nyatakan anggaran bajet bagi cadangan penyelidikan ini dan berikan butir – butir perbelanjaan lengkap dengan berpandukan kepada garis panduan yang dilampirkan.</i>	
	Budget details <i>Butiran belanjawan</i>	Amount requested by applicant <i>Jumlah yang dipohon oleh pemohon</i>
		Year 1 Tahun 1 (RM)
D(i)	Vote 21000 - Travelling and Transportation/ <i>Perjalanan dan Pengangkutan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	Perjalanan dan Pengangkutan semasa pengumpulan data RM 600 Persidangan, seminar atau bengkel RM 1000
D(ii)	Vote 24000 - Rental <i>Vot 24000 - Sewaan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	
D(iii)	Vote 27000 - Research Materials & Supplies <i>Vot 27000 - Bekalan dan Bahan Penyelidikan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	
D(iv)	Vote 28000 - Maintenance and Minor Repair Services <i>Bvot 28000 - Baik pulih kecil dan ubahsuai</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	

D(v)	Vote 29000 - Professional Services <i>Vot 29000 - Perkhidmatan Ikhtisas</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	Bayaran honorarium peserta RM 10 x 246 = RM 2460 Harta Intelek = RM 200 Percetakan Borang Soal Selidik RM 0.70 x 250 = RM175 Proof Reading Paper RM 0.05 x 10000 words = RM500
D(vi)	Vote 35000 - Accessories and Equipment <i>Vot 35000 - Aksesori dan Peralatan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	
TOTAL AMOUNT JUMLAH BESAR		RM 4935.00
E	Declaration by applicant / Akuan Pemohon (Please tick (✓): / (Sila tanda (✓)):	

I hereby declare that:

Saya dengan ini mengaku bahawa:

/

- 1. All information stated here are accurate, and PJI has right to reject or to cancel the offer without prior notice if there is any inaccurate information given.**

Semua maklumat yang diisi adalah benar, PJIM&A berhak menolak permohonan atau membatalkan tawaran pada bila-bila masa sekiranya keterangan yang dikemukakan adalah tidak benar.

/

- 2. Application of this research is presented for the Geran Semarak Penyelidikan**

Permohonan penyelidikan ini dikemukakan untuk Geran Semarak Penyelidikan.

/

- 3. Application of this research is subject to Ethical Committee approval (if applicable).**

Permohonan penyelidikan ini dimajukan ke Jawatankuasa Etika (jika berkenaan).

Date : 22/11/2024

Tarikh :

Applicant's Signature :

Tandatangan Pemohon :



Note: APPLICATIONS SUBMITTED WILL BE TREATED IN FULL CONFIDENCE. THE DECISION OF THE INTERNAL RESEARCH ACCULTURATION MAIN COMMITTEE UiTM CAWANGAN PERLIS IS FINAL. Semua permohonan dianggap sulit. Keputusan Jawatankuasa Induk Geran Penyelidikan Pembudayaan Dalam UiTM Cawangan Perlis adalah MUKTAMAD.

BORANG GSP 2024

Kod Rujukan: (Diisi oleh PJI)	
RIG	
Bukti Kolaborasi	

(Diisi oleh PJI)

**BORANG PERMOHONAN
GERAN SEMARAK PENYELIDIKAN (GSP) 2024**
Bahagian Penyelidikan & Jaringan Industri (PJI)
UiTM CAWANGAN PERLIS

A	TITLE OF PROPOSED RESEARCH: <i>Tajuk penyelidikan yang dicadangkan :</i> THE TRANSFORMATIONAL LEADERSHIP BEHAVIOR OF COACHES AND ATHLETES' SATISFACTION IN MALAYSIAN SPORTS SCHOOLS		
B	DETAILS OF RESEARCHER / MAKLUMAT PENYELIDIK		
B(i)	<table><tr><td>Name of Project Leader: <i>Nama Ketua Projek:</i> PROF. MADYA DR AHMAD FIKRI MOHD KASSIM</td><td>IC / Passport Number: <i>No. Kad Pengenalan/ Pasport:</i> 800629-10-5391</td></tr></table>	Name of Project Leader: <i>Nama Ketua Projek:</i> PROF. MADYA DR AHMAD FIKRI MOHD KASSIM	IC / Passport Number: <i>No. Kad Pengenalan/ Pasport:</i> 800629-10-5391
Name of Project Leader: <i>Nama Ketua Projek:</i> PROF. MADYA DR AHMAD FIKRI MOHD KASSIM	IC / Passport Number: <i>No. Kad Pengenalan/ Pasport:</i> 800629-10-5391		
B(iii)	Faculty/School/Centre/Unit (Please provide full address): <i>Fakulti/Jabatan /Pusat/Unit (Sila nyatakan)</i> FAKULTI SAINS SUKAN DAN REKREASI, UiTM CAWANGAN PERLIS, 02600, ARAU, PERLIS.		
B(iv)	<table><tr><td>Office Telephone No.: <i>No. Telefon Pejabat:</i> 049882002 -</td><td>Handphone No.: <i>No. Telefon Bimbit:</i> 0132860106</td></tr></table>	Office Telephone No.: <i>No. Telefon Pejabat:</i> 049882002 -	Handphone No.: <i>No. Telefon Bimbit:</i> 0132860106
Office Telephone No.: <i>No. Telefon Pejabat:</i> 049882002 -	Handphone No.: <i>No. Telefon Bimbit:</i> 0132860106		
B(v)	E-mail Address: <i>Alamat e-mel:</i> ahmadfikri@uitm.edu.my		

B(vi)	Date of first appointment with this University: <i>Tarikh mula berkhidmat dengan Universiti ini:</i> 10th July 2006																														
C	RESEARCH INFORMATION / MAKLUMAT PENYELIDIKAN																														
C(i)	Research Domain (Please tick (✓)): <i>Domain Penyelidikan (Sila tanda (✓)):</i> A. Pure and Applied Sciences (Sains Tulen dan gunaan) <table border="0"> <tr> <td>☐ Chemistry (Kimia)</td> <td>☐ Physic (Fizik)</td> <td>☐ Biology (Biologi)</td> </tr> <tr> <td>☐ Biochemistry (Biokimia)</td> <td>☐ Materials Science (Sains Bahan)</td> <td>☐ Mathematics and Statistics (Matematik dan Statistik)</td> </tr> <tr> <td>☐ Materials Science (Sains Bahan)</td> <td></td> <td></td> </tr> </table> B. Social Sciences (Sains Sosial) <table border="0"> <tr> <td>☐ Anthropology (Antropologi)</td> <td>☐ Psychology (Psikologi)</td> <td>☐ Sociology (Sosiologi)</td> </tr> <tr> <td>☐ Political Science (Sains Politik)</td> <td>☐ Business and Management (Pengurusan dan Perniagaan)</td> <td>☐ Geography (Geografi)</td> </tr> <tr> <td>☐ Economic (Ekonomi)</td> <td>☐ Human Ecology (Ekologi Manusia)</td> <td>☐ Communication (Komunikasi)</td> </tr> </table> C. Arts and Applied Arts (Sastera dan Sastera Ikhtisas) <table border="0"> <tr> <td>☐ Language and Linguistic (Bahasa dan Linguistik)</td> <td>☐ Literature (Kesusasteraan)</td> <td>☐ Religion (Agama)</td> </tr> <tr> <td>☐ Philosophy (Falsafah)</td> <td>☐ Civilization (Tamadun)</td> <td>☐ History (Sejarah)</td> </tr> <tr> <td>☐ Art (Seni)</td> <td>☐ Culture (Budaya)</td> <td>☐ Education (Pendidikan)</td> </tr> <tr> <td>☐ Policies and Law (Dasar dan Undang-undang)</td> <td>☐ Built Environment (Alam Bina-</td> <td>☐ Environment (Alam Sekitar-</td> </tr> </table>	☐ Chemistry (Kimia)	☐ Physic (Fizik)	☐ Biology (Biologi)	☐ Biochemistry (Biokimia)	☐ Materials Science (Sains Bahan)	☐ Mathematics and Statistics (Matematik dan Statistik)	☐ Materials Science (Sains Bahan)			☐ Anthropology (Antropologi)	☐ Psychology (Psikologi)	☐ Sociology (Sosiologi)	☐ Political Science (Sains Politik)	☐ Business and Management (Pengurusan dan Perniagaan)	☐ Geography (Geografi)	☐ Economic (Ekonomi)	☐ Human Ecology (Ekologi Manusia)	☐ Communication (Komunikasi)	☐ Language and Linguistic (Bahasa dan Linguistik)	☐ Literature (Kesusasteraan)	☐ Religion (Agama)	☐ Philosophy (Falsafah)	☐ Civilization (Tamadun)	☐ History (Sejarah)	☐ Art (Seni)	☐ Culture (Budaya)	☐ Education (Pendidikan)	☐ Policies and Law (Dasar dan Undang-undang)	☐ Built Environment (Alam Bina-	☐ Environment (Alam Sekitar-
☐ Chemistry (Kimia)	☐ Physic (Fizik)	☐ Biology (Biologi)																													
☐ Biochemistry (Biokimia)	☐ Materials Science (Sains Bahan)	☐ Mathematics and Statistics (Matematik dan Statistik)																													
☐ Materials Science (Sains Bahan)																															
☐ Anthropology (Antropologi)	☐ Psychology (Psikologi)	☐ Sociology (Sosiologi)																													
☐ Political Science (Sains Politik)	☐ Business and Management (Pengurusan dan Perniagaan)	☐ Geography (Geografi)																													
☐ Economic (Ekonomi)	☐ Human Ecology (Ekologi Manusia)	☐ Communication (Komunikasi)																													
☐ Language and Linguistic (Bahasa dan Linguistik)	☐ Literature (Kesusasteraan)	☐ Religion (Agama)																													
☐ Philosophy (Falsafah)	☐ Civilization (Tamadun)	☐ History (Sejarah)																													
☐ Art (Seni)	☐ Culture (Budaya)	☐ Education (Pendidikan)																													
☐ Policies and Law (Dasar dan Undang-undang)	☐ Built Environment (Alam Bina-	☐ Environment (Alam Sekitar-																													

Aspek Kemanusiaan)

Aspek Kemanusiaan)

D. Natural Sciences and National Heritage (*Sains Tabii dan Warisan Negara*)

☐ Environment
(*Alam Sekitar*)

☐ Forestry
(*Perhutanan*)

☐ Agriculture
(*Pertanian*)

☐ Marine
(*Marin*)

☐ Archaeology
(*Arkeologi*)

☐ Geoscience
(*Geosains*)

☐ Ethnography
(*Etnografi*)

☐ Built Environment
(*Heritage Aspect*)
Alam Bina (Aspek Warisan)

☐ Culture
(*Budaya*)

☐ Biodiversity
(*Kepelbagaian Biologi*)

E. Information and Communication Technology (*Teknologi Maklumat dan Komunikasi*)

☐ Software and Information System
(*Perisian dan Sistem Maklumat*)

☐ Soft Computing
(*Pengkomputeran Lembut*)

☐ Computer Networking
(*Rangkaian Komputer*)

☐ Information Security
(*Keselamatan Maklumat*)

☐ Multimedia
(*Multimedia*)

☐ Computer Engineering
(*Kejuruteraan Komputer*)

☐ Computer Science
(*Sains Komputer*)

F. Health Sciences (*Sains Kesihatan*)

☐ Basic Medical Sciences
(*Sains Perubatan Asas*)

☐ Pharmacy
(*Farmasi*)

☐ Pharmacology
(*Farmakologi*)

☐ Medical Microbiology
(*Mikrobiologi Perubatan*)

☐ Parasitology
(*Parasitologi*)

☐ Pathology
(*Pathologi*)

☐ Community Medical Prevention
(*Perubatan Pencegahan Masyarakat*)

☐ Clinical Surgical
(*Klinikal Surgikal*)

☐ Clinical Medical
(*Klinikal Medikal*)

☐ Associate Health Science
(*Sains Kesihatan Bersekutu*)

☐ Dental
(*Pergigian*)

☐ Nursing Science
(*Sains Kejururawatan*)

C(ii)	Location of Research: <i>Tempat penyelidikan dijalankan:</i> Sekolah Sukan Bukil Jalil (SSBJ), Kuala Lumpur Sekolah Sukan Tunku Mahkota Ismail (SSTMI), Johor Sekolah Sukan Malaysia Pahang (SSMP) Sekolah Sukan Malaysia Terengganu (SSMT) Sekolah Sukan Malaysia Sabah (SSMS)				
C(iii)	Duration of this research (Maximum 24 months): <i>Tempoh masa penyelidikan ini (Maksimum 24 bulan):</i> Duration: 2 year <i>Tempoh :</i> From : 1 Jan 2025 <i>Dari :</i> To : 31 Dec 2026 <i>Hingga :</i>				
C(iv)	Other Researchers: <i>Ahli-ahli penyelidik yang lain:</i>				
	Bil	Name <i>Nama</i>	IC / Staff Number: <i>No. Kad Pengenalan/ No. Pekerja:</i>	University / Industry / Agency <i>Fakulti/ P.Pengajian/ Pusat/Unit</i>	Academic Qualification/ Designation <i>Tahap Kelayakan Akademik/Jawatan</i>
	1	PROF. MADYA DR AHMAD NIZAN MAT NOOR	192918	FAKULTI PENGURUSAN DAN PERNIAGAAN	PhD
	2	DR ELLAIL AIN MOHD AZNAN	324663	FAKULTI SAINS SUKAN DAN REKREASI	PhD
	3	NOR NANDINIE MOHD NIZAM EDROS	368250	FAKULTI SAINS SUKAN DAN REKREASI	MASTERS
C(vi)	Please provide information on academic publications that has been published by the project leader for the last five (5) years. (Example: Journals, Books, Chapters in books, etc) <i>Sila kemukakan maklumat berkaitan penerbitan akademik yang telah diterbitkan oleh ketua penyelidik dalam tempoh lima (5) tahun terakhir. (Contoh: Jurnal, buku, bab dalam buku, dll)</i>				

	Title of publication <i>Tajuk penerbitan</i>	Name of journals/books <i>Nama jurnal/buku</i>	Year published <i>Tahun diterbitkan</i>
1	Transformational Leadership Behavior and Group Cohesion Values in Outdoor Recreation Curriculum Program Among the Sports Students: A Pilot Study	Jurnal Sains Sukan & Pendidikan Jasmani 13 (1), 75-88	2024
2	Moral Identity on Athletes' Prosocial and Antisocial Behaviour Perceived by Gender	Gading Journal for Social Sciences (e-ISSN 2600-7568), 1-9	2024
3	Investigation on effective communication and group cohesiveness in the outdoor recreation program curriculum at the Faculty of Sports Science and Recreation, UiTM	proceedings of the 1st International Summit Conference on Exercise Science	2024
4	An associative study: evaluating perceived risk management and risk perception in physical activity among university students	Jurnal Intelek 19 (2), 143-154	2024
5	The relationship between coaches' leadership styles and athletes' burnout among UiTM Perlis athletes	Jurnal Intelek 19 (2), 239-248	2024
6	Coach-athlete Relationship, trust and Confidence among team sport athletes	Malaysian Journal of Sport Science and Recreation 20 (1), 1-11	2024
7	Association between service quality and motivation to engage with sports facilities: a study among university students	Malaysian Journal of Sport Science and Recreation 20 (1), 1-11	2024
8	Proximate analysis and shelf-life studies of Yoghurt Chia (Salvia Hispanica L.) pudding	Journal of Academia 12, 139-149	2024
9	Investigation of Coaching Effectiveness and Perfectionist in Sports: A Systematic	Proceedings of the 8th International Conference on Movement, Health and Exercise: MoHE 2022—Refocusing on Sports and Exercise for a Post-pandemic World	2023
10	The Implication of Covid-19 Pandemic on Stress Level between Gender in Elite Athletes	ACPES 2022: Proceedings of the 8th ACPES (ASEAN Council of Physical Education and Sport) International Conference, ACPES 2022, October 28th–30th, 2022, Medan, North Sumatera, Indonesia	2023
11	The Interactions towards Moral Disengagement, Pro-social Behaviour and Anti-Social Behaviour among Students Athletes	Jurnal Intelek 18 (1), 195-201	2023
12	Self-talk on sport performance and selected psychological variables: a systematic review	Malaysian Journal of Sport Science and Recreation (MJSSR) 19 (2), 351-363	2023
13	Understanding Emotional Intelligence and Personality to Athletes' Performances: a Systematic Literature	International Conference on Movement, Health and Exercise	2023

14	Roles of coach's behaviour in affecting the prosocial and antisocial behaviour in athletes: a systematic review	Malaysian Journal of Sport Science and Recreation (MJSSR) 19 (1), 85-109	2023
15	Elucidation Of Coaching Effectiveness and Coach's Behavior on Athlete's Self-Perception	Malaysian Journal of Sport Science and Recreation (MJSSR) 18 (2), 130-149	2022
16	The Perception of Athlete's Anxiety Experience in Team and Individual Sports	Jurnal Sains Sukan & Pendidikan Jasmani 11 (1), 29-37	2022
17	Coaching effectiveness and coach-athlete relationship model offer possibilities solution for the competitive anxiety of young athletes	Malaysian Journal of Movement, Health & Exercise 11 (1), 15-22	2022
18	Does Coaching Effectiveness and Coach-Athlete Relationship Moderate the Anxiety Among Athletes?	Jurnal Sains Sukan & Pendidikan Jasmani 10 (2), 19-25	2021
19	Reliability and Validity of Risk Analysis for Fitness Facilities Questionnaire (Raff-Q) Development	International Journal of Academic Research in Progressive Education and Developme	2021
20	Assessing Coach's Personality and Transformational Leadership Behavior among Team and Individual Sports	International Journal of Indian Psychology 9 (3), 1061-1070	2021
21	Athletes' perception of their coach transformational leadership and coach-athlete relationship in team and individual sports	Jurnal Sains Sukan & Pendidikan Jasmani 10 (1), 24-31	2021
22	The prevalence of nutritional knowledge among soccer athletes within different levels of participant status	Jurnal Sains Sukan & Pendidikan Jasmani 10 (1), 1-6	2021
23	Perceptions of Coaching Behavior and Its Impact on Managerial of Team Sports Performance	Jurnal Intelek 15 (2), 60-66	2020
24	Coach Effectiveness and Transformational Leadership in Sport: The Effects of Gender and Athlete Experience	Jurnal Intelek 15 (2), 154-161	2020
25	The effects of exercise order during resistance training on muscular strength	Journal of Physics: Conference Series	2020
26	The effects of music during warm-up on anaerobic performance of football players	Int J Hum Mov 8 (2020): 477-482.	2020
27	The Effect of Various Carbohydrate Concentrations Mouth Rinsing on Intermittent Running Performance	International Conference on Movement, Health and Exer	2019

C(vii)	Executive Summary of Research Proposal (maximum 300 words) (Please include the problem statement, objectives, research methodology, expected output/outcomes/implication, and significance of output from the research project) <i>Ringkasan Cadangan Eksekutif Penyelidikan (maksimum 300 patah perkataan)</i> <i>(Meliputi pernyataan masalah, objektif, kaedah penyelidikan, jangkaan hasil penyelidikan/implikasi dan kepentingan output projek penyelidikan)</i> Leadership in sports is a social construct between coaches and athletes. Athletes' perceptions of their coaches' leadership can influence their interactions and satisfaction. Transformational leadership theory has recently been applied to sports research, enhancing understanding leadership dynamics. Sports leadership scholars have increasingly focused on transformational leadership over the past decade. Initial results indicate that transformational coaching behaviors correlate with higher athlete motivation, effort, and team cohesion. Transformational leaders foster skill development and motivate athletes, enhancing their relationships with them. However, previous studies on transformational leadership in sports are somewhat limited. Additionally, while theoretical support exists for a connection between coach-athlete satisfaction and transformational leadership, this relationship remains underexplored. Therefore, this study seeks to investigate the impact of transformational leadership on athlete satisfaction among Malaysian sports school athletes. It aims to determine if transformational coaches can better motivate athletes than those lacking such characteristics. The research will utilize a quantitative approach through a cross-sectional questionnaire survey. A validated tool, the Multifactor Leadership Questionnaire (MLQ) 5x-short, will assess transformational leadership, along with the Satisfaction Scale for Athletes (SSA) for athlete satisfaction. By developing leadership styles among young athletes, the nation can foster future societal leaders. Emphasizing transformational leadership can enhance national sports performance and promote national pride. The findings will inform Malaysian sports school coaches about transformational leadership and athlete satisfaction levels. This will aid coaches in adopting effective leadership styles and improving athletes' mental states for optimal performance. Such improvements also positively impact group dynamics, enhancing self-confidence and satisfaction among team members.
C(viii)	Detailed proposal of research project: <i>Cadangan maklumat penyelidikan secara terperinci:</i> (a) Research background including: / <i>Latarbelakang penyelidikan termasuk:</i> i) Problem Statement / <i>Pernyataan Masalah</i> <i>Problem Statements:</i> The Malaysian contingent's historic seventh-place finish at the 2023 Cambodia SEA Games, failing to achieve the target of 40 gold medals (Bernama, 2023), reflects a significant gap in the nation's athlete development system. With successful athletes often emerging from well-supported early training environments, such as sports schools, the critical role of coaches and their transformational leadership behaviours comes into focus. This research seeks to explore how these leadership behaviours influence athlete satisfaction and performance, particularly in the Malaysian sports school context. Transformational leadership, characterized by idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, has been studied widely in corporate and educational settings, demonstrating its positive impact on motivation, team cohesion, and performance (Mohd Kassim., 2018). However, limited empirical studies exist within the Malaysian sports context, especially focusing on athletes in sports schools. This study aims to understand how transformational leadership behaviors of coaches influence athlete satisfaction and overall outcomes within this unique cultural and institutional framework. Malaysian sports educational institutions function as pivotal arenas for the cultivation of emerging athletic talent; however, there exists a notable deficiency of scholarly inquiry into the influence of transformational leadership on athlete satisfaction. In contrast to other geographical regions or fields where transformational leadership has been scrutinized, the distinct attributes of Malaysian athletic organizations necessitate a concentrated investigation to ascertain the extent to which

coaching behaviors affect athletes' psychological states and performance metrics. By addressing this identified research void, the present study aspires to provide empirically substantiated recommendations aimed at enhancing coaching methodologies and fostering more nurturing environments.

The principal objective of this research endeavor is to analyze the influence of coaches' transformational leadership behaviors within sports teams on the satisfaction levels of athletes enrolled in Malaysian sports schools, particularly in the disciplines of football, hockey, and rugby. This investigation aims to ascertain whether coaches at Malaysian sports schools who embody transformational leadership traits can motivate and empower their athletes to achieve a greater degree of satisfaction compared to their counterparts who do not exhibit such leadership characteristics. The outcomes of this research may bear significant implications for coaching methodologies, athlete development initiatives, and the formulation of sports-related policies. Effective leadership transcends mere performance metrics, affecting athletes' psychological health, resilience, and dedication to their chosen sports. Through the comprehension and enhancement of transformational leadership practices among coaches within Malaysian sports schools, this study seeks to cultivate an environment that promotes the growth of both athletes and coaches, ultimately contributing to the advancement of national sports initiatives.

ii) **Hypothesis / Hipotesis**

H1: The levels of satisfaction among athletes participating in Malaysian sports schools are markedly elevated.

H2: The extent to which athletes perceive their coaches' transformational leadership within Malaysian sports schools is notably high.

H3: A statistically significant disparity exists in athlete satisfaction and the transformational leadership behaviors exhibited by coaches, contingent upon gender.

H4: A statistically significant variance is observed in the transformational leadership behaviors of coaches, influenced by the type of sport engaged in by athletes within Malaysian sports schools.

H5: A significant correlation is evident between the transformational leadership behaviors of coaches and the satisfaction levels of athletes in Malaysian sports schools.

iii) **Research Questions / Persoalan Penyelidikan**

1. What is the levels of satisfaction experienced by athletes enrolled in Malaysian sports schools?
2. How do the athletes assess the levels of their coaches' transformational leadership within the framework of Malaysian sports schools?
3. Are there discernible disparities in athlete satisfaction and the transformational leadership behaviors exhibited by coaches, differentiated by gender?
4. Do notable differences exist in the transformational leadership behaviors of coaches when contrasted with the type of sport engaged in by the athletes in Malaysian sports schools?
5. Is there a correlation between the transformational leadership behaviors of coaches and the satisfaction levels of athletes participating in Malaysian sports schools?

iv) **Literature Reviews / Kajian Literatur**

Malaysia concluded its participation in the biennial games in a disappointing seventh place overall, marking its lowest ranking since the inception of the event in 1959. Consequently, it fell short of its target of securing 40 gold medals at the 2023 SEA Games held in Cambodia (Bernama, 2023). "The Ministry of Youth and Sports (KBS) cannot achieve this goal in isolation; it necessitates the active participation of educational institutions, as athletes as young as 15 years old are capable of attaining gold medals," remarked Youth and Sports Minister Hannah Yeoh during a press

briefing that evaluated the performance of the Malaysian contingent at the 2023 Cambodia SEA Games (Bernama, 2023). In the context of Malaysia, sports schools are pivotal in cultivating proficient young athletes. To adequately prepare athletes for international representation, coaches at the grassroots and youth levels must adopt a more proactive approach. Furthermore, to bolster the effectiveness of teachers tasked with coaching at the school level, it is essential to enhance the involvement of educators who are designated as coaches. Consequently, this research aims to ascertain the extent to which transformational leadership behaviors affect athlete satisfaction in their respective sports and facilitate optimal performance outcomes.

Transformational leadership represents the mechanism through which a leader enhances collective or organizational performance beyond anticipated levels, facilitated by a profound emotional bond with followers combined with a shared dedication to a superior moral objective. As posited by Andriani, Kesumawati, and Kristiawan (2018), transformational leadership is conceptualized as a leadership paradigm that has the capacity to awaken or motivate individuals, thereby enabling them to evolve and attain elevated performance levels that were previously beyond reach. Within the realm of sports, the behavioral tendencies associated with transformational leadership may periodically affect athletes' performance outcomes through alterations in their perceptions regarding the effectiveness of their leader or coach (Mohd Kassim, 2021).

Moreover, the construct and methodology of transformational leadership can be characterized by four primary attributes. Historically, Bass (1985) elucidates transformational leadership and the pathways to success as this leadership style encompasses idealized influence (i.e., the articulation of significant values and a collective sense of mission), intellectual stimulation (i.e., the challenge of conventional thought processes and the encouragement of diverse viewpoints), inspirational motivation (i.e., the confident articulation of a compelling vision and objectives), and individualized consideration (i.e., the acknowledgment of followers as distinct individuals and the facilitation of their personal development). Idealized influence constitutes the most pivotal aspect that individuals can embody as transformative leaders modeling exemplary behavior. Furthermore, idealized influence encapsulates the leader's emotional rapport with subordinates, alongside the leader's capacity to engage individuals through visionary and ethical conduct (Linge & Sikalieh, 2019). According to Poturak, Mekic, Hadziahmetovic, and Budur (2020), inspirational motivation encompasses supportive behaviors that enhance follower motivation, such as maintaining a positive outlook regarding future prospects and articulating the organization's objectives to subordinates. In addition, intellectual stimulation is fundamental for fostering change; it necessitates the challenge of entrenched organizational beliefs and the promotion of the status quo by advocating for innovation, creativity, critical analysis, and problem-solving. Individual consideration signifies that employees ought to experience a sense of autonomy and ownership in relation to overarching corporate objectives. Additionally, individual consideration pertains to the mentorship of followers aimed at fostering their professional development and success (Faeq, 2020; Zardasht, Omed, & Taha, 2020). According to Bass' model, transformational leaders differentiate themselves from other leadership styles by fostering followers' motivation and constructive development, demonstrating ethical standards within the organization, and inspiring others to emulate such behaviors, thereby cultivating an ethical workplace characterized by clearly defined values, priorities, and standards.

Transformational leadership, characterized by inspiration, a call to action, and a comprehensive vision, facilitates the capacity of individuals to realize constructive change. The intrinsic elements of human nature that cultivate the capability to lead and motivate others, along with the transformative coaches who encourage and elevate their athletes beyond their initial potential, are of paramount importance. It has been proposed that transformational leadership should be utilized to improve the task environment, thereby augmenting athletes' discretionary efforts, their perceptions regarding the efficacy of their coach, and their overall satisfaction with the coach's leadership approach (Álvarez et al., 2019). According to Caliskan and Baydar (2016), athlete satisfaction is regarded as a significant outcome derived from various psychological attributes at the individual (intrapersonal) level.

Moreover, it is posited that the behaviors exhibited by coaches have a direct impact on the athletes' levels of satisfaction. Coaches who display transformational leadership qualities will exert influence on athletes, whether positively or negatively. The majority of prior research about

transformational leadership within the realm of sports remains limited, with scant investigations conducted in this domain (Gorgulu, 2019). Furthermore, there exists a notable deficiency in research about athletes in sports schools within Malaysia. This study lies in its potential to contribute to both theory and practice within the fields of sports management, education, and psychology. On a theoretical level, this research enriches the body of knowledge on transformational leadership within the sports context, specifically focusing on the Malaysian setting, which has been underrepresented in the literature. Given the unique cultural and institutional features of Malaysian sports schools, this study offers an opportunity to examine whether established theories on transformational leadership and athlete satisfaction apply in this context, potentially highlighting cultural or situational variations.

v) **Related References** / Rujukan berkaitan

Álvarez, O., Castillo, I., & Álvarez, M. (2019). Transformational Leadership, Task-Involving Climate, and Their Implications in Male Junior Soccer Players: A Multilevel Approach. *International Journal of Environmental Research and Public Health*, 16(20), 3649.
<https://doi.org/10.3390/ijerph16203649>

Andriani, S., Kesumawati, N., & Kristiawan, M. (2018). The Influence of the Transformational Leadership and Work Motivation on Teacher's Performance. *International Journal of Scientific & Technology Research*, 7, 19-29.

Bass, B. M. (1985). *Leadership and Performance Beyond Expectations*. New York: The Free Press.

Bernama. (2023, May 17). *Malaysia end 2023 SEA Games with worst-ever achievement*. MalaysiaNow.
<https://www.malaysianow.com/news/2023/05/17/malaysia-end-2023-sea-games-with-worst-ever-achievement>

Caliskan, G., & Baydar, H. O. (2016). Satisfaction scale for athlete (SSA): A study of validity and reliability. *European Scientific Journal*, 12(14), 13–26.

Faeq, M. (2020). Performance Evaluation Criteria Development Process for Academic Staff at Universities. *Black Sea Journal of Management and Marketing*, 1(1), 59-70.

Gorgulu, R. (2019). Transformational Leadership Inspired Extra Effort: The Mediating Role of Individual Consideration of the Coach-Athlete Relationship in College Basketball Players. *Universal Journal of Educational Research*.

Mohd Kassim A F., (2018). Athletes' perceptions of coaching effectiveness in team and individual sport.

Linge, T. K., & Sikalieh, D. (2019). Influence of idealized influence on employee job performance in the insurance industry in Kenya. *International Journal of Research in Business and Social Science* (2147-4478), 8(5), 266-273.

Mohd Kassim, A.F. (2021). Coach's Effectiveness Mediate Longitudinal Effects Of Transformational Leadership Behaviour On Athlete Outcomes. *Malaysian Journal of Sport Science and Recreation*.

Poturak, M., Mekić, E., Hadžiahmetović, N., & Budur, T. (2020). Effectiveness of Transformational Leadership among Different Cultures. *International Journal of Social Sciences and Educational Studies*.

Zardasht, P., Omed, S., & Taha, S. (2020). Importance of HRM policies on employee job satisfaction. *Black Sea Journal of Management and Marketing*, 1(1), 49-57

vi) **Relevance to Government Policy, if any / Perkaitan dengan Dasar Kerajaan, jika berkenaan**

The results of the investigation may serve as a reference and a repository of knowledge for coaches affiliated with Malaysian sports schools concerning transformational leadership styles and the levels of satisfaction experienced by athletes within these institutions. Such insights can aid coaches in formulating an optimal and suitable leadership approach tailored to the needs of athletes, as well as in addressing the emotional and psychological well-being of athletes to facilitate the attainment of peak athletic performance. This initiative is congruent with the objectives of the Majlis Sukan Negara, Malaysia, in its endeavor to cultivate a cohort of elite athletes for major global sporting events, alongside a long-term strategy for systematically and integratively training potential athletes (Program Podium & Pelapis Kebangsaan under the Majlis Sukan Negara). Furthermore, the National Sports Institute acknowledges the contributions of coaches through the National Coaching Licensing Scheme (SLKK). The National Coaching Academy additionally provides a thorough educational curriculum for sports coaching via the sports coach accreditation framework, specifically the National Coaching Certification Scheme (SPKK) at Levels I, II, and III. Consequently, the incorporation of a coach leadership program must be prioritized within the objectives of these educational initiatives. This scenario also yields indirect repercussions on the interpersonal dynamics among group members, such as enhancing the self-confidence, self-satisfaction, and enjoyment of individuals in their roles within a sports team.

From a pragmatic standpoint, this research elucidates several significant ramifications for coaches and administrators of sports schools in Malaysia. By comprehending the influence of transformational leadership behaviors on athlete satisfaction, coaches may adjust their leadership styles to cultivate a more effective training ecosystem. As a result, the outcomes of this study could inform the design of training programs and workshops aimed at enhancing coaches' capacities for the development of transformational leadership competencies, which should be oriented towards fostering an enabling environment for active youth athletes. Furthermore, the insights garnered from this study may also be utilized by policymakers to formulate educational policies in sports that bolster the practice of league development and augment the efficacy of sports schools in Malaysia.

(b) Objective (s) of the Research

Objektif Penyelidikan

1. To assess the levels of satisfaction experienced by athletes enrolled in Malaysian sports schools.
2. To assess athletes' levels of their coaches' transformational leadership within the framework of Malaysian sports schools.
3. To assess disparities in athlete satisfaction and the transformational leadership behaviors exhibited by coaches, differentiated by gender among Malaysian sports school athletes.
4. To examine differences in the transformational leadership behaviors of coaches when contrasted with the type of sport engaged in by the athletes in Malaysian sports schools.
5. To verify the correlation between the transformational leadership behaviors of coaches and the satisfaction levels of athletes participating in Malaysian sports schools.

(c) Methodology

Kaedah penyelidikan

Please state in the form / Sila nyatakan di borang ini

i. Research Design:

The research will employ a quantitative methodology utilizing a cross-sectional survey facilitated by a questionnaire. This investigation will incorporate a validated instrument designed to assess transformational leadership, specifically the Multifactor Leadership Questionnaire (MLQ) 5x-short, as developed by Cahyono et al. (2020). The subscales of transformational leadership are delineated as follows: Idealized Influence (II) comprising 6 items (with a Cronbach's Alpha of 0.92), Inspirational Motivation (IM) consisting of 5 items (with a Cronbach's Alpha of 0.90), Intellectual Stimulation (IS) encompassing 5 items (with a Cronbach's Alpha of 0.80), and Individualized Consideration (IC) including 4 items (with a Cronbach's Alpha of 0.85), in addition to the athletes'

satisfaction as measured by the Satisfaction Scale for Athletes (SSA) developed by Caliskan and Baydar (2016), within the context of athletes at Malaysian Sports Schools.

ii. Population and Sample:

The subjects of this study comprise student-athletes from five specialized sports school in Malaysia. The institutions participating in this research include Sekolah Sukan Bukit Jalil located in Kuala Lumpur, Sekolah Sukan Tunku Mahkota Ismail situated in Johor, Sekolah Sukan Malaysia Pahang, Sekolah Sukan Malaysia Terengganu, and Sekolah Sukan Malaysia Sabah.

Each school is anticipated to contribute 200 students to this study; thus, the total participant count is calculated as $200 \times 5 \text{ Schools} = 1000$ participants. According to Delice (2001), a sample size ranging from 30 to 500 is generally deemed adequate for most scholarly inquiries at a 5% confidence level. Nonetheless, the determination of sample size must adequately reflect the quality of the sample, considering the extensive variety of sample size alternatives (Morse, 2000; Mason, 2010). Consequently, for a quantitative investigation, a participant pool of 1000 individuals is regarded as substantial.

iii. Research procedure:

Once the investigation receives approval from the ethical committee of the authors' institution, all schools will be contacted, and the researchers will visit the coaches regarding their athletes' involvement in the study; informed consent will be acquired during the data collection phase. Before responding to the questionnaire or completing the questionnaire form, the researchers will elucidate the instructions, outline the objectives of the study, and clarify several terms within the questionnaires to the respondents. Subsequently, the respondents will be provided with an informed consent document before data collection, which will inform them of their confidentiality and anonymity rights, their ability to withdraw at any time, the assurance that the obtained information will be maintained confidentially, as well as the opportunity to pose any inquiries.

Once the respondents have filled out the consent form, they will be presented with an individualized informed personal questionnaire. The respondents will be instructed to complete the questionnaire independently. Concise and clear instructions will be included in the form to guide the respondents on how to accurately answer all sections of the questionnaire as provided by the researcher. Respondents are required to furnish the necessary details within the questionnaire. A duration of 30 minutes will be allotted for the respondents to complete the questionnaires.

iv. Data Analysis

The data to be gathered will be subjected to analysis utilizing the Statistical Package for the Social Sciences (SPSS) Version 28 for the Windows operating system. An assessment of transformational leadership behaviors and athlete satisfaction will be conducted through the application of a comprehensive array of descriptive statistics, Pearson correlation, and T-tests. (The specifics of the data analysis procedures are aligned with the research inquiries.)

v. Data Collection Period:

3 months to fulfil all the 5 locations selection.

(d) Expected Results/Benefit

Jangkaan Hasil Penyelidikan

1. Novel theories/New findings/Knowledge

The investigation into transformational leadership within the context of sports educational institutions elucidates a profound understanding of the influence of coaching methodologies on athlete satisfaction. Transformational leadership attributes, encompassing individualized consideration and inspirational motivation, exhibit a positive correlation with athletes' comprehensive satisfaction and psychological well-being. This association is particularly salient when coaches modify their leadership approaches to align with the psychological requisites of athletes, thereby augmenting their motivation and performance levels.

2. Research Publications

Journal Sains Sukan dan Pendidikan Jasmani (MyCite)

Malaysian Journal of Sport Science and Recreation (ERA)
International Journal of Sports Science and Coaching (Scopus)

3. **Specific or Potential Grant Applications (please specify targeted grant application)**

FRGS and/or GIP

4. **Number of PhD and Masters (by research) Students (if any)**

One (1)

5. **Impact on Society, Economy and Nation**

This research endeavor aims to cultivate affirmative relationships between coaches and athletes, thereby enhancing the social development of athletes, a factor that is indispensable for holistic well-being. It has the potential to advance collective values and norms that contribute to a nurturing sports culture, one that prioritizes collaboration and personal development for both student-athletes and coaches alike. In terms of economic ramifications, performance improvements, grounded in transformational leadership, can yield superior competitive outcomes, which subsequently enhance funding and sponsorship prospects for athletic programs. By nurturing leadership competencies and styles among young athletes, the nation has the opportunity to cultivate future leaders who will make positive contributions to society. With a pronounced emphasis on transformational leadership, national sports performance can thrive on the international stage, thereby fostering a sense of national pride and unity.

(e) **Research activity & Milestone**

Aktiviti penyelidikan & Carta perbatuan

Research Activity and Milestone

	1/1/2025	1/2/2025	1/3/2025	1/4/2025	1/5/2025	1/6/2025	1/7/2025	1/8/2025	1/9/2025	1/10/2025	1/11/2025	1/12/2025
ETHICAL APPROVAL AND PREPARATION	3 MONTHS											
PILOT STUDY				1 MONTH								
DATA COLLECTION					4 MONTHS							
DATA ANALYSIS									1 MONTH			
REPORT WRITING										3 MONTHS		
JOURNAL PAPER WRITING										3 MONTHS		

D

BUDGET /BELANJAWAN

Please indicate your estimated budget for this research and details of expenditure according to the guidelines attached.

Sila nyatakan anggaran bajet bagi cadangan penyelidikan ini dan berikan butir – butir perbelanjaan lengkap dengan berpandukan kepada garis panduan yang dilampirkan.

Budget details
Butiran belanjawan

Amount requested by applicant
Jumlah yang dipohon oleh pemohon

		Year 1 (Tahun 1) (RM)	Year 2 (Tahun 2) (RM)
D(i)	Vote 21000 - Travelling and Transportation/ <i>Perjalanan dan Pengangkutan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	Perjalanan dan Pengangkutan semasa pengumpulan data RM 1200 (Lokasi sekolah Sukan Malaysia) 1. Sekolah Sukan Bukit Jalil 2. Sekolah Sukan Tunku Mahkota Ismail 3. Sekolah Sukan Pahang, 4. Sekolah Sukan Terengganu, 5. Sekolah Sukan Sabah	Persidangan, seminar atau bengkel RM 800
D(ii)	Vote 24000 - Rental <i>Vot 24000 - Sewaan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>		
D(iii)	Vote 27000 - Research Materials & Supplies <i>Vot 27000 - Bekalan dan Bahan Penyelidikan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>		

D(iv)	Vote 28000 - Maintenance and Minor Repair Services <i>Bvot 28000 - Baik pulih kecil dan ubahsuai</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>		
D(v)	Vote 29000 - Professional Services <i>Vot 29000 - Perkhidmatan Ikhtisas</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>	Bayaran honorarium peserta RM 5 x 500 = RM 2500 Percetakan Borang Soal Selidik RM 0.50 x 250 = RM125	Harta Intelek = RM 200 Proof Reading Paper RM 0.05 x 10000 words = RM500
D(vi)	Vote 35000 - Accessories and Equipment <i>Vot 35000 - Aksesori dan Peralatan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>		
TOTAL AMOUNT <i>JUMLAH BESAR</i>		RM 5325	
E	Declaration by applicant / Akuan Pemohon (Please tick (✓)): / (Sila tanda (✓)):		

I hereby declare that:

Saya dengan ini mengaku bahawa:

- ☐ 1. **All information stated here are accurate, and PJI has right to reject or to cancel the offer without prior notice if there is any inaccurate information given.**
Semua maklumat yang diisi adalah benar, PJIM&A berhak menolak permohonan atau membatalkan tawaran pada bila-bila masa sekiranya keterangan yang dikemukakan adalah tidak benar.
- ☐ 2. **Application of this research is presented for the Geran Semarak Penyelidikan**
Permohonan penyelidikan ini dikemukakan untuk Geran Semarak Penyelidikan.
- ☐ 3. **Application of this research is subject to Ethical Committee approval (if applicable).**
Permohonan penyelidikan ini dimajukan ke Jawatankuasa Etika (jika berkenaan).

Date :

Tarikh : 24/11/2024

Applicant's Signature :

Tandatangan Pemohon : _____


PROF. MADYA DR. AHMAD SYED MOHD KASSIM
TIMBALAN REKTOR HAL-EPHORI AGCENNA
UiTM CAWANGAN PERLIS

Note: APPLICATIONS SUBMITTED WILL BE TREATED IN FULL CONFIDENCE. THE DECISION OF THE INTERNAL RESEARCH ACCULTURATION MAIN COMMITTEE UiTM CAWANGAN PERLIS IS FINAL.
Semua permohonan dianggap sulit. Keputusan Jawatankuasa Induk Geran Penyelidikan Pembudayaan Dalam UiTM Cawangan Perlis adalah MUKTAMAD.

Kod Rujukan: (Diisi oleh PJI)	
RIG	
Bukti Kolaborasi	

(Diisi oleh PJI)

BORANG PERMOHONAN GERAN SEMARAK PENYELIDIKAN (GSP) 2024 Bahagian Penyelidikan & Jaringan Industri (PJI) UiTM CAWANGAN PERLIS			
A	TITLE OF PROPOSED RESEARCH: <i>Tajuk penyelidikan yang dicadangkan:</i> Mechanistic Exploration of Urease Enzyme Inhibition by Organosulfur Compounds via automated computational interaction site screening (aISS) of Semi-empirical GFN2-xTB Method		
B	DETAILS OF RESEARCHER / MAKLUMAT PENYELIDIK		
B(i)	<table><tr><td> Name of Project Leader: <i>Nama Ketua Projek:</i> MOHD HAFIZ BIN YAAKOB </td><td> IC / Passport Number: <i>No. Kad Pengenalan/ Pasport:</i> 850106-14-5111 </td></tr></table>	Name of Project Leader: <i>Nama Ketua Projek:</i> MOHD HAFIZ BIN YAAKOB	IC / Passport Number: <i>No. Kad Pengenalan/ Pasport:</i> 850106-14-5111
Name of Project Leader: <i>Nama Ketua Projek:</i> MOHD HAFIZ BIN YAAKOB	IC / Passport Number: <i>No. Kad Pengenalan/ Pasport:</i> 850106-14-5111		
B(iii)	Faculty/School/Centre/Unit (Please provide full address): <i>Fakulti/Jabatan /Pusat/Unit</i> Fakulti Sains Gunaan, UiTM Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis		
B(iv)	<table><tr><td> Office Telephone No.: <i>No. Telefon Pejabat:</i> - </td><td> Handphone No.: <i>No. Telefon Bimbit:</i> 012-3846748 </td></tr></table>	Office Telephone No.: <i>No. Telefon Pejabat:</i> -	Handphone No.: <i>No. Telefon Bimbit:</i> 012-3846748
Office Telephone No.: <i>No. Telefon Pejabat:</i> -	Handphone No.: <i>No. Telefon Bimbit:</i> 012-3846748		

B(v)	E-mail Address: Alamat e-mel: hafiz959@uitm.edu.my																											
B(vi)	Date of first appointment with this University: Tarikh mula berkhidmat dengan Universiti ini: 1 st February 2011																											
C	RESEARCH INFORMATION / MAKLUMAT PENYELIDIKAN																											
C(i)	Research Domain (Please tick (✓)): Domain Penyelidikan (Sila tanda (✓)): A. Pure and Applied Sciences (Sains Tulen dan gunaan) <table border="0"> <tr> <td>☒ Chemistry (Kimia)</td> <td>☐ Physic (Fizik)</td> <td>☐ Biology (Biologi)</td> </tr> <tr> <td>☐ Biochemistry (Biokimia)</td> <td>☐ Materials Science (Sains Bahan)</td> <td>☐ Mathematics and Statistics (Matematik dan Statistik)</td> </tr> <tr> <td>☐ Materials Science (Sains Bahan)</td> <td></td> <td></td> </tr> </table> B. Social Sciences (Sains Sosial) <table border="0"> <tr> <td>☐ Anthropology (Antropologi)</td> <td>☐ Psychology (Psikologi)</td> <td>☐ Sociology (Sosiologi)</td> </tr> <tr> <td>☐ Political Science (Sains Politik)</td> <td>☐ Business and Management (Pengurusan dan Perniagaan)</td> <td>☐ Geography (Geografi)</td> </tr> <tr> <td>☐ Economic (Ekonomi)</td> <td>☐ Human Ecology (Ekologi Manusia)</td> <td>☐ Communication (Komunikasi)</td> </tr> </table> C. Arts and Applied Arts (Sastera dan Sastera Ikhtisas) <table border="0"> <tr> <td>☐ Language and Linguistic (Bahasa dan Linguistik)</td> <td>☐ Literature (Kesusasteraan)</td> <td>☐ Religion (Agama)</td> </tr> <tr> <td>☐ Philosophy (Falsafah)</td> <td>☐ Civilization (Tamadun)</td> <td>☐ History (Sejarah)</td> </tr> <tr> <td>☐ Art (Seni)</td> <td>☐ Culture (Budaya)</td> <td>☐ Education (Pendidikan)</td> </tr> </table>	☒ Chemistry (Kimia)	☐ Physic (Fizik)	☐ Biology (Biologi)	☐ Biochemistry (Biokimia)	☐ Materials Science (Sains Bahan)	☐ Mathematics and Statistics (Matematik dan Statistik)	☐ Materials Science (Sains Bahan)			☐ Anthropology (Antropologi)	☐ Psychology (Psikologi)	☐ Sociology (Sosiologi)	☐ Political Science (Sains Politik)	☐ Business and Management (Pengurusan dan Perniagaan)	☐ Geography (Geografi)	☐ Economic (Ekonomi)	☐ Human Ecology (Ekologi Manusia)	☐ Communication (Komunikasi)	☐ Language and Linguistic (Bahasa dan Linguistik)	☐ Literature (Kesusasteraan)	☐ Religion (Agama)	☐ Philosophy (Falsafah)	☐ Civilization (Tamadun)	☐ History (Sejarah)	☐ Art (Seni)	☐ Culture (Budaya)	☐ Education (Pendidikan)
☒ Chemistry (Kimia)	☐ Physic (Fizik)	☐ Biology (Biologi)																										
☐ Biochemistry (Biokimia)	☐ Materials Science (Sains Bahan)	☐ Mathematics and Statistics (Matematik dan Statistik)																										
☐ Materials Science (Sains Bahan)																												
☐ Anthropology (Antropologi)	☐ Psychology (Psikologi)	☐ Sociology (Sosiologi)																										
☐ Political Science (Sains Politik)	☐ Business and Management (Pengurusan dan Perniagaan)	☐ Geography (Geografi)																										
☐ Economic (Ekonomi)	☐ Human Ecology (Ekologi Manusia)	☐ Communication (Komunikasi)																										
☐ Language and Linguistic (Bahasa dan Linguistik)	☐ Literature (Kesusasteraan)	☐ Religion (Agama)																										
☐ Philosophy (Falsafah)	☐ Civilization (Tamadun)	☐ History (Sejarah)																										
☐ Art (Seni)	☐ Culture (Budaya)	☐ Education (Pendidikan)																										

☐ Policies and Law
(Dasar dan Undang-undang)

☐ Built Environment
(Alam Bina-
Aspek Kemanusiaan)

☐ Environment
(Alam Sekitar-
Aspek Kemanusiaan)

D. Natural Sciences and National Heritage (*Sains Tabii dan Warisan Negara*)

☐ Environment
(Alam Sekitar)

☐ Forestry
(Perhutanan)

☐ Agriculture
(Pertanian)

☐ Marine
(Marin)

☐ Archaeology
(Arkeologi)

☐ Geoscience
(Geosains)

☐ Ethnography
(Etnografi)

☐ Built Environment
(Heritage Aspect)
Alam Bina (Aspek Warisan)

☐ Culture
(Budaya)

☐ Biodiversity
(Kepelbagaian Biologi)

E. Information and Communication Technology (*Teknologi Maklumat dan Komunikasi*)

☐ Software and Information System
(Perisian dan Sistem Maklumat)

☐ Soft Computing
(Pengkomputeran Lembut)

☐ Computer Networking
(Rangkaian Komputer)

☐ Information Security
(Keselamatan Maklumat)

☐ Multimedia
(Multimedia)

☐ Computer Engineering
(Kejuruteraan Komputer)

☐ Computer Science
(Sains Komputer)

F. Health Sciences (*Sains Kesihatan*)

☐ Basic Medical Sciences
(Sains Perubatan Asas)

☐ Pharmacy
(Farmasi)

☐ Pharmacology
(Farmakologi)

☐ Medical Microbiology
(Mikrobiologi Perubatan)

☐ Parasitology
(Parasitologi)

☐ Pathology
(Pathologi)

☐ Community Medical Prevention
(Perubatan Pencegahan
Masyarakat)

☐ Clinical Surgical
(Klinikal Surgikal)

☐ Clinical Medical
(Klinikal Medikal)

☐ Associate Health Science
(Sains Kesihatan Bersekutu)

☐ Dental
(Pergigian)

☐ Nursing Science
(Sains Kejururawatan)

C(ii)	Location of Research: <i>Tempat penyelidikan dijalankan:</i> Makmal Fizik Interaktif, Bangunan Al-Farabi 3, UiTM Perlis Branch				
C(iii)	Duration of this research (Maximum 24 months): <i>Tempoh masa penyelidikan ini (Maksimum 24 bulan):</i> Duration: 2 year <i>Tempoh :</i> From : 1 Jan 2025 <i>Dari :</i> To : 31 Dec 2026 <i>Hingga :</i>				
C(iv)	Other Researchers: <i>Ahli-ahli penyelidik yang lain:</i>				
	Bil	Name <i>Nama</i>	IC / Staff Number: <i>No. Kad Pengenalan/ No. Pekerja:</i>	University / Industry / Agency <i>Fakulti/ P.Pengajian/ Pusat/Unit</i>	Academic Qualification/ Designation <i>Tahap Kelayakan Akademik/Jawatan</i>
	1	Ang Lee Sin	301631	UiTM Caw. Perlis/Fakulti Sains Gunaan/Fizik	PhD / Pensyarah Kanan
	2	Zaidi Ab Ghani	279433	UiTM Caw. Perlis/Fakulti Sains Gunaan/Kimia	PhD / Pensyarah Kanan
	3	Norlin Shuhaime	309277	UiTM Caw. Perlis/Fakulti Sains Gunaan/Fizik	Msc / Pensyarah
	4	Nor Atikah Husna Ahmad Nasir	325361	UiTM Caw. Perlis/Fakulti Sains Gunaan/Biologi	Msc / Pensyarah
	5	Sharifah Zati Hanani Syed Zuber	841223-09-5104	UniMAP/Fakulti Kejuruteraan Teknologi Kimia	Msc / Pensyarah

C(vi)	Please provide information on academic publications that has been published by the project leader for the last five (5) years. (Example: Journals, Books, Chapters in books, etc) <i>Sila kemukakan maklumat berkaitan penerbitan akademik yang telah diterbitkan oleh ketua penyelidik dalam tempoh lima (5) tahun terakhir. (Contoh: Jurnal, buku, bab dalam buku, dll)</i>		
	Title of publication <i>Tajuk penerbitan</i>	Name of journals/books <i>Nama jurnal/buku</i>	Year published <i>Tahun diterbitkan</i>
	Theoretical Study on the Disparate Spatial Arrangement of 3',4',5,7-tetrahydroxy-3-flavene Towards Jack Bean Urease Enzyme Active Site	Malaysian Journal of Fundamental and Applied Sciences (WoS indexed)	2024
	Kinetic, Isotherm, and Thermodynamic Studies of the Removal of Dissolved Chemical Oxygen Demand (dCOD) from Landfill Leachate by Iron Oxide Nanoparticles (IONPs)	Malaysian Journal of Chemistry (Scopus indexed)	2024
	Interactions of Urease with Flavone: A Theoretical Perspective	Journal of Sustainability Science and Management (Scopus indexed)	2023
	More Than Five Decades of Research on Urease Inhibitors: A Bibliometric Study	Journal of Sustainability Science and Management (Scopus indexed)	2022
	Structural and Electronic Properties of NBPT Inhibitor Attached to Urease	The 1st International Recent Trends in Engineering, Advanced Computing and Technology Conference 2020	2021
C(vii)	Executive Summary of Research Proposal (maximum 300 words) (Please include the problem statement, objectives, research methodology, expected output/outcomes/implication, and significance of output from the research project) <i>Ringkasan Cadangan Eksekutif Penyelidikan (maksimum 300 patah perkataan)</i> <i>(Meliputi pernyataan masalah, objektif, kaedah penyelidikan, jangkaan hasil penyelidikan/implikasi dan kepentingan output projek penyelidikan)</i> Improving fertilizer efficiency is essential for sustainable agriculture, as urea-based fertilizers are a cost-effective nitrogen source. However, their rapid hydrolysis by soil urease leads to excessive ammonia emissions, causing environmental and health issues. While synthetic inhibitors like NBPT are effective, they pose toxicity, environmental instability, and adverse plant effects. Natural inhibitors, such as plant-based organosulfur compounds, offer an eco-friendly alternative with the potential to chelate urease active sites. Nevertheless, the molecular interactions between organosulfur compounds and urease are not well understood, hindering the rational development of effective inhibitors. This study aims to address this gap using automated Interaction Site Screening (aISS) docking submodule and GFN2-xTB method through computer-based simulations, known for their reliability in structural and electronic property analysis. We will examine organosulfur compounds, including diallyl sulfide (DAS), diallyl disulfide (DADS), diallyl trisulfide (DATS), allicin, and alliin, utilizing Multiwfn for topological studies. The analysis will focus on binding types, relative stabilities, and reactivity, employing molecular orbital theory and topological analysis. The goal is to align molecular simulations with experimental data, providing insights into effective urease inhibitors. Anticipated outcomes include the identification of eco-friendly urease inhibitors, development of plant-based inhibitors, and optimization of inhibitors through structure-based design, thus contributing to sustainable agricultural practices.		

C(viii)

Detailed proposal of research project:

Cadangan maklumat penyelidikan secara terperinci:

(a) **Research background including:** / *Latarbelakang penyelidikan termasuk:*

i) **Problem Statement** / *Pernyataan Masalah*

Improving fertilizer efficiency is crucial for sustainable agriculture as urea-based fertilizers provide a cost-effective source of nitrogen. However, their rapid hydrolysis by the enzyme urease in the soil leads to excessive NH_3 emissions, leading to environmental and health problems. To counteract this problem, the EU has approved urease inhibitors under the National Emission Ceilings Directive to reduce these emissions. Although synthetic inhibitors such as NBPT are effective, they present challenges such as toxicity, environmental instability and adverse effects on plants. Natural inhibitors, like the plant-based organosulfur compound, are significant because they are environmentally friendly and have the potential to chelate with the urease active site form. However, the interactions between organosulfur and urease remain poorly understood at the molecular level, limiting the rational development of effective inhibitors. Quantum mechanical calculations such as aISS and GFN2-xTB from semi-empirical tight binding approaches can provide crucial insights into the structural and electronic properties of flavonoid-urease complexes and pave the way for the development of effective, sustainable urease inhibitors for environmentally friendly urea-based fertilizers.

ii) **Hypothesis** / *Hipotesis*

- Organosulfur compounds are capable of inhibiting urease due to their ability to interact with the enzyme and disrupt its activity.
- Urease-inhibitor complexes will undergo structural and electronic changes in comparison to their initial states due to the nature of the constituents; the configurations with the lowest relative energy will be the most stable.
- Due to their individual preferences, the reactants in urease-inhibitor systems will follow distinct pathways when combining to form a product.

iii) **Research Questions** / *Persoalan Penyelidikan*

1. How organosulfur compounds bind to the urease active site, and what are their binding modes and affinities as determined by the automated Interaction Site Screening docking submodule and GFN2-xTB method?
2. How the structural and electronic properties of the urease active site change upon binding of organosulfur compounds, as determined through topological analysis?

iv) **Literature Reviews** / *Kajian Literatur*

A) Urea hydrolysis by Urease Enzyme

Hydrolysis of urea is a crucial biochemical process that converts urea into ammonia and carbon dioxide, catalyzed primarily by the enzyme urease (Figure 1). This response is important in biological systems and has profound implications for agricultural practices, particularly the use of nitrogen fertilizers. The efficiency of urea hydrolysis affects the nitrogen availability of crops, thereby influencing agricultural productivity and environmental sustainability [1].

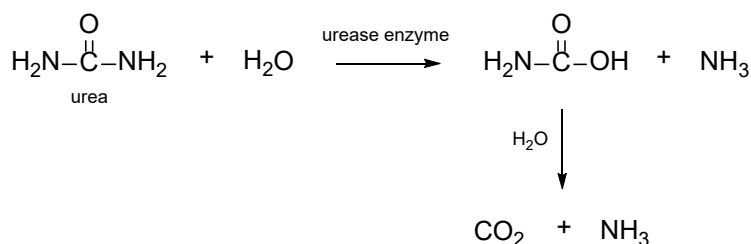


Figure 1. Hydrolysis of urea with urease enzyme as catalyst.

The mechanism of urea hydrolysis by urease involves the formation of a transient enzyme-substrate complex, whereby the urease enzyme facilitates the nucleophilic attack of water on the carbonyl carbon of urea as shown in Figure 2. This reaction leads to the formation of carbamate, which subsequently decomposes into ammonia and carbon dioxide. The catalytic efficiency of urease is influenced by several factors, including pH, temperature, and the presence of metal ions, which are essential for the structural integrity and activity of the enzyme.

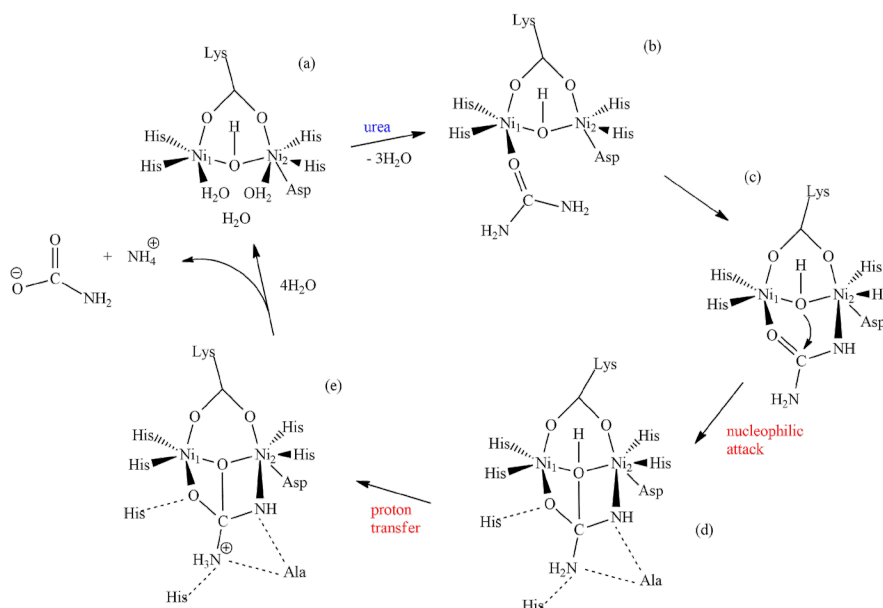


Figure 2. The proposed catalytic mechanism of urea hydrolysis by urease enzyme [2].

Urea is widely used as a nitrogen fertilizer due to its high nitrogen content (approximately 46% by weight) and cost-effectiveness. However, its rapid hydrolysis can lead to significant nitrogen losses through volatilization and leaching, leading to environmental problems such as groundwater pollution and air pollution [3]. Studies have shown that under optimal soil conditions, urea can completely hydrolyze within a few days, which can lead to ammonia volatilization if improperly handled [4, 5]. For example, it has been reported that urea fertilizer can fully hydrolyze within three days to a week depending on soil conditions. This rapid hydrolysis can be harmful because it may not match plants' nitrogen uptake patterns, leading to inefficiencies in fertilizer use [6].

B) Use of Urease Inhibitor in Agricultural Industry

To mitigate these losses, various strategies have been developed, including the use of urease inhibitors. The use of urease inhibitors in the agricultural industry has attracted considerable attention due to their potential to increase nitrogen use efficiency (NUE) and reduce nitrogen losses through fertilization practices. Urease inhibitors such as N-(n-butyl)thiophosphoric triamide (NBPT) slow the hydrolysis of urea, which is critical for minimizing ammonia volatilization as a major pathway for nitrogen losses in agricultural [7, 8]. This mechanism not only helps retain nitrogen in the soil, but also contributes to better crop yields and reduced environmental impacts associated with nitrogen fertilizers [9]. Research suggests that the use of urease inhibitors can result in significant agronomic benefits. For example, studies have shown that the use of NBPT can lead to yield increases of approximately 5.3% on average in various crops because it can compete with urea for the active sites of urease enzymes, thereby inhibiting the rapid conversion of urea to ammonia [10]. Furthermore, combining urease inhibitors with nitrification inhibitors has been shown to further improve soil nitrogen retention by delaying the conversion of ammonium to nitrate, which is susceptible to leaching [11, 12]. This synergistic effect not only improves nitrogen availability for plant uptake but also reduces nitrous oxide emissions, a potent greenhouse gas associated with nitrogen fertilization [13]. The main advantage of using urease inhibitors is summarized in Figure 3. However, synthetic chemical urease inhibitors such as NBPT, though beneficial for controlling urea breakdown, can lead to harmful side effects in the agricultural ecosystem.

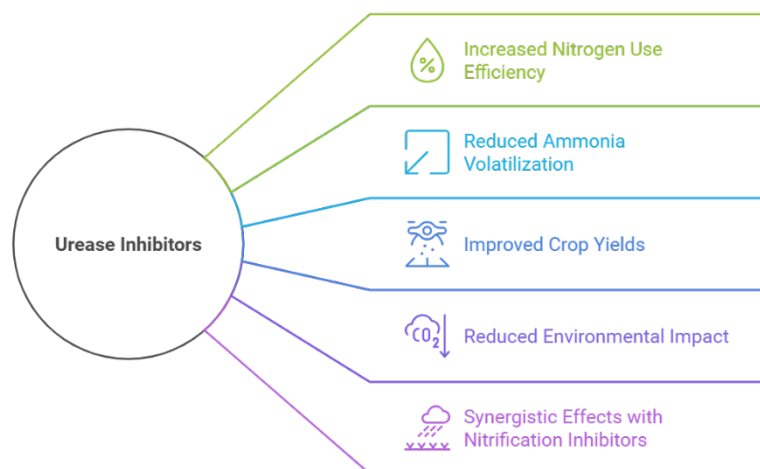


Figure 3. Key benefits of using urease inhibitors in agriculture.

The use of synthetic chemical urease inhibitors in agriculture has raised significant concerns about their negative effects on the environment and human health. Urease inhibitors are designed to slow the hydrolysis of urea, thereby reducing nitrogen losses and improving nitrogen use efficiency in crops. Despite their intended use, these applications might inadvertently bring about unfavourable impacts on soil fertility and the overall ecological balance. One of the primary negative effects of synthetic urease inhibitors is their contribution to soil degradation. While these inhibitors can reduce NH₃ emissions from urea-fertilized soils, their long-term effects on soil microbial communities and nutrient cycling remain a concern. Studies have shown that the application of NBPT urease inhibitors can alter the natural balance of soil nutrients, potentially leading to nutrient depletion and reduced soil fertility over time [9, 13].

Additionally, the environmental impacts of synthetic urease inhibitors extend beyond soil health. Runoff from fields treated with these chemicals can contaminate water bodies and lead to eutrophication, disrupting aquatic ecosystems and threatening biodiversity [14]. The accumulation of synthetic chemicals in the environment poses risks not only to wildlife but also to human health, as these substances enter the food chain and can lead to chronic health problems [15, 16]. The

persistence of synthetic chemicals in the environment raises concerns about their long-term impacts, as they can persist in soil and water systems for extended periods of time and cause cumulative damage. Consequently, there is an increasing need to explore natural source compounds as urease inhibitors, which are biodegradable and less likely to accumulate in the environment, thereby offering a more sustainable and eco-friendlier alternative for agricultural practices.

C) Organosulfur as Natural Source Urease Inhibitor

Organosulfur compounds have emerged as important natural urease inhibitors in the agricultural sector, primarily due to their ability to mitigate ammonia volatilization from urea fertilizers. Studies show that organosulfur compounds, such as those obtained from garlic (*Allium sativum*), have a strong urease-inhibiting effect and effectively reduce the catalytic capacity of urease in the soil [17, 18]. The inhibition mechanism is often attributed to the interaction of thiol groups in organosulfur with cysteine group in urease (as shown in Figure 4), which can bind to the active site of urease and thus prevent its enzymatic action.

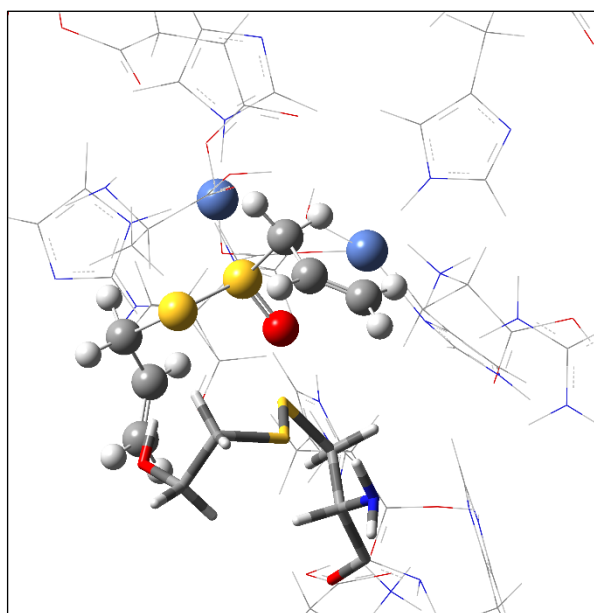


Figure 4. The interaction between allicin, an organosulfur compound (ball and stick structure) with urease active site; blue spheres: nickel ions; tube: cysteine residue; wireframe: other urease residues.

Recent studies have highlighted the effectiveness of various organosulfur compounds, including allicin and diallyl disulfide (DADS), has been reported to be one of the most potent inhibitors of urease activity [19]. The use of these natural inhibitors not only increases the efficiency of urea fertilizers but also contributes to sustainable agricultural practices by minimizing nitrogen losses and reducing the environmental impact of fertilization [20]. Furthermore, the use of natural urease inhibitors meets the growing demand for environmentally friendly agricultural solutions as they pose minimal risks to soil health and biodiversity compared to synthetic alternatives [5]. Given the significant advantages of organosulfur compounds, it is essential to investigate the precise mechanisms by which these inhibitors affect urease activity at the molecular level. Understanding these mechanisms can provide deeper insights into their binding interactions, the structural changes induced in the enzyme, and the overall inhibitory pathway. Such detailed knowledge can facilitate the design of more effective and specific inhibitors, enhance the development of sustainable agricultural practices, and potentially uncover new applications for these natural compounds in other fields.

D) Theoretical Investigations on Urease Inhibition

Theoretical studies on the inhibition of the urease enzyme using computational tools provide valuable insights into the mechanisms of inhibition and help in the development of novel inhibitors with improved potency and selectivity. Automated interaction site screening (aISS) and the semiempirical quantum mechanical method GFNn-xTB can be used to predict the binding modes and affinities of organosulfur compounds to the target region of the enzyme (active site or cavity) by generating ligand conformations and calculating their binding energies in the optimized geometry the complex [21, 22]. Several studies have examined how different inhibitors interact with the active site of urease. GFNn-xTB provides insights into the flexibility of enzymes and the interactions of inhibitors with large numbers of atoms (from a few hundred to thousands of atoms) [23, 24]. In conclusion, theoretical investigation on urease enzyme inhibition involves the use of various computational tools and techniques to study the interactions between the enzyme and its inhibitors at the molecular level. These studies provide valuable insights into the mechanism of enzyme inhibition and can help in the development of novel urease inhibitors with improved potency and select the potential candidates for further comparison and production.

v) **Related References** / Rujukan berkaitan

- [1] Atav, V., Gürbüz, M. A., Kayali, E., and Yalinkiliç, E. (2024). Optimizing Nitrogen Management in Maize (*Zea mays* L.) Using Urease and Nitrification Inhibitors. *Communications in soil science and plant analysis*, 1-14. <https://doi.org/10.1080/00103624.2024.2424236>
- [2] Svane, S., Sigurdarson, J. J., Finkenwirth, F., Eitinger, T., and Karring, H. (2020). Inhibition of urease activity by different compounds provides insight into the modulation and association of bacterial nickel import and ureolysis. *Scientific Reports*, 10(1). <https://doi.org/10.1038/s41598-020-65107-9>
- [3] Javazmi, L., Low, T., Ash, G., and Young, A. (2020). Investigation of slow release of urea from biodegradable single- and double-layered hollow nanofibre yarns. *Scientific Reports*, 10(1), 19619. <https://doi.org/10.1038/s41598-020-76395-6>
- [4] Mobley, H. L. T., Island, M. D., and Hausinger, R. P. (1995). Molecular-biology of microbial ureases. *Microbiological reviews*, 59(3), 451-480. <https://doi.org/10.1128/MMBR.59.3.451-480.1995>
- [5] Li, J. *et al.* (2021). Potential of *chamomile recutita* plant material to inhibit urease activity and reduce NH₃ volatilization in two agricultural soils. *Atmosphere*, 12(9), 1223. <https://doi.org/10.3390/atmos12091223>
- [6] Swify, S., Mazeika, R., Baltrusaitis, J., Drapanauskaite, D., Barcauskaite, K., and Mancinelli, R. (2024). Review: Modified urea fertilizers and their effects on improving nitrogen use efficiency (NUE). *Sustainability*, 16(1), 188. <https://doi.org/10.3390/su16010188>
- [7] Owens, J. L. *et al.* (2023). Winter wheat responses to enhanced efficiency liquid nitrogen fertilizers in the Canadian Prairies. *Canadian journal of plant science*, 103(4), 353-367. <https://doi.org/10.1139/CJPS-2022-0208>
- [8] Mergener, R. A., Sangoi, L., and Coelho, A. E. (2022). Productivity and profitability of maize as affected by nitrogen sources and rates. *Semina-ciencias agrarias*, 43(4), 1457-1468. <https://doi.org/10.5433/1679-0359.2022v43n4p1457>
- [9] Krol, D. J., Forrestal, P. J., Wall, D., Lanigan, G. J., Sanz-Gomez, J., and Richards, K. G. (2020). Nitrogen fertilisers with urease inhibitors reduce nitrous oxide and ammonia losses, while retaining yield in temperate grassland. *Science of the total environment*, 725, 138329. <https://doi.org/10.1016/j.scitotenv.2020.138329>
- [10] Liu, S. L., Wang, X. H., Yin, X. H., Savoy, H. J., McClure, A., and Essington, M. E. (2019). Ammonia Volatilization Loss and Corn Nitrogen Nutrition and Productivity with Efficiency Enhanced UAN and Urea under No-tillage. *Scientific reports*, 9, 6610. <https://doi.org/10.1038/s41598-019-42912-5>
- [11] Li, Y. Y. *et al.* (2020). Agronomic evaluation of polymer-coated urea and urease and nitrification inhibitors for cotton production under drip-fertigation in a dry climate. *Scientific reports*, 10(1), 1472. <https://doi.org/10.1038/s41598-020-57655-x>

- [12] Chen, M. T. L. *et al.* (2023). Evidence map of the benefits of enhanced-efficiency fertilisers for the environment, nutrient use efficiency, soil fertility, and crop production. *Environmental research letters*, 18(4), 043005. <https://doi.org/10.1088/1748-9326/acb833>
- [13] Deng, B. L., Shen, F. F., Guo, X. M., Siemann, E., and Zhang, L. (2022). Urease inhibitor and biochar independently affected N₂O emissions from *Camellia oleifera* soils. *Plant soil and environment*, 68(9), 424-430. <https://doi.org/10.17221/112/2022-PSE>
- [14] Kergosien, N., Stiger-Pouvreau, V., Connan, S., Hennequart, F., and Brébion, J. (2023). Mini-Review: brown macroalgae as a promising raw material to produce biostimulants for the agriculture sector. *Frontiers in agronomy*, 5, 1109989. <https://doi.org/10.3389/fagro.2023.1109989>
- [15] Katt, F. and Meixner, O. (2020). A systematic review of drivers influencing consumer willingness to pay for organic food. *Trends in food science & technology*, 100, 374-388. <https://doi.org/10.1016/j.tifs.2020.04.029>
- [16] Thiviya, P., Gunawardena, N., Gamage, A., Madhujith, T., and Merah, O. (2022). Apiaceae Family as a Valuable Source of Biocidal Components and their Potential Uses in Agriculture. *Horticulturae*, 8(7), 614. <https://doi.org/10.3390/horticulturae8070614>
- [17] Bouamrane, S. *et al.* (2024). Garlic as an effective antifungal inhibitor: A combination of reverse docking, molecular dynamics simulation, ADMET screening, DFT, and retrosynthesis studies. *Arabian Journal of Chemistry*, 17(3), 105642. <https://doi.org/https://doi.org/10.1016/j.arabjc.2024.105642>
- [18] Mathialagan, R., Mansor, N., Al-Khateeb, B., Mohamad, M. H., and Shamsuddin, M. R. (2017). Evaluation of Allicin as Soil Urease Inhibitor. *Procedia Engineering*, 184, 449-459. <https://doi.org/10.1016/j.proeng.2017.04.116>
- [19] Salehuddin, N. F., Mansor, N., Yahya, W. Z. N., Noor Affendi, N. M., and Manogaran, M. D. (2021). Organosulfur Compounds as Soil Urease Inhibitors and Their Effect on Kinetics of Urea Hydrolysis. *Journal of Soil Science and Plant Nutrition*, 21(4), 2652-2659. <https://doi.org/10.1007/s42729-021-00553-6>
- [20] Affendi, N. M. N., Mansor, N., and Samiri, S. S. (2020). Addition of Chemical and Natural Urease Inhibitors in Reducing Ammonia and Nitrous Oxide Losses. *Journal of soil science and plant nutrition*, 20(1), 253-258. <https://doi.org/10.1007/s42729-019-00136-6>
- [21] Bannwarth, C., Ehlert, S., and Grimme, S. (2019). GFN2-xTB—An Accurate and Broadly Parametrized Self-Consistent Tight-Binding Quantum Chemical Method with Multipole Electrostatics and Density-Dependent Dispersion Contributions. *Journal of Chemical Theory and Computation*, 15(3), 1652-1671. <https://doi.org/10.1021/acs.jctc.8b01176>
- [22] Plett, C. and Grimme, S. (2023). Automated and Efficient Generation of General Molecular Aggregate Structures. *Angewandte Chemie International Edition*, 62(4), e202214477. <https://doi.org/https://doi.org/10.1002/anie.202214477>
- [23] Iwanek, W. (2022). Theoretical calculations of formation and reactivity of o-quinomethide derivatives of resorcin[4]arene with reference to empirical data. *Royal society open science*, 9(10), 220541. <https://doi.org/10.1098/rsos.220541>
- [24] Peng, C. *et al.* (2019). Improving the accuracy of predicting protein–ligand binding-free energy with semiempirical quantum chemistry charge. *Future Medicinal Chemistry*, 11(4), 303-321. <https://doi.org/10.4155/fmc-2018-0207>

vi) **Relevance to Government Policy, if any / Perkaitan dengan Dasar Kerajaan, jika berkenaan**

The Malaysian government is pursuing several agricultural policies aimed at promoting sustainable development, improving food security and improving farmers' livelihoods. The most relevant key policy is the so-called National Agricultural and Food Policy 2021-2030 (NAP2.0). The NAP2.0 was launched in 2019 as a continuation of the NAP. The policy aims to transform the agrofood sector into a high-income and high-value industry. The NAP2.0 focuses on six key areas: modernizing agriculture, increasing productivity, promoting value-added activities, strengthening the supply chain, promoting sustainability and increasing competitiveness. Overall, the Malaysian government's agricultural policy emphasizes the importance of sustainable development, technology and innovation, as well as improving the competitiveness of the sector. These measures are intended to ensure that the country's agricultural sector can meet the food security needs of the population while contributing to the country's economic growth.

(b) Objective (s) of the Research

Objektif Penyelidikan

- i) To ascertain the binding modes and binding affinities of various organosulfur compounds at the urease active site using automated Interaction Site Screening docking submodule and GFN2-xTB method.
- ii) To elucidate changes in the structural and electronic effects of organosulfur compounds binding on the enzyme's active site using topological analysis.

(c) Methodology

Kaedah penyelidikan

Please state in the form / Sila nyatakan di borang ini

Description of the research methodology:

This study will be executed by automated Interaction Site Screening (aISS) docking submodule and GFN2-xTB method using computer-based simulations. This level of theory is generally considered to provide reliable results on the structural and electronic properties. The urease inhibitors considered in this study are organosulfur compounds of diallyl sulfide (DAS), diallyl disulfide (DADS), diallyl trisulfide (DATS), allicin, and alliin.

Multiwfn is further used to study the topology of the resulting combined molecules. The analysis will include the types of binding, the relative stabilities and the reactivity of the combinations. Molecular orbital theory, particularly Richard Bader's linear combination of atomic orbitals (LCAO) and atoms in molecules (AIM), will be the backbone of electronic structure and topology analysis. The main goal of this study will be to reconcile the results between molecular simulations and experimental data. The information obtained will help shed light on the factors that influence a compound as inhibitors. The research framework of this study are shown in Figure 5.

Phase 1:

The research activity focused on identifying suitable crystal structures of organosulfur inhibitors and urease enzymes. Using suitable crystal structure data in theoretical studies is essential for accurate and reliable computational models. It ensures precise atomic details, which are crucial for validating predictions against experimental data and understanding material properties. High-quality structural data also enhances simulation accuracy and ensures reproducible scientific findings.

Jack bean urease (JBU), also known as the Canavalia Ensiformis enzyme, will be chosen due its exceptional ureolytic activity. Research indicates that JBU can demonstrate ureolytic activity ranging from 2700 to 3500 μmol urea/min mg, depending on the enzyme's purity and conditions. the 3LA4 JBU crystal structure will be truncated to form active site with the following residues His407, His409, Lys490, His492, Asp494, His519, His545, Cys592, His593, Arg609, Asp633 and Ala636 retained. Hence, the 3LA4 JBU crystal structure from RCSB Protein Data Bank will be selected to be used in this study due to the stated less than 10% difference between R-free and R-work value, as it is considered as a high-resolution structure and provides exact insights into the protein's structure and function. For the organosulfur compounds, diallyl sulfide (DAS), diallyl disulfide (DADS), diallyl trisulfide (DATS), allicin, and alliin will be used as the inhibitor. All structures will be evaluated using GaussView 5.0 software.

Phase 2:

The automated interaction site screening (aISS) docking submodule will be used to study the preferred orientation of organosulfur compounds into the surrounding of urease enzyme. The parameters used in this study will be set to the default mode of the aISS docking submodule. All the generated structures will be checked to address any improper issues with the atoms and bond before submitted to the GFN2-xTB calculations in the xTB software version 6.7.1.

The interaction energy (E^{int}) between organosulfur compounds and urease enzyme at the specific orientation will be calculated by Equation 1.

$$E^{\text{int}} = E_{\text{os+urease}} - E_{\text{urease}} - E_{\text{os}} \quad (1)$$

Where,

E^{int} = interaction energy between urease and organosulfur

$E_{\text{os+urease}}$ = energy after minimizing the composite structure

E_{urease} = energy of the composite structure after removing organosulfur structure

E_{os} = energy of the composite after removing the urease molecule

Positive E^{int} indicates the repulsive interaction while the negative reveals the attractive interactions. The geometry of the lowest E^{int} will be submitted to DFT calculations at level B3LYP/6-31G** to benchmark the range of energies calculated between both methods.

Phase 3:

Electrostatic potential (ESP) and quantum theory of atoms in molecules (QTAIM) analysis of the optimized complexes will be performed by Multiwfn software. The ESP coloured molecular surface map will be rendered by VMD molecular graphics viewer (version 1.9.4) based on the outputs of Multiwfn. The grid spacings will be set to 0.2 Bohr and the isosurface of the vdW surface will be around 0.001 e/bohr³. In QTAIM analysis, bond critical points (3,-1) and the associated topological and energetic properties such as Laplacian of electron density, Lagrangian kinetic energy, potential energy density and hydrogen bond binding energy (BEH-bond) will be calculated to evaluate the nature of bonding interactions. Theoretical bond degree parameter ($BD = H_b/\rho_b$) as a function of $|V_b|/G_b$ plot for the strongest and lowest interaction will be analyzed to identify key features of the electron density distribution that characterize the bonding and non-covalent interactions involved in the system. The interatomic interactions were divided into three types: pure closed shell (CS, region I, $\nabla^2\rho_b > 0$, $H_b > 0$), transit closed shell (CS, region II, $\nabla^2\rho_b > 0$, $H_b < 0$), and pure shared shell (SS, region III, $\nabla^2\rho_b < 0$, $H_b < 0$). The BEH-bond for the selected bond critical points (BCPs) will be calculated by Equation 2. The

$$BE_{\text{H-bond}} = -332.34 \times \rho_{\text{BCP}}/\text{a.u.} - 1.0661 \quad (2)$$

To perform reaction pathway analysis, this study will begin by identifying all relevant intermediates and elementary reactions within the optimized complexes. The analysis will involve determining energy barriers and transition states to identify the most favourable reaction routes. Pathways will be visualized using diagrams that highlight the sequence and relative fluxes of reactions. This methodology will help in understanding the evolution of the system over the interaction between the residues, optimizing reaction conditions, and designing strategies to minimize undesired side reactions. By systematically exploring these pathways, the study aims to provide insights into the mechanisms driving chemical transformations and improve the efficiency and selectivity of the processes under investigation.

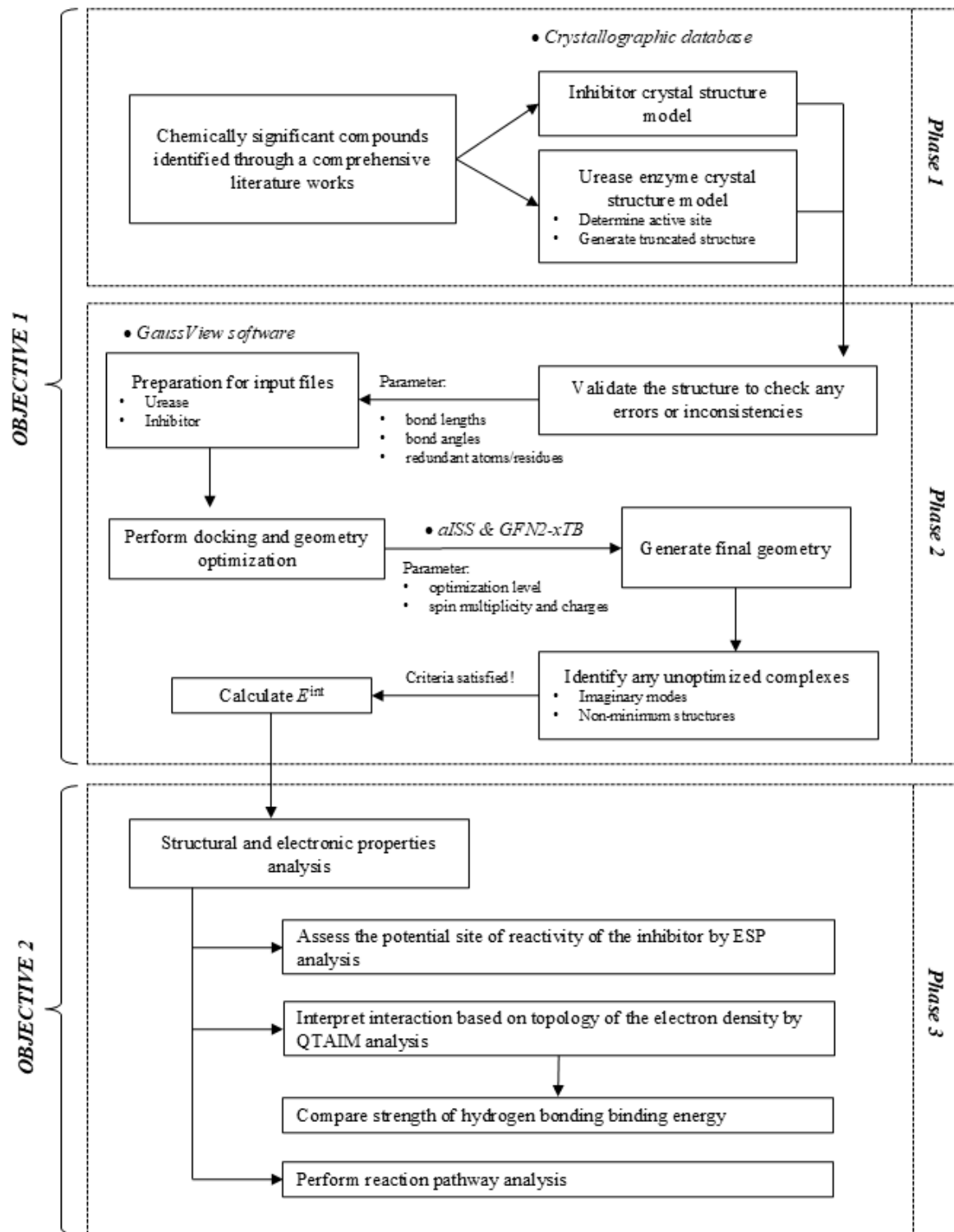


Figure 5. Methodological framework for understanding the interaction of organosulfur compounds with urease.

(d) Expected Results/Benefit
Jangkaan Hasil Penyelidikan

1. Novel theories/New findings/Knowledge

In general, the research findings on inhibitors of urease provide promising avenues for the development of new agricultural additives that can effectively target urease to reduce nitrogen loss in soils.

Specifically, in this project, we set out to find organosulfur compound that are environmentally friendly as urease inhibitor. With this project, we can set up a scheme of work to achieve the following goals:

- a) Use of natural source compounds as urease inhibitors (in this case, organosulfur).
- b) Development of plant-based urease inhibitors (based on the geometry and reaction paths).
- c) Structure-based design of urease inhibitors (the structural analysis helps to optimize urease inhibitors).

2. Research Publications

The output of this research will be published in Computational Biology and Chemistry (WoS/Scopus indexed) or any other publication titles that index by WoS/Scopus.

3. Specific or Potential Grant Applications (please specify targeted grant application)

No specific or potential grant application will be planned with almost similar approach as this proposal because we have managed to get a grant in FRGS 2024. However, we will be hunting FRGS 2025 grant in the field of carbon capture and storage, and electrochemical conversion of CO₂ using computational study.

4. Number of PhD and Masters (by research) Students (if any)

No PhD or MSc. student involvement in this research.

5. Impact on Society, Economy and Nation

The proposed research on mechanistic exploration of urease inhibition by organosulfur compounds directly addresses critical agricultural and environmental challenges and is in line with the UN Sustainable Development Goals (SDGs) and Malaysia's National Agrifood Policy (NAP 2.0, from 2021 to 2030). By identifying effective urease inhibitors, this study can reduce ammonia emissions, improve soil health and increase fertilizer efficiency, contributing to SDG 2 (Zero Hunger) and SDG 13 (Climate Action). It supports sustainable agriculture, promotes Malaysia's agrotechnology and biotechnology industries, thereby promoting SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production). The project is in line with the NAP's goal of modernizing agriculture through innovation, ensuring food security and conserving natural resources.

(e) Research activity & Milestone
Aktiviti penyelidikan & Carta perbatuan

Description	Date	Cumulative Project Completion Percentage (%)
Activity 1: Completion of the task in conducting an extensive literature review on urease enzyme inhibition, organosulfur compounds, and the GFN2-xTB method.	1 Jan 2025	5
Activity 2: Completion of the task in obtaining and evaluating the reliable structures of organosulfur compounds and urease enzyme.	1 Feb 2025	8
Activity 3: Completion of the task in preparing the input files, docking between urease and organosulfur using aISS and geometry optimization of the complexes.	1 Apr 2025	15
Activity 4: Completion of the task in obtaining results on stability and interaction energies from structural analysis.	1 Nov 2025	60
Activity 5: Completion the task in topological analysis (ESP, QTAIM, H _{bond} and reaction pathway mechanism).	1 Mar 2026	75
Activity 6: Completion of the task in preparing and submit research papers to peer-reviewed journal.	1 Jul 2026	90
Activity 7: Completion of the task in submitting the final report and plan for future studies on urease inhibition.	1 Nov 2026 – 31 Dec 2026	100

[illegible]

D	BUDGET /BELANJAWAN							
	Please indicate your estimated budget for this research and details of expenditure according to the guidelines attached. <i>Sila nyatakan anggaran bajet bagi cadangan penyelidikan ini dan berikan butir – butir perbelanjaan lengkap dengan berpandukan kepada garis panduan yang dilampirkan.</i> <table border="1" data-bbox="201 453 1557 747"> <thead> <tr> <th data-bbox="201 453 1122 611" rowspan="2">Budget details <i>Butiran belanjawan</i></th> <th colspan="2" data-bbox="1122 453 1557 611">Amount requested by applicant <i>Jumlah yang dipohon oleh pemohon</i></th> </tr> <tr> <th data-bbox="1122 611 1338 747">Year 1 (Tahun 1) (RM)</th> <th data-bbox="1338 611 1557 747">Year 2 (Tahun 2) (RM)</th> </tr> </thead> </table>			Budget details <i>Butiran belanjawan</i>	Amount requested by applicant <i>Jumlah yang dipohon oleh pemohon</i>		Year 1 (Tahun 1) (RM)	Year 2 (Tahun 2) (RM)
Budget details <i>Butiran belanjawan</i>	Amount requested by applicant <i>Jumlah yang dipohon oleh pemohon</i>							
	Year 1 (Tahun 1) (RM)	Year 2 (Tahun 2) (RM)						
D(i)	Vote 21000 - Travelling and Transportation/ <i>Perjalanan dan Pengangkutan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>							
D(ii)	Vote 24000 - Rental <i>Vot 24000 - Sewaan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i> High end workstation rental fees with this specifications: • Intel® Core™ i9 Processor • 16GB of RAM • SSD storage device Rental fee per month: RM 800 Rental duration: 5 months (first year)	4,000						
D(iii)	Vote 27000 - Research Materials & Supplies <i>Vot 27000 - Bekalan dan Bahan Penyelidikan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>							

D(iv)	Vote 28000 - Maintenance and Minor Repair Services <i>Bvot 28000 - Baik pulih kecil dan ubahsuai</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>		
D(v)	Vote 29000 - Professional Services <i>Vot 29000 - Perkhidmatan Ikhtisas</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i> 1. Journal publication fee (WoS/Scopus indexed): RM 800 2. MyIPO copyright application fees: RM 200		1,000
D(vi)	Vote 35000 - Accessories and Equipment <i>Vot 35000 - Aksesori dan Peralatan</i> Please specify <i>Sila nyatakan secara lengkap dengan pecahannya sekali.</i>		
TOTAL AMOUNT JUMLAH BESAR		5,000	

