PROCEEDINGS

SIMPOSIUM KLUSTER KEJURUTERAAN 2024

Transforming Challenges Into Engineering Opportunities

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PRAKATA

PRAKATA

UCAPAN PERASMIAN

YB Afnan Hamimi Bin Dato' Taib Azamudden
Ketua Pemuda PAS Malaysia, Dewan Pemuda PAS Malaysia

Assalamualaikum warahmatullahi wabarakatuh. Terima kasih kepada Pengerusi Majlis.

Yang dimuliakan barisan dif-dif kehormat: Yang Berusaha Ustaz Hanif Jamaluddin, Naib Ketua Pemuda PAS; Yang Berhormat Puan Mardhiyyah Johari, Ketua Pengarah Ameerah Malaysia, ADUN Negeri Kedah, Peguam Sivil dan Syarie; Yang Berusaha Tuan Muhammad Syahmi Mansor, Ketua Pengarah Jabatan Profesional Muda (JPro), Dewan Pemuda PAS Malaysia, Certified Project Management Professional; Yang Berusaha L.Ar. Haji Fauzi Abu Bakar, Timbalan Pesuruhjaya PAS 1, Badan Perhubungan PAS Wilayah Persekutuan, mantan Presiden Institute Landscape Malaysia (ILAM); dan Yang Berusaha Tuan Azmer Syazwan bin Ahmad Suparmin, Ketua Pemuda PAS Wilayah Persekutuan.

Yang dihormati barisan pengucaptama: Yang Berhormat Ir. Ts. Khairil Nizam Khirudin, Ahli Parlimen Jerantut, mantan staf jurutera PETRONAS, Malaysian DOSH Offshore Self-Regulation Inspector; Prof. Ir. Dr. Hairul, mantan Naib Presiden Penyelidikan dan Inovasi MMU, kini Rektor University College TATI; serta Prof. Madya Dr. Hanif Yaacob, CEO Terengganu Strategic & Integrity Institute (TSIS).

Yang diraikan para pembentang Simposium Kluster Kejuruteraan serta hadirin dan hadirat yang dirahmati Allah sekalian.

Alhamdulillah, syukur ke hadrat Allah SWT kerana dengan izin-Nya kita dapat berhimpun pada pagi yang mulia ini. Selawat dan salam ke atas junjungan besar baginda Nabi Muhammad SAW, pembawa risalah ilmu yang menjadi cahaya penerang kepada umat manusia.

Hadirin yang dihormati, Allah SWT berfirman dalam Surah Az-Zumar ayat 9: "Katakanlah, adakah sama orang-orang yang mengetahui dengan orang-orang yang tidak mengetahui? Sesungguhnya orang yang berakal sahaja yang dapat menerima pelajaran." Ayat ini menegaskan bahawa ilmu adalah asas kemajuan, dan kejuruteraan merupakan salah satu cabang ilmu yang mencorakkan peradaban manusia.

Allah SWT juga berfirman dalam Surah At-Taubah ayat 122 tentang keutamaan sebahagian umat memberi tumpuan mendalami ilmu dan memberi peringatan kepada kaumnya agar mereka dapat menjaga diri. Tuntutan fardhu kifayah ini meliputi penguasaan ilmu teknologi dan kejuruteraan yang memberi manfaat kepada ummah.

Sejarah Islam membuktikan bahawa ilmu dan teknologi menjadi pemacu kegemilangan tamadun. Antara tokoh tersebut ialah Al-Jazari, digelar Master Engineer dan Father of Robotics, melalui karya agungnya Kitab fi Ma'rifat al-Hiyal al-Handasiyya yang menjadi asas kepada banyak perkembangan mekanikal moden. Al-Khwarizmi pula memperkenalkan kaedah sistematik penyelesaian persamaan linear dan kuadratik, asas kepada algebra serta kejuruteraan moden. Terdapat ramai lagi tokoh ilmuwan Islam dalam pelbagai bidang seperti fizik, astronomi, perubatan, muzik dan falsafah.

Sebagaimana sering diingatkan oleh Tuan Guru Haji Abdul Hadi Awang, ilmu adalah amanah untuk kesejahteraan duniawi dan ukhrawi. Ilmu bukan sekadar alat mencapai kejayaan dunia, tetapi juga untuk menegakkan keadilan, kesejahteraan dan kemakmuran umat. Rasulullah SAW bersabda: "Barangsiapa yang menempuh jalan untuk menuntut ilmu, maka Allah akan mudahkan baginya jalan ke syurga." (Riwayat Muslim). Dalam konteks teknokrat dan profesional PAS, golongan ini bukan sekadar pelengkap, malah pemimpin yang membawa Islam ke tahap tertinggi melalui penguasaan ilmu dan akhlak.

Tema “KITA MEMIMPIN” yang diketengahkan dalam Muktamar Dewan Pemuda PAS Malaysia (DPPM) ke-65 menggariskan tiga hala tuju utama: membina generasi sejahtera yang bersedia memimpin kemenangan, memimpin sokongan anak muda, dan menarik sokongan pengundi bukan Islam. Seiring dengan itu, Pemuda PAS memikul tanggungjawab mempersiapkan barisan amilin yang komited melaksanakan dasar-dasar parti serta berupaya menerajui bidang strategik. Simposium ini menjadi medan penting untuk berkongsi pengetahuan, bertukar idea dan memperkukuh jaringan; seterusnya memperkasa golongan muda sebagai pencetus perubahan serta pembawa obor kepimpinan Islam di pelbagai sektor.

Kita maklum bahawa cabaran semasa semakin kompleks. Kejuruteraan bukan sahaja menuntut inovasi, tetapi juga etika supaya teknologi dimanfaatkan selari dengan syarak. Umat Islam perlu menguasai teknologi sambil menerapkan nilai Islam agar menjadi contoh kepada dunia. Seperti diingatkan Ibnu Khaldun, kebangkitan tamadun bergantung kepada kekuatan ilmu dan hanya akan kekal jika dipimpin oleh nilai moral yang kukuh.

Allah SWT mengingatkan dalam Surah Al-Qasas ayat 77 agar kita menyeimbangkan kebahagiaan akhirat dan bahagian dunia, serta menjauhi kerosakan di bumi. Ini menuntut agar ilmu kejuruteraan dijadikan alat kesejahteraan ummah, bukan penyebab ketidakadilan atau kerosakan. Sehubungan itu, umat Islam tidak boleh hanya menjadi pengguna teknologi, tetapi juga pencipta, pembangun dan pemimpin teknologi; teknologi tanpa moral dan akhlak hanya membawa mudarat.

Akhirnya, marilah kita jadikan simposium ini sebagai platform untuk bertukar pandangan, membina jaringan dan memacu teknologi ke tahap lebih tinggi, selari dengan tuntutan Islam. Dalam Surah Hud ayat 61, Allah SWT berfirman bahawa Dia menjadikan kita pemakmur bumi. Dengan lafaz Bismillahirrahmanirrahim, saya dengan ini merasmikan Simposium Kluster Kejuruteraan 2024. Sekian, terima kasih. Wassalamu’alaikum warahmatullahi wabarakatuh.

PENDAHULUAN

Simposium Kluster Kejuruteraan Jabatan Profesional Muda (JPro) Dewan Pemuda PAS Malaysia (DPPM): Transforming Challenges into Engineering Opportunities

Amirruddin Bin Abdul Kadir[1], Muhammad Naqib Bin Mat Asri[1], Aisyah Binti Abd Razak[1], Ahmad Yatimi Bin Mohamad[1], Khairul Hafidz Bin Mohamad Khairi[1], Muhammad Qusyairie Bin Saari[1], Sakinah Binti Mazlan[1], Mohd Fuad Bin Zakaria[1], Zul Fadli Bin Mohamad Tohid[1], Ts. Hani Binti Ihsanuddin[1], Muhamat Naufal Bin Saruji[1], Saifuddin Nur Akmal Bin Sohaimi[1], Ts. Muhammad Luqman Bin Mohd Muda[1], Muhammad Hilmi Bin Muhammad Arif[1], Siti Nadhirah Binti Osman[1], Mohamad Yazid Bin Mohd Azmi[1], Norazmina Binti Mohd Zali[1], Mohd Riduan Bin Mohd Yusoff[1], Khairul Azhar Abdul Manaf[1], Muhammad Syahmi Mansor[1]

[1]Ahli Jawatankuasa Simposium Kluster Kejuruteraan 2024

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Abstrak

Pelbagai isu nasional yang melanda bidang kejuruteraan pada masa kini. Sebagai contoh jurang gaji antara syarikat tempatan dan antarabangsa adalah satu isu kompleks yang memerlukan kerjasama daripada pelbagai pihak; dengan usaha yang berterusan daripada majikan, pekerja, dan kerajaan, jurang ini boleh dikurangkan, sekaligus meningkatkan kesejahteraan ekonomi negara dan daya saing syarikat tempatan di arena global. Manakala industri semikonduktor di Malaysia sedang berkembang pesat dengan permintaan global yang semakin meningkat untuk cip elektronik; namun negara menghadapi kekurangan bakat dalam sektor ini dengan dianggarkan Malaysia memerlukan 60,000 jurutera tempatan untuk memenuhi keperluan industri semikonduktor yang kritikal kepada ekonomi digital dan revolusi teknologi masa depan. Pertumbuhan pesat dalam industri penerbangan global pula telah meningkatkan permintaan terhadap jurutera berkemahiran tinggi dan berlesen pesawat bukan sahaja di Malaysia, malah di seluruh dunia, sektor ini memerlukan tenaga kerja profesional yang mampu menyelenggara, membaik pulih, dan memastikan keselamatan pesawat memenuhi piawaian antarabangsa. Terkini, Jabatan Bomba dan Penyelamat Malaysia (JBPM) telah mengarahkan pemberhentian serta-merta kerja-kerja pembinaan berhampiran Taman Mas, Puchong sebagai langkah keselamatan susulan insiden atau potensi risiko yang memerlukan tindakan segera dan insiden tragis seorang kanak-kanak lelaki berusia lima tahun ditemui meninggal dunia selepas dipercayai ditinggalkan di dalam kereta yang diparkir berdekatan pintu belakang Hospital Shah Alam dipercayai berlaku akibat cuaca panas dan kekurangan pengudaraan dalam kenderaan tersebut. Pada tahun 2023, sebanyak 38,950 kes kecederaan pekerjaan telah direkodkan di seluruh Malaysia, termasuk 320 kes kematian menekankan keperluan mendesak untuk memperkukuhkan langkah-langkah keselamatan di tempat kerja bagi melindungi nyawa pekerja dan mencegah insiden yang tidak diingini manakala seorang warga asing disyaki terjatuh dan tertimbus akibat insiden tanah mendap yang berlaku di hadapan Masjid India, Kuala Lumpur; mencetuskan panik di kawasan sekitar, memandangkan lokasi berkenaan adalah kawasan tumpuan orang ramai. Jesteru itu, Kluster Kejuruteraan Jabatan Profesional Muda (JPro) Dewan Pemuda PAS Malaysia (DPPM) menganjurkan Simposium Kluster Kejuruteraan pada 17 November 2024 di Auditorium 1, Kompleks Kejiranan Presint 16 Putraja dalam mengetengahkan isu, cabaran dan solusi terhadap tema bidang-bidang Kejuruteraan seperti Construction Engineering; Highway & Transportation Engineering; Oil & Gas / Mining Engineering; Building Services / Mechanical & Electrical Engineering; Manufacturing/Agriculture/Food Engineering; Data Analytics/Computer & Telecommunication Engineering; Medical & Health Engineering; Academia Engineering; Energy & Utilities Engineering; dan Environmental / Health/Safety. Simposium Kluster Kejuruteraan 2024 juga bertujuan menghimpunkan dan memposisikan golongan profesional muda untuk membina dan menyumbang kepakaran dalam bidang masing masing bagi membentuk negara Malaysia yang lebih baik dan maju dan dalam masa yang sama memastikan jaringan dan ukhuwah diantara ahli Jpro dapat disemat dan berkekalan bagi mewujudkan satu jemaah yang kukuh dengan idea-idea yang baru.

Kata Kunci: *Isu Nasional; Simposium Kluster Kejuruteraan; Jaringan dan Ukhuwah*

1.0 PENGENALAN

Simposium Kluster Kejuruteraan 2024 anjuran Jabatan Profesional Muda (JPro) di bawah Dewan Pemuda PAS Malaysia (DPPM) mencatatkan kehadiran lebih 100 peserta pada acara sulungnya. Program itu bertujuan untuk meningkatkan kompetensi profesional muda, memupuk hubungan rangkaian antara individu dalam pelbagai bidang kejuruteraan, dan menyumbang idea ke arah pembangunan negara yang lestari dan berdaya saing.Selain itu, program itu turut menjadi platform penting bagi profesional muda untuk memperkukuhkan ilmu dan membina masa depan yang lebih baik [1].

Perasmi Simposium Kluster Kejuruteraan; Ketua Pemuda PAS Malaysia, Afnan Hamimi Taib Azamudden menegaskan bahawa kejuruteraan memainkan peranan penting sebagai fardu kifayah yang melengkapi keperluan fardu ain dalam membangunkan masyarakat Islam yang progresif. Menurut beliau, bidang kejuruteraan bukan hanya sekadar kerjaya atau profesion sekular, tetapi ia juga berfungsi memenuhi keperluan asas umat Islam, termasuk dalam penyediaan teknologi dan infrastruktur yang menyokong kemudahan ibadah dan kehidupan seharian.Afnan mengimbas langkah Allahyarham Tuan Guru Nik Abdul Aziz Nik Mat, yang pada tahun 1995 memperkenalkan syarat minimum tiga bilik untuk rumah kos rendah melalui Majlis Bandaran Kota Bharu Islam (MBKB). Peraturan ini adalah contoh bagaimana kuasa politik dapat digunakan untuk menerapkan nilai Islam dalam pembangunan sosial dan kemasyarakatan, menunjukkan bahawa kejuruteraan memainkan peranan penting dalam membangunkan masyarakat yang seimbang antara material dan spiritual. Afnan menyeru masyarakat untuk mengubah mentaliti dan mengiktiraf kejuruteraan sebagai ibadah kolektif, di mana hanya sebahagian individu yang perlu mendalami bidang ini untuk memenuhi keperluan seluruh komuniti. Sebagai contoh, bidang ini penting dalam menyediakan teknologi air bersih, yang bukan hanya menyokong kehidupan harian tetapi juga memenuhi keperluan asas bagi kemudahan ibadah seperti solat. Ucapan tersebut disampaikan dalam Simposium Kluster Kejuruteraan anjuran Jabatan Profesional Muda (JPro) melalui Dewan Pemuda PAS Malaysia. Selain itu, Afnan turut melancarkan logo rasmi program dan memberi penghargaan kepada tiga pembicara utama.

Pembicara pertama adalah Prof Ir Dr Hairul Azhar Abdul Rashid, Rektor Kolej Universiti TATI, yang menyampaikan ucaptama bertajuk “Pembangunan Bakat dan Kepimpinan Melalui Laluan Kejuruteraan”. Ucaptama kedua disampaikan oleh Prof Madya Dr Mohd Hanif Yaacob, Ketua Pegawai Eksekutif Institut Strategik dan Integriti Terengganu (TSIS), dengan tajuk “Kerajaan SG4 Pembolehdaya Agenda Ekonomi Nasional”. Ucaptama ketiga oleh Ir Ts Khairil Nizam Khirudin, Ahli Parlimen Jerantut, membincangkan agenda ekonomi nasional dalam konteks kerajaan SG4, yang telah mencatatkan kemajuan signifikan dalam usaha negara ke arah kelestarian dan tenaga hijau [2][3].

5.0 METHODOLOGI

Simposium yang berlangsung di Auditorium 1, Kompleks Kejiranan Presint 16 ini menghimpunkan tenaga profesional muda dalam bidang kejuruteraan untuk menyelami isu, cabaran dan solusi terkini yang merangkumi 10 bidang kejuruteraan.Antaranya ialah Kejuruteraan Pembinaan; Kejuruteraan Lebuhraya dan Pengangkutan; Kejuruteraan Perlombongan, Minyak dan Gas; Perkhidmatan Bangunan, Kejuruteraan Mekanikal dan Elektrik; dan Pembuatan, Pertanian, Kejuruteraan Makanan.Seterusnya, Analitis Data, Kejuruteraan Komputer dan Telekomunikasi; Kejuruteraan Perubatan; Kejuruteraan Akademik; Kejuruteraan Tenaga dan Utiliti; dan Alam Sekitar, Kesihatan dan Keselamatan. Seramai 3 ucaptama dan 10 pembentang oleh pakar berpengalaman turut diadakan untuk menampilkan pelbagai perspektif dalam menangani cabaran semasa serta memanfaatkan peluang teknologi terkini seperti dalam **Jadual 1**. Seorang peserta Simposium Kluster Kejuruteraan dikenakan bayaran yuran peserta RM40 seorang dan perbelanjaan Simposium Kluster Kejuruteraan secara keseluruhannya berjumlah RM6,691.25 seperti dalam **Jadual 2**.

Jadual 1. Senarai Ucaptama dan Pembentang

Bil.	Nama dan Kapasiti	Tajuk
1.	Prof. Ir. Dr. Hairul Azhar Abdul Rashid, Rektor, University College TATI (UC TATI)	Ucaptama 1: Talent and Leadership Development Through Engineering Pathway
2.	Prof Madya Dr Mohd Hanif Yaacob, Ketua Pegawai Eksekutif Institut Strategik dan Integriti Terengganu (TSIS)	Ucaptama 2: Kerajaan SG4 Pembolehdaya Agenda Ekonomi Nasional
3.	YB Ir. Ts. Hj. Khairil Nizam Khirudin, Ahli Parlimen Jerantut, Ketua Portfolio Pengangkutan PN, Inspection Technical Manager @ Staff Engineer (Inspection)	Ucaptama 3: Paving the Path Towards Energy Transition in State Governments 4 (SG4)
4.	Tuan Muhammad Qusyairie Bin Saari Sales & Application Engineer Atomic Solution S/B & PhD Student (Advanced Material)	Pembentangan 1 & Sesi Soal Jawab: Sintesis dan Pencirian Sifat Dielektrik Kapasitor Berasaskan CCTO, Kaca dan Bahan Nadir Bumi.
5.	P.Geol. Ahmad Zulqurnain Bin Ghazali Pengarah Urusan Geoventure Solution Sdn. Bhd.	Pembentangan 2 & Sesi Soal Jawab: Geohazard In Malaysia: Situation & Future Recommendation
6.	Dr. Wan Md Syukri Bin Wan Mohamad CTO / CFO Siri Sdn. Bhd.	Pembentangan 3 & Sesi Soal Jawab Digital Business Model For Smart Cities: Unlocking Urban Transformation
7.	Tuan Muhammad Hafiz Hadi Bin Sumardi Reliability Engineer	Pembentangan 4 & Sesi Soal Jawab Young Engineers to Innovate and Drive Change
8.	Dr. Siti Aminah Binti Muhammad Imran Scientific Director Ming Medical Services	Pembentangan 5 & Sesi Soal Jawab Tissue Engineering & Regenerative Therapy: The Future or Now
9.	Ir. Dr. Ahmad Hamdan bin Ariffin Pensyarah Kanan Jabatan Kejuruteraan Aeronautik, Universiti Tun Hussein Onn Malaysi	Pembentangan 6 & Sesi Soal Jawab Pengurusan Ruang Udara Pesawat Tanpa Pemandu
10.	Ts. Hj. Keel Gunanda @ Mohd Zaki Bin Idral Engineering Services Manager at Eastman Chemical Company	Pembentangan 7 & Sesi Soal Jawab Kaedah Kejuruteraan Bagi Mencegah Kes Tertinggal Anak/Bayi Di dalam Kereta
11.	Ts. Dr. Khairul Fahzan Bin Salleh Pensyarah Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam	Pembentangan 8 & Sesi Soal Jawab Cabaran Ergonomik Mutakhir Ini
12.	Ts. Faiz Bin Razali Research & Development Engineer	Pembentangan 9 & Sesi Soal Jawab Kesedaran Keselamatan Daripada Kenderaan Tenggelam
13.	Tuan Muhammad Ayub Bin Md Husni CAD, Process Manufacturing Engineer	Pembentangan 10 & Sesi Soal Jawab Bring Lean Concept to Home & School

Jadual 2. Perbelanjaan Simposium Kluster Kejuruteraan

Bil.	Perkara	Perbelanjaan (RM)	Catitan
1.	Cenderahati	1,024.45	Peserta, Pembentang, Ucaptama & Perasmi
2.	Token Pembentang	1,350.00	10 pembentang
3.	Media	340.00	Bunting Roll Up
4.	Program	539.50	Booklet
5.	Catering	2,080.00	Sarapan, *Tea Break, Lunch* & Minum Petang
6.	Pendaftaran	169.80	*Tagging*
7.	Sewa Auditorium	530.50	Hari Kejadian (9am-6pm)
8.	Rehearsal	57.00	Malam sebelum hari kejadian (10pm-11pm)
9.	Token Perasmi & Ucaptama	600.00	1 perasmi & 3 penyampai ucaptama
	Jumlah	**6,691.25**	

3.0 INITIPATI UCAPTAMA DAN PEMBENTANG

Intipati ucaptama dan pembentang bertemakan bidang-bidang Kejuruteraan seperti *Construction Engineering; Highway & Transportation Engineering; Oil & Gas / Mining Engineering; Building Services / Mechanical & Electrical Engineering; Manufacturing/Agriculture/Food Engineering; Data Analytics/Computer & Telecommunication Engineering; Medical & Health Engineering; Academia Engineering; Energy & Utilities Engineering; dan Environmental / Health/Safety.*

3.1 Ucaptama 1

Pembangunan Bakat Melalui Kejuruteraan: Pendekatan Strategik Kepimpinan Islam dalam Era Transformasi Politik dan Sosial.

Prof. Ir. Dr. Hairul Azhar Abdul Rashid
University College TATI (UC TATI) | Kluster Kejuruteraan, JPro, DPPM

PAS (Parti Islam Se-Malaysia) memainkan peranan penting dalam kerajaan gabungan Perikatan Nasional Malaysia. Sebagai entiti politik yang dominan, ia mentadbir negeri Kedah, Perlis, Kelantan, dan Terengganu, dan pemimpinnya menduduki jawatan penting peringkat menteri dan negeri. Bagaimanapun, PAS menghadapi cabaran struktur, khususnya dalam pembangunan kepimpinan dan bakat. Isu-isu ini boleh menghalang keupayaannya untuk mengekalkan keberkesanan pentadbiran dan menyesuaikan diri dengan tuntutan politik yang berkembang. Memahami cara PAS menangani cabaran ini memberikan gambaran tentang daya tahan jangka panjang parti dan implikasi yang lebih luas terhadap kestabilan politik Malaysia.

PAS menghadapi beberapa cabaran organisasi dan kepimpinan dalam usaha mengekalkan pengaruh politik dan keberkesanan tadbir urusnya. Isu kritikal ialah memastikan pelantikan kepimpinan berdasarkan merit dan bukannya hubungan politik. Pelantikan berasaskan merit adalah penting untuk meningkatkan kecekapan pentadbiran dan memupuk budaya akauntabiliti. Ditambah dengan ini adalah keperluan untuk meningkatkan ketelusan dalam proses pemilihan calon untuk mengekalkan dan mengukuhkan kepercayaan orang ramai, khususnya dalam iklim politik di mana persepsi nepotisme atau pilih kasih boleh menghakis kredibiliti. Untuk menangani cabaran ini, PAS boleh melabur dalam latihan kepimpinan berstruktur, program bimbingan dan pendidikan politik untuk ahlinya. Inisiatif ini boleh membantu memupuk kumpulan pemimpin yang berkebolehan dan bersedia. Bagaimanapun, usaha parti dalam hal ini dikekang oleh sumber kewangan yang terhad, yang memberi kesan kepada keupayaannya untuk melabur secukupnya dalam pembangunan bakat. Had kewangan ini menekankan kepentingan peruntukan strategik sumber dan potensi perkongsian untuk pembangunan kapasiti. Lebih-lebih lagi, PAS mesti meningkatkan keupayaannya untuk bertindak balas secara berkesan kepada senario politik yang berkembang pesat. Ini termasuk membangunkan strategi penyesuaian dan memastikan pemimpinnya memiliki kemahiran analisis untuk mengemudi dinamik politik yang kompleks. Mengurus imej awam adalah satu lagi kebimbangan yang mendesak, kerana PAS berdepan kritikan yang boleh menjejaskan reputasinya. Strategi komunikasi yang mantap yang menangani rungutan awam secara telus dan berkesan adalah kritikal dalam konteks ini. Dengan menangani cabaran ini secara sistematik, PAS boleh mengukuhkan rangka kerja organisasinya, memastikan ketahanan politik jangka panjang dan tadbir urus yang berkesan di negeri-negeri di bawah pentadbirannya.

Jurutera dilengkapi dengan set kemahiran dan perspektif unik yang sangat sesuai untuk peranan kepimpinan. Latihan mereka menekankan analisis masalah kompleks, reka bentuk penyelesaian praktikal, dan pelaksanaan berkesan penyelesaian ini; keupayaan yang menjadi asas kepada kepimpinan yang berjaya. Kejuruteraan juga mengutamakan nilai seperti keselamatan awam, kemampanan, dan pembuatan keputusan beretika, yang sejajar rapat dengan prinsip integriti, tanggungjawab sosial, dan kepimpinan pekhidmat Islam. Nilai-nilai bersama ini menggariskan potensi untuk jurutera memimpin dengan kepakaran teknikal dan keyakinan moral. Tokoh teladan yang merangkumi sifat-sifat ini ialah Allahyarham Dr Mohd Khazani Abdullah. Seorang jurutera dan inovator yang terkenal, Almarhum Dr. Khazani menggabungkan kepakaran teknikalnya dengan kepimpinan berwawasan, menyumbang secara signifikan kepada bidang teknologi dan memberi inspirasi kepada orang lain melalui komitmennya terhadap prinsip etika dan kemajuan masyarakat. Kepimpinannya dicirikan oleh gabungan pandangan jauh yang strategik dan rasa tanggungjawab yang mendalam terhadap peningkatan masyarakat, menjadikannya contoh teladan bagi jurutera yang bercita-cita memimpin. Selain itu, sifat dinamik projek kejuruteraan, yang sering melibatkan cabaran yang tidak dijangka, memupuk ketabahan dan

kebolehsuaian. Ciri-ciri ini penting untuk pemimpin mengemudi persekitaran yang tidak dapat diramalkan dan berkembang. Kejuruteraan juga menggabungkan pemikiran sistem dan perancangan jangka panjang, membolehkan pemimpin membangunkan visi strategik dan melaksanakannya dengan berkesan. Kerjasama adalah satu lagi asas amalan kejuruteraan. Jurutera kerap bekerja dalam pasukan pelbagai disiplin, memupuk kemahiran interpersonal dan komunikasi yang kuat. Kebolehan ini adalah penting bagi pemimpin untuk memberi inspirasi, membimbing, dan menyatukan kumpulan yang pelbagai ke arah matlamat bersama. Ringkasnya, kecekapan dan nilai yang wujud dalam latihan kejuruteraan, yang ditunjukkan oleh pemimpin seperti Almarhum Dr. Mohd Khazani Abdullah, menyediakan asas yang kukuh untuk kepimpinan, terutamanya dalam konteks yang memerlukan pandangan teknikal, pertimbangan etika dan pandangan jauh strategik.

3.2 Ucaptama 2

Kerajaan 4 Negeri (SG4) sebagai Pembolehdaya Agenda Ekonomi Nasional

Prof Madya Dr. Mohd Hanif Bin Yaacob
Terengganu Strategic & Integrity Institute (TSIS) | Kluster Kejuruteraan, JPro, DPPM

Artikel ini menghuraikan peranan State Government Four (SG4) – gabungan Kedah, Kelantan, Perlis dan Terengganu – sebagai blok kerjasama rentas negeri yang berpotensi memperkukuh Agenda Ekonomi Nasional (AEN). SG4 dinilai sebagai mekanisme strategik untuk mengurangkan ketidakseimbangan wilayah melalui pemerkasaan sektor teras seperti pertanian, tenaga, pelancongan dan perdagangan lintas sempadan. Berasaskan data Keluaran Dalam Negeri Kasar (KDNK) dan demografi, kedudukan ekonomi blok ini memperlihatkan asas yang memadai: Kedah sekitar RM59 bilion KDNK dengan populasi 2.2 juta, Kelantan sekitar RM28 bilion (1.9 juta), Perlis sekitar RM9 bilion (0.3 juta) dan Terengganu sekitar RM38.2 bilion (1.2 juta) pada 2023.

Penilaian ini disokong analisis SWOT untuk mengenal pasti kekuatan, kelemahan, peluang dan ancaman utama. Dalam konteks pembangunan wilayah Malaysia yang tidak seimbang, SG4 berperanan sebagai adaptasi model kerjasama ekonomi serantau yang telah terbukti di tempat lain. Pengalaman antarabangsa seperti MP3EI di Indonesia dan kerjasama Bund-Länder di Jerman menunjukkan bahawa penggabungan koridor ekonomi dan perkongsian fiskal-pentadbiran mampu mempercepat konvergensi wilayah. SG4 turut menempatkan dirinya pada trajektori serupa dengan memanfaatkan kekuatan relatif setiap negeri dalam blok Pantai Timur–Utara. Kedah menonjol melalui tiga tunjang: elektronik dan elektrik (E&E), pelancongan, serta agromakanan. Kulim Hi-Tech Park mengukuhkan ekosistem rantaian semikonduktor—termasuk pelaburan silikon karbida bernilai besar sementara Langkawi mengekalkan status sebagai destinasi pelancongan antarabangsa yang memacu rantaian perkhidmatan dan MICE.

Di samping itu, kawasan MADA yang meliputi Kedah–Perlis menyumbang sekitar 40% pengeluaran padi negara; penggunaan teknologi ladang moden, sistem pengairan pintar dan model kontrak berskala besar berpotensi memperkukuh keselamatan makanan. Akses logistik melalui PLUS, rangkaian rel dan pelabuhan utara menyokong kelajuan ‘time-to-market’ bagi produk E&E dan agromakanan. Kelantan berada pada persimpangan peralihan tenaga dan logistik. Empangan Nenggiri (anggaran 300 MW) dijangka menambah kebolehsediaan tenaga hijau, manakala potensi suria yang tinggi membuka ruang LSS PV dan inisiatif komuniti. Laluan ECRL mengurangkan kos logistik sambil menghubungkan ke pelabuhan utama, seterusnya memperkukuh peranan Kelantan sebagai hab pengedaran ke Selatan Thailand. Dalam agromakanan, negeri ini memerlukan pecutan mekanisasi, penambahbaikan saliran dan pengembangan rantaian sejuk serta hiliran beras premium bagi menampan risiko variasi iklim. Peningkatan infrastruktur jalan seperti CSR dan KBKK pula memperbaiki kebolehcapaian pedalaman-pesisir.

Terengganu mengekalkan kluster minyak, gas dan petrokimia berasaskan rangkaian pemprosesan gas di Kerteh, yang menyediakan kelebihan dalam kejuruteraan proses dan keselamatan operasi serta limpahan peluang kepada vendor tempatan untuk beralih ke kimia hijau dan tenaga bersih. Kapasiti hidro Kenyir menyumbang kepada Grid Semenanjung dan membuka prospek hibrid hidro-solar terapung. Pelabuhan Kemaman yang disokong jajaran ECRL meningkatkan ‘multimodal connectivity’ dan memperluas pasaran eksport bagi pembuatan berat serta bahan asas.

Perlis memainkan peranan sebagai gerbang perdagangan ASEAN melalui Padang Besar yang menghubungkan terminal kargo, pelabuhan darat dan rel Malaysia Thailand, mempercepat aktiviti ‘cross-docking’ serta penghantaran ‘last-mile’. Chuping Valley Industrial Area (CVIA) diposisikan sebagai taman perindustrian hijau yang menumpu kepada pembuatan halal, elektronik automotif dan teknologi hijau; sinerginya dengan Perlis Inland Port (PIP) menambah tarikan pelaburan. Tahap keamatan suria yang tinggi menjadikan Perlis ideal untuk LSS PV dan sistem tenaga hibrid industri.

Secara merentas negeri, kekuatan SG4 terletak pada kepelbagaian asas ekonomi yang saling melengkapi Kedah dengan E&E, Terengganu dengan minyak-gas-petrokimia, Perlis dengan logistik sempadan dan industri hijau, serta Kelantan dengan agromakanan dan tenaga boleh diperbaharui. Aset logistik bersepadu ECRL, Pelabuhan Kemaman, PIP di Padang Besar serta rangkaian lebuh raya dan rel utara Selatan meningkatkan akses ke pasaran ASEAN dan pelabuhan antarabangsa. Potensi tenaga bersih daripada hidro (Kenyir dan Nenggiri) dan suria (Perlis–Kedah) pula memberikan kelebihan kompetitif dari sudut ESG. Namun, beberapa kelemahan perlu ditangani.

Jurang kemiskinan yang lebih tinggi di sebahagian negeri mengehadkan permintaan domestik dan memerlukan intervensi inklusif dalam pembangunan kemahiran. Kebergantungan Terengganu pada komoditi petroleum mendedahkan ekonomi kepada volatiliti harga, menuntut kepelbagaian hiliran ke arah kimia khas dan bahan termaju. Dari sisi peluang, peluasan rantaian E&E dan automotif elektrik, perdagangan sempadan bernilai tambah, peralihan tenaga hijau (PPA hijau, tarif lestari, agrovoltaik) dan pemulihan pelancongan membuka ruang pertumbuhan baharu. Ancaman utama termasuk risiko iklim terhadap pengeluaran padi, ketidakpastian pelaksanaan projek mega (ECRL, CSR, KBKK) serta persaingan agresif negeri jiran dalam menarik FDI dan bakat. Mitigasi memerlukan penyelarasan rentas agensi, pembangunan modal insan, perumahan mampu milik dan peningkatan kualiti hidup.

Kesimpulannya, SG4 berpotensi menjadi blok ekonomi strategik dan pembolehdaya AEN jika ditunjangi tadbir urus bersepadu, strategi fiskal inovatif dan perancangan mitigasi iklim yang menyeluruh. Kejayaan pelaksanaan menuntut mekanisme bersama yang jelas antara negeri-negeri SG4, pembentukan Dana Pembangunan SG4 yang menggabungkan sumber negeri, persekutuan dan swasta, serta tumpuan kepada kepelbagaian ekonomi yang mengurangkan pergantungan kepada petroleum dan pertanian tradisional. Dengan pengoptimuman kekuatan sektor, pemanfaatan peluang geopolitik dan penutupan jurang struktur, SG4 mampu mengurangkan jurang pembangunan wilayah dan memperkukuh daya saing Malaysia di rantau ASEAN.

3.3 Ucaptama 3

Merintis Laluan ke Arah Peralihan Tenaga dalam Kerajaan Negeri 4 (SG4)

YB Ir. Ts. Hj. Khairil Nizam Khirudin.
Ketua Portfolio Pengangkutan PN | Kluster Kejuruteraan, JPro, DPPM

Negeri-negeri SG4 (Kedah, Perlis, Kelantan, dan Terengganu) mempunyai potensi besar untuk menyumbang kepada agenda peralihan tenaga negara seperti yang digariskan dalam Pelan Hala Tuju Peralihan Tenaga Negara (National Energy Transition Roadmap, NETR). Penyelarasan antara inisiatif negeri dengan pelan peringkat nasional ini penting untuk memastikan sinergi dalam perancangan dan pelaksanaan projek tenaga bersih. Negeri SG4 boleh memainkan peranan melalui pembangunan infrastruktur tenaga boleh diperbaharui seperti tenaga solar, angin, dan hidro, sejajar dengan objektif NETR. Langkah ini bukan sahaja dapat mempercepatkan peralihan tenaga tetapi juga meningkatkan ekonomi tempatan melalui penciptaan pekerjaan hijau dan pelaburan strategik. Negeri SG4 mempunyai potensi unik untuk menjadi peneraju dalam peralihan tenaga berikutan sumber alam yang kaya seperti cahaya matahari dan sungai, serta kedudukan geografi yang strategik. Dengan memanfaatkan sumber daya ini, SG4 dapat menjadi model peralihan tenaga untuk negeri lain di Malaysia dan negara serantau. Peluang boleh diterokai melalui kerjasama dengan pelabur asing dan tempatan, pembangunan teknologi hijau, serta mewujudkan hab penyelidikan dan pembangunan (R&D) tenaga mampan di rantau ini. Usaha ini boleh menjadikan SG4 sebagai pusat tenaga boleh diperbaharui yang kompetitif di Asia Tenggara, sekali gus meningkatkan daya saing ekonomi dan keberdayaan alam sekitar.

Kerangka tersebut bukan retorik atau wacana akademik semata-mata, sebaliknya telah diterjemahkan kepada gerak kerja nyata di Terengganu. Dalam tempoh setengah tahun selepas simposium, kerajaan negeri Terengganu di bawah pentadbiran PAS membuktikan komitmen melalui pelaksanaan berimpak tinggi, sehingga diiktiraf oleh PETRONAS sebagai Hab Masa Depan Peralihan Tenaga Negara. Pengiktirafan ini diumumkan semasa pelancaran acara East Coast Energy (ECE) pada 3 Mei 2025 di Kuala Lumpur, menjelang penganjuran ECE pada 23–24 Jun 2025 di Kuala Terengganu. Antara tumpuan utama yang dibentangkan Ir. Khairil ialah strategi pemodenan grid, pembangunan tenaga kerja hijau, pengurangan kebergantungan bahan api fosil dan pengembangan tenaga boleh baharu—semuanya kini menampakkan hasil melalui projek-projek berskala besar di negeri ini.

Projek Ladang Solar Terapung Hibrid Kenyir dijangka menghasilkan sehingga 1,000 MW tenaga solar dan meletakkan Tasik Kenyir sebagai tapak tenaga bersih strategik; sebahagian kapasiti tersebut turut memacu pembangunan Hab Hidrogen Hijau pertama negara. Inisiatif kapasiti manusia diperkukuh melalui PETRONAS Energy Transition Academy @ INSTEP yang bukan sekadar pusat latihan, malah menjadi kilang modal insan hijau dalam bidang penangkapan dan penyimpanan karbon (CCS), hidrogen dan pemasangan solar. Sejak 2018, Program Vendor & Industri Tempatan turut menyalurkan lebih RM342 juta kepada 54 vendor, membuktikan keterlibatan industri setempat dalam ekosistem peralihan tenaga. Dari sudut kelestarian marin, projek Rigs-to-Reef meningkatkan biodiversiti laut sehingga 30%, sekali gus menunjukkan bahawa pembangunan ekonomi dan pemuliharaan alam sekitar boleh bergerak seiring.

Keistimewaan Terengganu bukan sekadar hasil teknikal atau dukungan industri, tetapi juga berpunca daripada model tadbir urus yang diterajui kepimpinan PAS. Kepimpinan ini menterjemah nilai Islam seperti keadilan, amanah dan kelestarian ke dalam dasar pembangunan yang praktikal serta berorientasikan hasil ekonomi dan sosial untuk rakyat. Kerajaan negeri proaktif memeterai kerjasama strategik dengan syarikat utama seperti PETRONAS dan TNB, di samping melibatkan komuniti setempat dalam inisiatif pembangunan. Ketelusan dan profesionalisme pentadbiran mengukuhkan keyakinan pelabur serta pengiktirafan kerajaan pusat, menjadikan Terengganu model tadbir urus yang diyakini dan berwibawa. Hubungan awam–swasta antara Terengganu, PETRONAS dan TNB bukan

sahaja menjanakan tenaga, malah membentuk model pembangunan mampan yang boleh direplikasi oleh negeri-negeri lain, khususnya di Pantai Timur dan utara Semenanjung.

Transformasi industri yang didorong mencakupi solar terapung sebagai alternatif tanpa penggunaan tanah, hidrogen hijau sebagai masa depan bahan api global, serta agenda pendidikan dan pemerkasaan vendor tempatan bagi merakyatkan manfaat ekonomi. Asas kelestarian yang kukuh meningkatkan keyakinan sosial dan memberikan legitimasi jangka panjang kepada pelaburan. Justeru, perjalanan Terengganu daripada negeri berasaskan petroleum kepada hab tenaga bersih bukan berlaku kebetulan; ia lahir daripada visi strategik, keberanian politik dan kesungguhan pelaksanaan dasar. Daripada kerangka yang dibentang pada simposium 2024 kepada projek mega yang kini berjalan, Terengganu membuktikan bahawa PAS bukan sekadar bercakap tetapi bekerja—menjadi contoh pentadbiran Islam profesional yang mendahului perubahan, memacu kemajuan dan memelihara alam sebagai amanah khalifah di bumi Malaysia, insya-Allah.

3.4 Pembentang 1

Proceedings of the Engineering Cluster Symposium
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Synthesis and Characterization of Dielectric Properties of Capacitor Based on CCTO, Glass, and Rare Earth Elements: A short overview.

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CCTO, dielectric ceramic, rare earth doping, ZBS glass, solid-state synthesis, dielectric loss, capacitors

ABSTRACT

Ceramic materials with colossal dielectric properties have the potential to revolutionize capacitor technologies. Among them, calcium copper titanate (CCTO) has drawn significant attention due to its unusually high dielectric constant that remains nearly stable across a broad temperature range. However, high dielectric loss and inconsistent electrical behavior remain key obstacles to commercialization. This work aims to explores a short overview the previous work in synthesizing and dielectric enhancement of CCTO through two strategies: (1) doping with rare earth elements (REEs) such as Lanthanum (La) and Ytterbium (Yb), and (2) integration of $ZnO–B_2O_3–SiO_2$ (ZBS) glass as an intergranular additive. The samples were synthesized using a solid-state reaction route and characterized via XRD, FESEM, and LCR analysis. The results showed that doping and glass incorporation modified the microstructure and significantly enhanced dielectric properties, especially by reducing dielectric loss, thereby making the material more feasible for capacitor applications.

1.0 Introduction

Dielectric ceramics are pivotal in electronic applications, including capacitors, sensors, resonators, and filters. Among them, calcium copper titanate ($CaCu_3Ti_4O_{12}$ or CCTO) has emerged as a potential material due to its colossal dielectric constant (ε_r ~10^4–10^5), low-temperature sintering, and structural stability over wide frequency and temperature ranges. The appearances of CCTO is reported to be brown solid after calcinations heat treatment. The molar mass, density and melting point of CCTO is 614.1789 g/mol, 4.7 g/cm^3 and >1000 °C respectively.

$CaCu_3Ti_4O_{12}$ (CCTO) is a complex oxide that adopts a pseudo-cubic perovskite-like structure, often described by the general formula $AA'_3B_4O_{12}$. This structure is a derivative of the conventional ABO_3 perovskite (Figure 1) framework but features a more intricate cation arrangement. In CCTO, calcium ions (Ca^{2+}) occupy the A-sites with 12-fold coordination, while copper ions (Cu^{2+}) are positioned at the A'-sites in a square-planar coordination, which is relatively uncommon in perovskite- type materials. Titanium ions (Ti^{4+}) reside in the B-sites, forming TiO_6 octahedra that are corner-shared to create a three-dimensional network. Oxygen ions (O^{2-}) complete the framework by linking the TiO_6 and CuO_4 units. The crystal structure of CCTO belongs to the body-centered cubic space group Im3, with a lattice

parameter of approximately 7.39 Å and four formula units per unit cell (Z = 4).

Despite its high dielectric constant, CCTO does not exhibit ferroelectric behavior, and its dielectric response is primarily attributed to extrinsic effects, particularly the internal barrier layer capacitor (IBLC) mechanism. This mechanism arises from interfacial polarization between semiconducting grains and insulating grain boundaries, which is a key contributor to the material's colossal, temperature-independent dielectric permittivity.

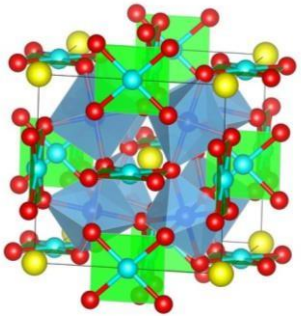

Figure 1: Perovskite crystal structure of CCTO.

First reported by Subramaniam et al. (2000), the giant permittivity of CCTO is linked to internal barrier layer capacitor (IBLC) effects, where insulating grain boundaries and semiconducting grains cause Maxwell-Wagner interfacial polarization. However, CCTO also suffers from a high dielectric loss (tan $\delta \sim 10^{-2}$), making it unsuitable for commercial capacitors like MLCCs without further enhancement.

Several strategies have been proposed to overcome this limitation, including doping with rare earth elements such as lanthanum (La), yttrium (Y), and ytterbium (Yb), which can modify grain conductivity and enhance grain boundary resistance. Another approach involves the addition of glass phases like ZnO–B_2O_3–SiO_2 (ZBS) to facilitate sintering, densify the microstructure, and reduce grain boundary defects. This research combines both strategies to develop a CCTO-based ceramic with improved dielectric properties using a simple and scalable solid-state synthesis method.

2.0 Methodology

2.1 Raw Materials and Chemical Composition

The ceramic samples were synthesized via the solid-state reaction method, which is a widely used, cost-effective, and scalable approach in ceramic processing. The raw materials used for the synthesis included high-purity precursors for CCTO, namely calcium carbonate ($CaCO_3$, ≥99.9%), copper(II) oxide (CuO, ≥99.9%), and titanium dioxide (TiO_2, ≥99.8%). To introduce the glass phase, a ZnO–B_2O_3–SiO_2 (ZBS) system in a 1:1:1 molar ratio was prepared using analytical-grade reagents.

Meanwhile, rare earth oxides such as lanthanum oxide (La_2O_3) and ytterbium oxide (Yb_2O_3), each with a purity of ≥99.9%, were employed as dopants to modify the dielectric behavior of the base CCTO material.

2.2 Synthesis via Solid-State Reaction & Powder Processing

The weighed raw powders were thoroughly mixed and ball-milled for six hours using ethanol as the milling medium to ensure homogeneity. The resulting mixture was then calcined at approximately 900°C for four hours to promote the formation of phase-pure CCTO through solid-state reactions. In parallel, the ZBS glass phase was prepared separately using the melt-quench technique (Figure 2.a) and subsequently ground into a fine powder (Figure 2.b). After calcination, the ceramic powders were pressed into cylindrical pellets at 200 MPa using a hydraulic press with 10 mm diameter dies. These

pellets were further densified through sintering at temperatures ranging from 1000°C to 1100°C in ambient air for six hours.

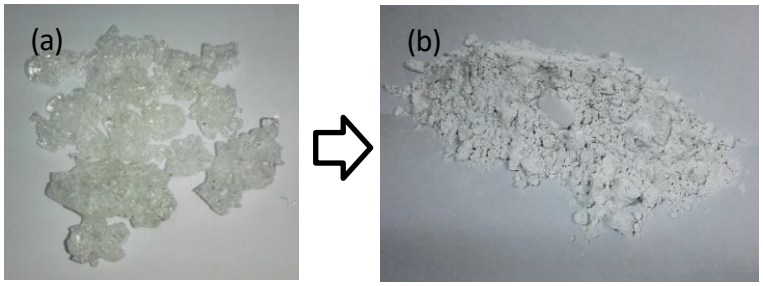

Figure 2.a: ZBS glass frit prepared using melt quench techniques and Figure 2.b: ZBS glass powder prepared using high speed platinum ball mill.

2.3 Characterization Techniques

The synthesized samples were characterized using various analytical techniques to evaluate their structural, microstructural, and dielectric properties. X-ray Diffraction (XRD) analysis, performed using a PANalytical X'Pert PRO diffractometer, was employed to identify the crystalline phases present, confirm the successful formation of CCTO, and assess lattice distortion due to doping. Microstructural analysis was carried out using a Field Emission Scanning Electron Microscope (FESEM) to observe grain morphology, particle distribution, and the presence of glassy grain boundaries in ZBS-containing samples. Dielectric properties, including the dielectric constant (ε_r) and loss tangent (tan δ), were measured using an HP4284A LCR meter across a frequency range of 100 Hz to 1 MHz to evaluate the performance and stability of the developed ceramics.

3.0 Results and Discussion

3.1 Phase Analysis and Microstructure

XRD analysis confirmed the successful formation of the CCTO perovskite phase (space group Im3) in all synthesized samples. The presence of secondary phases was minimal, particularly in doped and glass-added compositions, indicating a high degree of phase purity. Notably, slight shifts in diffraction peak positions were observed in the La^{3+}- and Yb^{3+}-doped samples, which can be attributed to lattice distortions resulting from the substitution of these rare earth ions at Ca^{2+} sites within the crystal structure.

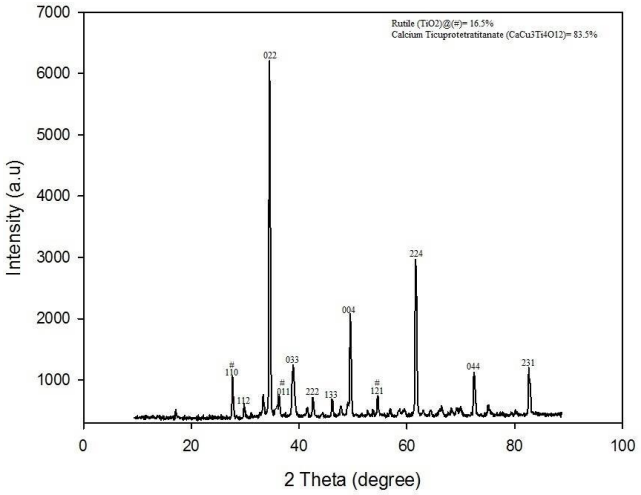

Figure 3: XRD pattern of ZBS-CCTO composite

Microstructural analysis using FESEM revealed distinct differences among the samples. The pure CCTO exhibited large, irregular grains with noticeable porosity and weak intergranular bonding. In

contrast, the ZBS-CCTO composites displayed a more refined and densified microstructure, with smaller grains and smooth, glassy grain boundaries that help to suppress leakage currents and reduce dielectric loss. The samples doped with La or Yb showed improved grain size uniformity and more homogeneous distribution, both of which contributed to enhanced grain boundary resistance and lower overall dielectric losses.

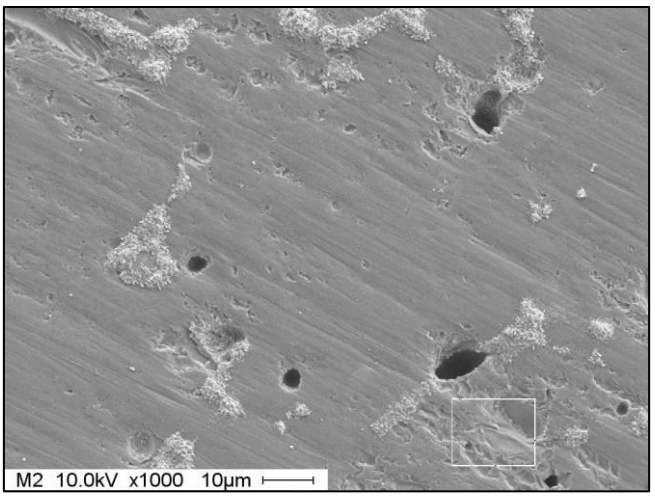

Figure 4: FESEM microstructure.

Element	Wt%	At%
B K	15.97	36.40
O K	22.68	34.93
CuL	24.81	09.62
ZnL	03.21	01.21
SiK	00.27	00.24
CaK	05.88	03.61
TiK	27.19	13.99

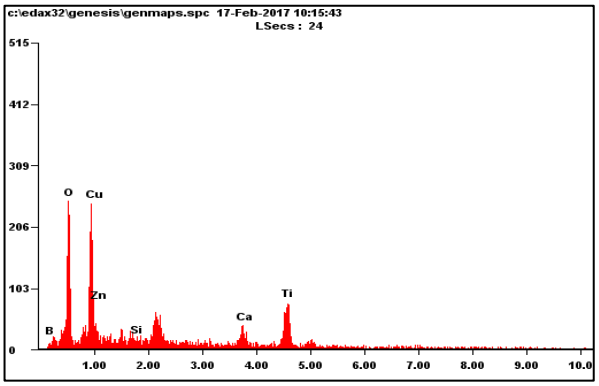

Table 1 and Figure 5: EDX analysis

3.2 Dielectric Properties

The dielectric properties of the synthesized ceramics were evaluated at 1 kHz, with the results summarized in Table 2. The pure CCTO sample exhibited a high dielectric constant (ε_r) of 5.50×10^7, accompanied by a relatively high dielectric loss (tan δ) of 9.749×10^{-3}. Upon doping with rare earth elements, both La- and Yb-doped CCTO samples demonstrated a significant reduction in dielectric loss to 1.830×10^{-3} and 1.477×10^{-3}, respectively, while maintaining reasonably high permittivity values. The incorporation of ZBS glass into the CCTO matrix further enhanced the dielectric behavior, with ZBS-CCTO achieving a dielectric constant of 4.95×10^7 and a reduced tan δ of 1.302×10^{-3}. While some compositions still exhibited moderate losses when compared to commercial MLCC standards, the overall improvements highlight the synergistic effects of rare earth doping and glass phase incorporation in optimizing the dielectric performance of CCTO-based ceramics. Table 1 shows dielectric constant and dielectric loss that measured at 1 kHz.

Table 2: Dielectric properties and dielectric loss of CCTO.

Sample	ε_r @ 1 kHz	tan δ @ 1 kHz	References
Pure CCTO	5.50×10^7	9.749×10^{-3}	Siti Amirah, UMP, 2017
CCTO + La	4.18×10^7	1.830×10^{-3}	Siti Amirah, UMP, 2017
CCTO + Yb	2.43×10^7	1.477×10^{-3}	Siti Amirah, UMP, 2017
CCTO + ZBS	4.95×10^7	1.302×10^{-3}	Qusyairie, UMK, 2018

The La and Yb dopants effectively suppressed dielectric loss while maintaining high permittivity. ZBS glass further contributed to a stable dielectric response at low frequencies, although some samples still exhibited moderate loss compared to commercial MLCC materials.

3.3 Mechanism of Enhancement

The improvements observed in the dielectric properties of the modified CCTO ceramics can be explained through three key mechanisms. First, the optimization of the internal barrier layer capacitor (IBLC) effect, achieved through rare earth doping, enhances the insulating nature of the grain boundaries while preserving the semiconducting behavior of the grains, leading to improved dielectric performance. Second, the introduction of ZBS glass forms a glassy phase at grain interfaces, which acts as an effective barrier to suppress dielectric loss by minimizing intergranular conduction. Third, the substitution of Ca^{2+} ions with La^{3+} and Yb^{3+} induces lattice distortions, defect dipole formation, and charge compensation, all of which contribute to stabilizing the dielectric response over a range of frequencies. These mechanisms are well supported by previous studies. Rao and Sundaresan (2008) demonstrated that doping CCTO with rare earth elements such as La and Y effectively reduces dielectric loss through electron compensation mechanisms. Similarly, Kumar and Choudhary (2010) reported that the inclusion of glassy intergranular phases enhances densification, improves microstructure, and lowers conduction paths, ultimately leading to better dielectric behavior.

4.0 Conclusions

This study demonstrates that the dielectric performance of CCTO ceramics can be significantly improved through the synergistic incorporation of ZBS glass and rare earth element (REE) dopants, specifically lanthanum (La) and ytterbium (Yb). The modifications led to notable enhancements in key dielectric parameters, including a sustained high dielectric constant and a substantial reduction in dielectric loss, particularly with La and Yb doping, where values of tan δ below 10^{-3} were achieved. These improvements are attributed to better grain boundary control, enhanced densification, and stabilization of dielectric response through defect engineering and grain boundary insulation. As a result, CCTO-based composites exhibit strong potential as candidate materials for next-generation capacitor technologies, especially in applications requiring high permittivity and thermal stability, such as Low Temperature Co-Fired Ceramics (LTCC) and Multi-Layer Ceramic Capacitors (MLCC). Nevertheless, further optimization in terms of sintering temperature, dopant concentration, and long-term reliability is required to bridge the gap between laboratory performance and commercial deployment.

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3.5 Pembentang 2

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Digital Business Models For Smart Cities: Unlocking Urban Transformation

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ABSTRACT

The emergence of smart cities, driven by advancements in digital technologies, has the potential to fundamentally reshape urban environments. Central to this transformation are digital business models innovative frameworks that harness data, technology, and infrastructure to create value in urban settings. As cities become more interconnected and data-driven, these models offer unprecedented opportunities for enhancing operational efficiency, promoting sustainability, and improving the quality of life for residents. This article examines how digital business models are facilitating the evolution of smarter, more resilient cities by optimizing urban services, fostering innovation, and driving economic growth. Through a detailed exploration of key examples and emerging trends, this work highlights the role of these models in unlocking the full potential of urban transformation on a global scale.

1. The Role of Digital Business Models in Smart Cities

A digital business model involves a strategic framework in which cutting-edge technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data, and cloud computing are incorporated into urban infrastructure and services to deliver value (Albino, Berardi, & Dangelico, 2015). These models are crucial in the development of smart cities : urban areas that leverage digital innovation to enhance citizens' quality of life, optimize resources, and improve governance (Bannister & Connolly, 2014).

Digital business models in smart cities are focused on optimizing essential urban services like transportation, energy, and waste management, while also enhancing governance and public services. By leveraging data analytics, businesses are able to improve urban efficiency, generate new revenue opportunities, and address pressing urban challenges (Harrison et al., 2010).

2. Key Examples of Digital Business Models in Smart Cities

The Internet of Things (IoT) plays a transformative role in smart cities. Devices like sensors, smart vehicles, and connected appliances generate large volumes of data, which can be used to improve urban services for instance, Smart Traffic Management is a Traffic sensor provide real-time data to manage congestion and optimize transportation systems (Schaffers et al., 2011).

Smart Waste Management is a Sensors in waste containers notify management companies when they are full, improving waste collection efficiency (Giffinger et al., 2007). Business Model is the service-base model that often underpins these innovations, where companies offer real-time monitoring and management services, typically generating revenue through subscription models (Brous, Janssen, & Herder, 2020).

Mobility-as-a-Service (MaaS) integrates various transport services—such as ride-hailing, bike-sharing, and public transit—into a single digital platform. Users can seamlessly plan, book, and pay for various transportation options, promoting multimodal transport and reducing dependence on private vehicles. This model typically uses a platform-based approach, where technology firms create apps that combine transportation services and generate revenue through user subscriptions or per-trip charges (Shaheen & Cohen, 2020).

Smart buildings incorporate advanced technologies that enable the real-time management of building systems such as HVAC, lighting, and security. These solutions improve energy efficiency, reduce operational costs, and enhance occupant comfort. For example, smart lighting systems automatically adjust based on occupancy or external conditions, conserving energy. Companies providing these solutions generally follow a Software-as-a-Service (SaaS) model, offering subscription-based software that remotely manages building systems, generating continuous revenue while improving building efficiency (Komninos, 2015).

Smart cities generate a vast array of data through sensors, energy grids, and even social media. This data can be utilized to optimize public services, ranging from healthcare to law enforcement. Predictive analytics, for example, can forecast traffic conditions or predict public service demands. The Data-as-a-Service (DaaS) model is commonly employed, where companies collect and analyze data and sell insights to urban planners, government agencies, and private businesses, providing valuable intelligence for decision-making (Lee, Phaal, & Lee, 2014).

3. Facilitating Urban Transformation through Digital Business Models

Digital business models are integral to the transformation of urban environments. They help optimize city operations, improving efficiency and delivering several key benefits. Improved Efficiency, Smart city technologies streamline urban operations, optimize resource allocation, and reduce waste. IoT systems, for instance, can monitor energy consumption and adjust usage dynamically, leading to cost reductions and a smaller environmental footprint (Korhonen, Honkasalo, & Seppälä, 2018).

Citizen Engagement, These models emphasize increasing citizen involvement by offering real-time data and access to city services. For example, apps that allow citizens to report issues like potholes or malfunctioning streetlights foster stronger collaboration between citizens and local governments (March & Ribera-Fumaz, 2016).

Economic Growth, Digital business models stimulate economic development by encouraging innovation and attracting investments. The rise of smart infrastructure and green technologies creates new markets and job opportunities in sectors like technology and sustainability (Manyika et al., 2011).

Environmental Sustainability, Sustainability is a cornerstone of many smart city models. Technologies like smart grids and waste-to-energy systems enable cities to lower their environmental impact. For instance, intelligent waste management systems can optimize collection routes, reducing carbon emissions (Korhonen, Honkasalo, & Seppälä, 2018).

4. Challenges and Opportunities

Despite the substantial potential of digital business models, there are challenges to address. Privacy and security concerns are paramount, as the collection of personal data necessitates strict safeguards and adherence to regulations (Söderström, Paasche, & Klauser, 2014). Additionally, the risk of deepening the digital divide must be considered, as marginalized communities may struggle to access the technology needed to fully participate in the smart city ecosystem (Bannister & Connolly, 2014).

However, these challenges also present opportunities for innovation. Companies focusing on cybersecurity can develop robust data protection solutions, while efforts to promote digital inclusion can ensure that no community is excluded from the benefits of smart city technologies (Kitchin, 2014).

5. Conclusion

The digital transformation of urban areas is fueled by innovative business models that incorporate emerging technologies to optimize infrastructure and public services. As cities continue to embrace smart solutions, these digital business models will play a pivotal role in shaping the future of urban living. By enhancing efficiency, fostering sustainability, and empowering citizens, these models offer a roadmap to more resilient, livable, and prosperous cities. Moving forward, while the potential for urban transformation remains vast, overcoming challenges such as security, equity, and integration will be essential to fully realizing the promise of digital business models in smart cities.

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3.6 Pembentang 3

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Beyond the Status Quo: Inspiring Young Engineers to Innovate and Drive Change

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Young engineers, Innovation, Value creation, Analytics-driven culture, Problem-solving, Leadership, Organizational growth

ABSTRACT

In today's fast-paced and dynamic work environment, young engineers are increasingly expected to be catalysts for innovation, driving organizational growth and creating measurable value. This paper explores the factors that enable young engineers to innovate and create value within their workplaces, emphasizing the ability to identify gaps in current work processes and propose effective solutions. Through a comprehensive review of existing literature, this study identifies key factors that support young engineers in their journey from problem identification to solution implementation. The research emphasizes the critical role of cultivating an analytics-driven culture that fosters innovation, serving as a mediating factor to significantly enhance the business value captured by young engineers. To explore this dynamic, an Analytical Value Captured Framework is proposed to demonstrate how young engineers can create tangible business value within their organizations. The framework highlights several key drivers, including the strategic use of technology to optimize processes and improve efficiency, and the development of capability, enhancing technical skills and problem-solving abilities to identify and address operational gaps. Additionally, it emphasizes the significance of attitude and skills, promoting a growth mindset, creativity, and critical thinking, which are essential for fostering innovation. Furthermore, leadership plays a crucial role in encouraging young engineers to take ownership of their ideas and push for meaningful change within the organization. This framework illustrates that when these factors are aligned with an analytics- driven culture, young engineers are empowered not only to propose innovative solutions but also to implement them effectively, leading to substantial improvements in business operations and capturing significant business value.

1. Introduction

Artificial intelligence (AI) is at the forefront of the fourth industrial revolution, fundamentally altering traditional business models and reshaping practices in strategy, innovation, and performance management [1],[2],[3]. Despite the rapid advancements in AI, the lack of an innovation culture within organizations can lead to stagnation, making it difficult for businesses to adapt to these changes. This stagnation not only reduces an organization's ability to stay competitive but also diminishes employee

engagement, hampers problem-solving, and results in missed growth opportunities.

While AI technology progresses at an astonishing rate, the complex challenges in today's business environment require more than just machine-driven solutions; they demand robust human-machine hybrid approaches that leverage both AI and human capabilities to their fullest potential [4],[5]. Engineers, in particular, have a critical role to play in this context, as they are uniquely positioned to create value by integrating technologies with human insights.

Their analytical thinking, problem-solving skills, and technical expertise make them well-suited to identify opportunities for technology implementation and to design innovative solutions that enhance operational efficiency, product development, and data-driven decision-making. Additionally, while engineers' inherent curiosity and adaptability allow them to explore and embrace new advance technologies, their attention to detail ensures the desired systems are implemented effectively and ethically.

However, one of the key challenges for organizations involves creating a balanced and ethical interplay between psychological, social, organizational, informational, and technical systems to optimize collaboration between humans and intelligent machines [6]. Such a balanced approach not only drives innovation but also ensures that the integration of technology into the workplace enhances overall organizational performance and sustains growth.

2. Research Problem

Between 2018 and 2022, the number of new graduates entering the workforce nearly doubled compared to the increase in high-skilled job opportunities (Figures 1). However, many of these graduates are deemed unqualified for the available high-skilled positions, as their qualifications and skills do not align with job requirements in key sectors. This misalignment has left companies across industries struggling to fill highly skilled roles, especially in managerial, professional, technical, and associated professional positions.

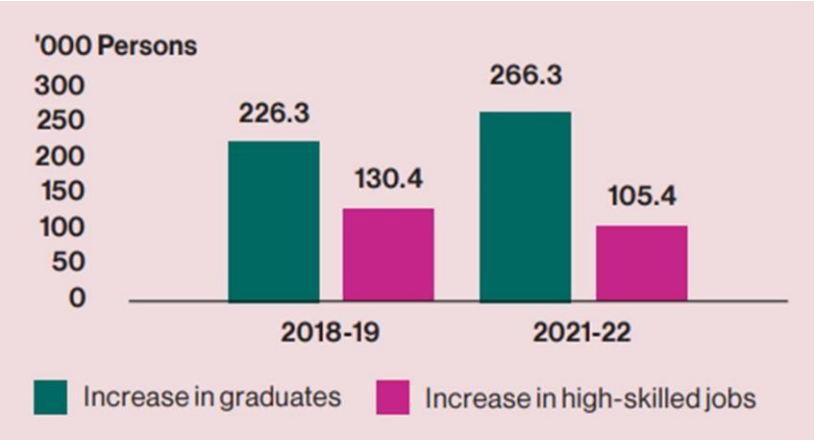


Figure 1: Increase in Graduates in the Labor Force and High-Skilled Job Creation

The persistent shortage of suitable candidates for high-skilled jobs highlights a skills mismatch. Many graduates lack soft skills and specialized knowledge that are often not acquired through formal education alone. According to a 2023 World Bank report, a significant portion of firms—55.7%—reported challenges in finding employees with essential interpersonal and communication skills, crucial for fostering workplace collaboration and productivity (Figure 2). This mismatch in skills underscores gaps in academic curricula and the need for skill development outside traditional learning environments.

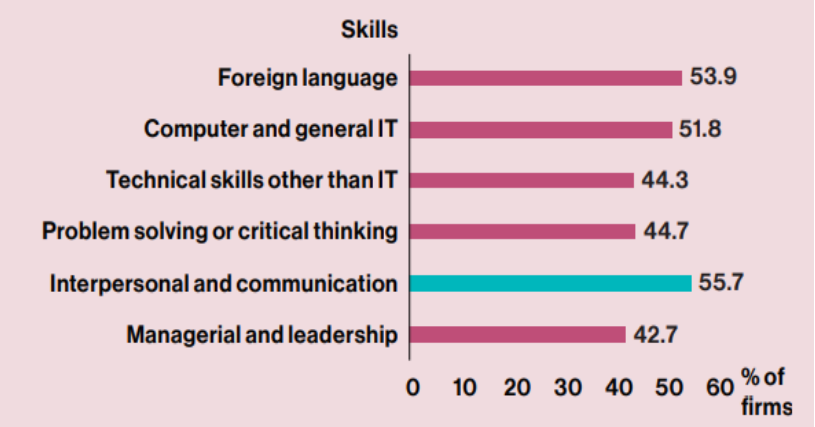
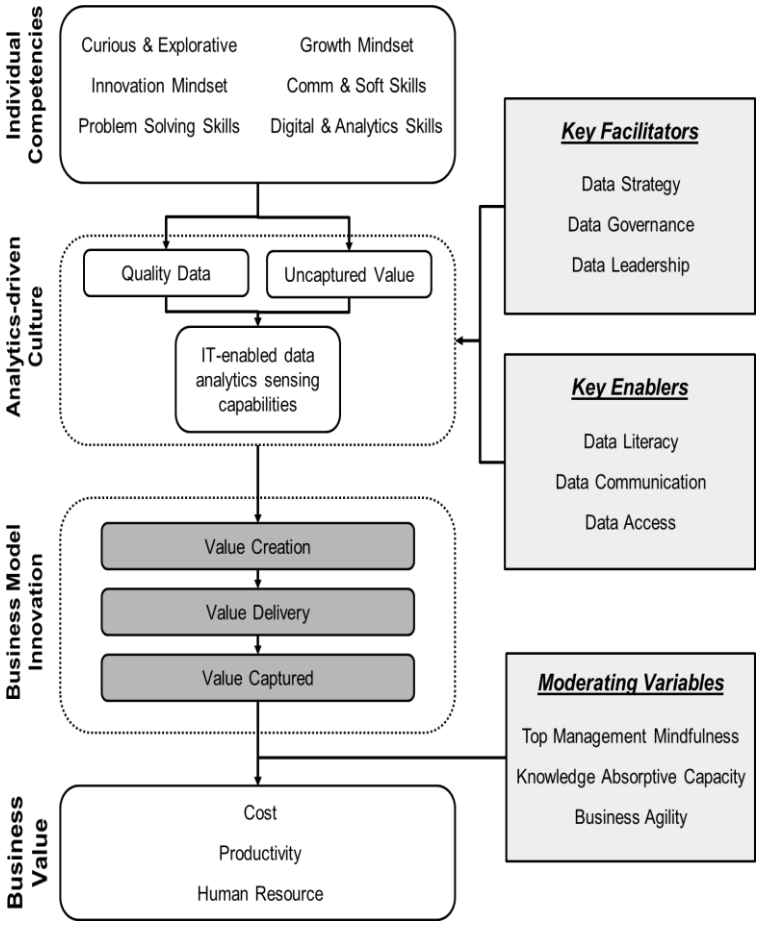


Figure 2: Share of Firms with Difficulty Finding Employees with Specific Skills Addressing

Addressing this challenge requires exploring strategies to bridge these gaps, both culturally and operationally, to unlock the full potential of emerging graduates in the workforce. Doing so would allow firms to maximize their investments in analytics and innovation, as well as build a labor force that meets the dynamic demands of highly skilled sectors. This approach is crucial to fostering a sustainable talent pipeline that can support future economic growth.

3. Proposed Solution

Value Creation in Analytics-Driven Culture Framework:



4. Conclusion

Understanding business value is crucial for engineers, as it enables them to align their technical expertise with strategic organizational goals, ultimately contributing to growth and innovation. Engineers must move beyond technical proficiency and cultivate skills in analytics, communication, and strategic thinking to identify, measure, and realize business value effectively. This broader skill set allows engineers to assess the impact of their work on organizational objectives, make data-informed decisions, and drive value through continuous improvement and innovation. By developing these skills, engineers can become key players in value creation, transforming their contributions into measurable business outcomes and ensuring their technical efforts translate into meaningful organizational advancements.

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3.7 Pembentang 4

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Tissue Engineering and Regenerative Therapy: The Future or Now ?

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ABSTRACT

Tissue Engineering and regenerative therapy is a field in medicine that relates to the ability to correct congenital anomalies and to repair or replace tissues that have been destroyed by age, disease, or trauma. To date, promising preclinical and clinical data supported the possibility of using regenerative medicine to treat both acute and chronic diseases. One of the regenerative medicine therapies that have been used widely is stem cells. Stem cells, especially mesenchymal and hematopoietic stem cells, play an important role in treating chronic diseases, such as leukemia, bone marrow, autoimmune disease, and urinary problems. Despite considerable advancements in stem cell biology, their applications are limited by ethical concerns and regulatory oversight. In Malaysia, since 2021, first in human clinical trials for cell and gene therapy products (CGTP) are not allowed, which halted the efforts to get the necessary approval for this therapy. This paper will discuss the current developments in tissue engineering and regenerative therapy worldwide as well as in Malaysia. I will also discuss on the prospect and challenges in making this therapy available in Malaysia.

1. Introduction

Tissue engineering and regenerative medicine (TERM) are groundbreaking interdisciplinary fields that sit at the confluence of biology, engineering, and clinical practice, focusing on the restoration, maintenance, and enhancement of tissue and organ function. In an era where chronic diseases and injuries are increasingly prevalent, coupled with an aging population, the demand for innovative therapeutic strategies is more pressing than ever. These disciplines aim to address complex medical challenges through the development of novel solutions that can significantly improve patient outcomes.

Tissue engineering utilizes cells, scaffolds, and biologically active molecules to create functional tissues [1]. This approach allows researchers and clinicians to design constructs that closely mimic the structural and functional properties of native tissues. By utilizing a variety of cell types—ranging from stem cells to differentiated cells—scientists can cultivate tissues that can be used for transplantation, drug testing, and other applications. The integration of scaffolds made from biocompatible materials further enhances the potential of engineered tissues, providing a supportive environment for cell growth and differentiation.

Regenerative medicine extends the scope of tissue engineering by emphasizing the harnessing of the body's intrinsic repair mechanisms. This field explores the use of stem cells, which possess the

remarkable ability to differentiate into various cell types, thus offering promising avenues for treating a multitude of conditions [2, 3]. In addition to stem cells, regenerative medicine employs biomaterials that can be engineered to interact with biological systems in ways that promote healing and tissue regeneration. Advanced therapeutic techniques, such as gene therapy and cellular therapies, are also integral to this field, further broadening the range of treatment options available.

The implications of TERM are particularly significant when considering the management of chronic diseases. Traditional treatment methods often focus on symptom alleviation rather than addressing the underlying causes of these conditions. TERM, however, offers the potential for more effective interventions that target the root problems, leading to not only improved healing but also enhanced quality of life for patients. This innovative approach could transform the treatment landscape for chronic conditions such as diabetes, cardiovascular diseases, and neurodegenerative disorders.

The convergence of tissue engineering and regenerative medicine marks a pivotal advancement in the field of biomedical science. These disciplines offer transformative approaches to some of the most challenging medical issues faced today, including chronic diseases, injuries, and age-related degeneration. As research continues to evolve and clinical applications expand, TERM holds the promise of revolutionizing therapeutic practices and addressing the unmet medical needs of diverse patient populations. The ongoing exploration of these fields will undoubtedly lead to new insights and breakthroughs that can further enhance patient care and outcomes.

This review aims to discuss the current state of TERM research, applications, and limitations in Malaysia, positioning this within the context of global and regional advancements. By exploring TERM's potential and comparing Malaysia's progress with neighboring countries, this paper seeks to offer insights into how Malaysia can further cultivate TERM to benefit its healthcare landscape.

1. Current Practices and Research in Tissue Engineering and Regenerative Medicine in Malaysia.

1.1 Research and Practices

Malaysia has seen significant growth in TERM research in recent years, especially in stem cell research, bioengineering, and scaffold technology. The Malaysian Ministry of Health and Higher Education have supported TERM initiatives, promoting collaborations among academic institutions, medical centers, and biotech firms.

Malaysia is making significant strides in the exploration and application of stem cell technologies, particularly focusing on mesenchymal stem cells (MSCs), hematopoietic stem cells, and induced pluripotent stem cells (iPSCs). MSCs, known for their ability to differentiate into various cell types and their potential to modulate immune responses, are being investigated for their therapeutic applications in regenerative medicine [3, 4]. Researchers are exploring their use in treating conditions like osteoarthritis, where MSCs can help repair damaged cartilage and improve joint function. Similarly, the regenerative capabilities of hematopoietic stem cells are being harnessed, especially in the context of hematological disorders and as a potential treatment avenue for conditions such as cardiovascular diseases, where these cells can contribute to tissue repair and regeneration.

Furthermore, the focus on skin regeneration is another critical area of research in Malaysia, where stem cell therapies are being explored for their potential in wound healing and aesthetic applications. MSCs have shown promise in promoting skin repair and reducing scarring, making them valuable in the treatment of chronic wounds and burns. As Malaysia continues to invest in stem cell research and its clinical applications, these efforts are not only advancing scientific knowledge but also positioning the country as a leader in regenerative medicine in the region. The integration of these innovative

therapies could significantly impact the management of various conditions, paving the way for more effective and personalized treatment options for patients in Malaysia and beyond. Malaysia is actively involved in the exploration of mesenchymal stem cells (MSCs), hematopoietic stem cells, and induced pluripotent stem cells (iPSCs). Research is focused on developing therapies for conditions such as diabetes, osteoarthritis, cardiovascular diseases, and skin regeneration.

In addition to stem cell research, the development of biomaterials is a critical focus area in Malaysia's scientific landscape. Researchers are actively working to create biocompatible materials that can serve as scaffolds in tissue engineering applications. These materials are designed to mimic the natural extracellular matrix, providing structural support for cells and promoting their growth and differentiation. By utilizing a range of biocompatible materials, including natural polymers like collagen and chitosan, as well as synthetic alternatives such as polylactic acid, Malaysian scientists are working to improve the integration and functionality of engineered tissues within the body. These materials are utilized in bone, cartilage, and skin tissue engineering. The integration of bioactive molecules and growth factors into these biomaterials is also being explored, as it enhances their regenerative properties and fosters a conducive environment for healing. This focus on advanced biomaterials is pivotal for applications in wound healing and tissue repair, where the aim is to encourage tissue regeneration and functional recovery.

Furthermore, the integration of bioactive molecules and growth factors into biomaterials is a burgeoning area of research in Malaysia. By developing smart biomaterials that can release these therapeutic agents in a controlled manner, researchers aim to create environments that promote healing and tissue formation. This approach is particularly relevant in wound healing applications, where enhancing angiogenesis and tissue repair is crucial for effective recovery. The ability to design biomaterials that respond dynamically to physiological conditions represents a significant advancement in regenerative medicine, potentially leading to improved clinical outcomes for patients.

Tissue engineering as a field combines the insights gained from stem cell and biomaterials research, leading to innovative solutions for complex medical issues. Malaysian researchers are at the forefront of developing tissue-engineered constructs that can address the limitations of traditional therapies. For instance, advancements in 3D bioprinting technologies are enabling the creation of more complex tissue structures, which closely resemble natural tissues in terms of architecture and function [5]. This innovative approach opens up possibilities for personalized medicine, allowing for the customization of therapies tailored to individual patients' needs. Research teams in Malaysia are also experimenting with organoid technology and bioartificial constructs for liver, kidney, and heart tissues, although these are primarily in pre-clinical stages [6]. Current efforts aim to reduce the need for organ transplantation by developing alternative options.

1.2 Clinical Applications and Trials

In Malaysia, regenerative medicine has gained more interest over the years. The potential of using RMT in Malaysian clinical settings as a substitute for traditional treatment or as a potential therapeutic option in the future has drawn more attention. Although still in nascent stages, clinical trials in Malaysia have begun to explore the efficacy of stem cell therapies for orthopedic and dermatological conditions [7]. Public and private sectors are collaborating to ensure that safety and ethical standards are met, reflecting Malaysia's efforts to align with global TERM research.

2. Benefits of Tissue Engineering and Regenerative Medicine in Malaysia

The benefits of TERM in Malaysia are increasingly evident as the technology matures. Proven studies have shown potential in several areas chronic disease management, reduced in dependency on transplants as well as increasing the country's economic growth and medical tourism. TERM has shown promise in managing chronic illnesses, which are prevalent in Malaysia, including diabetes and

cardiovascular diseases. Stem cell therapies offer a potential solution for tissue repair and regeneration, which can reduce the burden of long-term healthcare costs. For example, if regenerative therapy is able to reverse kidney failure, a patient that would initially need to undergo dialysis three times a week will no longer need to do so. This will eventually reduce the health burden of the country that subsidizes for patients that have to undergo dialysis.

Advances in bioartificial organ research may also eventually reduce the demand for organ transplants, which are limited by donor shortages. Scaffold-based tissue engineering can address the growing need for bone and cartilage repair in Malaysia's aging population [8]. This will also reduce the risk of rejection and complications from graft-versus-host disease (GVHD) in transplant patients.

Malaysia's emphasis on Tissue Engineering and Regenerative Medicine (TERM) positions it as a potential hub for medical tourism in Southeast Asia. The country's investment in advanced research and development in these innovative fields reflects a commitment to enhancing healthcare capabilities and attracting international patients. With its combination of cutting-edge technology and skilled professionals, Malaysia offers a range of TERM treatments that appeal to medical tourists seeking solutions for conditions such as orthopedic injuries, degenerative diseases, and aesthetic procedures [8]. This growing focus on TERM not only showcases Malaysia's medical advancements but also reinforces its reputation as a destination for high-quality, specialized healthcare.

As medical tourists increasingly seek advanced TERM treatments, this trend contributes significantly to Malaysia's healthcare revenue. Patients from neighboring countries and beyond are drawn to the promise of regenerative therapies that can improve recovery times and outcomes, making Malaysia an attractive alternative to traditional healthcare options. The surge in medical tourism related to TERM enhances not just the healthcare sector but also stimulates the local economy, benefiting industries like hospitality and transportation [9]. Furthermore, the Malaysian government actively supports this growth through initiatives aimed at improving healthcare infrastructure and promoting the country as a center for medical excellence. This strategic positioning not only bolsters Malaysia's status in the global medical tourism market but also underscores its commitment to providing innovative and effective healthcare solutions.

3. Limitations and Challenges of Tissue Engineering and Regenerative Medicine in Malaysia

Despite its potential, TERM in Malaysia faces several challenges. While stem cell therapy has promising benefits, regulatory frameworks in Malaysia are still under development, particularly regarding the use of genetically modified stem cells and bioethical considerations. The cell and gene therapy products (CGTP) in Malaysia only has a guideline dated most recently in 2024 (Guidelines On Stem Cell And Cell-Based Research And Therapy 3rd Edition, MOH/P/PAK/542.24 (GU) - e), to be used and followed by fellow researchers as well as industrial players. There is no proper law and regulation as of yet in the country to monitor and ensure the safety and efficacy of all CGTP in Malaysia [10].

The application of stem cell therapy in Malaysia, being a Muslim-majority country, must also align with the Islamic principles. In Islam, the use of stem cell therapy is generally considered permissible, provided it adheres to ethical guidelines that respect human dignity and life. Islamic bioethics emphasizes the importance of preserving human life, and scholars have debated the permissibility of using stem cells, particularly those derived from embryos, based on the sanctity of life [11]. Malaysia is also a multi-racial country with diverse religious belief system. The regulation and ethical approvals must consider the population traditions and beliefs [12]. Despite its potential to treat various diseases, challenges in implementing stem cell therapy include limited public understanding, ethical concerns over embryonic stem cell use, and the need for specialized infrastructure and trained professionals.

Another limitation for TERM in Malaysia is the massive high costs of the products and limited accessibility to the general public. The cost of TERM therapies remains high due to the operational costs and the materials being used to manufacture and develop TERM products, which limits the accessibility to most Malaysians [13]. This is especially true for complex stem cell treatments, which require specialized facilities and highly trained personnel. The therapy is currently exclusive to those who not only know about it, but also those who could afford it, among less than 0.1% of the total population.

Lastly, the lack of research funding and infrastructure has always impaired the growth and development of TERM in Malaysia. Compared to neighboring countries such as Singapore and Thailand, Malaysia's investment in TERM research infrastructure and funding is very limited. Singapore, for instance, has established the Agency for Science, Technology, and Research (A*STAR) to support TERM innovation, while Thailand has a well-established network of stem cell research centers.

Both Singapore and Thailand are leaders in TERM within Southeast Asia. Singapore's A*STAR and collaborations with global institutions have bolstered its TERM capabilities, while Thailand's National Stem Cell Bank and partnerships with hospitals facilitate clinical applications. In contrast, Malaysia lacks centralized TERM research and funding bodies, potentially hindering its growth and competitiveness in the region [14, 15].

4. Conclusions

To advance TERM in Malaysia, several strategies can be considered. Malaysia should strengthen the regulatory frameworks by implementing robust regulations to ensure safety and efficacy standards for TERM therapies can increase public trust and attract more investment [14]. The government should also increase funding and infrastructure dedicated for TERM by establishing dedicated research centers. Increasing funding for TERM research would foster innovation and potentially draw international collaboration. Furthermore, it will help to validate the current practices of TERM in Malaysia using scientific evidence.

There should also be a good public and private partnership. Most industrial players do not collaborate with the public institutions. Encouraging partnerships between academic institutions, industry, and government can help bridge knowledge gaps, improve access to TERM therapies, and drive market growth.

In conclusion, Malaysia's commitment to TERM has the potential to transform healthcare by addressing critical health needs and positioning the country as a leader in medical innovation within Southeast Asia. By implementing these recommendations, Malaysia can continue to develop TERM and increase its accessibility to benefit the broader population.

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3.8 Pembentang 5

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The Significance of the Fleet Management and Control (UFMC) System for Unmanned Aerial Systems (UAS) in Malaysia

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ABSTRACT

E-commerce has been a major driver of growth in the global parcel market, which is projected to reach 200 billion parcels by 2025. To meet this demand, major companies such as Google and Amazon are investing in unmanned aerial systems (UAS) delivery services. By 2030, the drone package delivery market is expected to expand from USD 2.1 billion in 2023 to USD 27.4 billion. To support this growth, the UAS Fleet Management System (UFMS) is required. The movement of drones used for tasks such as delivery, inspection, mapping, and surveying would be managed through the UFMS. This system enables operator communication, safety tracking, and real-time management. In addition, Malaysia should adopt regulations governing the use of UAS, with safety of the ecosystem given the highest priority. The International Civil Aviation Organization's recommended standard practices should be implemented in the Malaysian context. At present, however, Malaysia's UFMS, regulations, and safety ecosystem remain insufficiently prepared. To address this, the research team is currently developing a UFMS prototype for residential areas and proposing a comprehensive safety ecosystem and regulatory framework for future adoption. This initiative, which focuses on the social, economic, and regulatory impacts of UAS technology, represents an important step toward community integration. The outcomes are intended to support the development of a drone delivery sector that is both safe and effective.

1. Introduction

The rapid expansion of e-commerce has transformed logistics networks worldwide, creating pressure on conventional courier services. Urban congestion, rising costs, and scalability issues have exposed the limitations of traditional systems [1,2]. Unmanned aerial systems (UAS) have emerged as a potential solution for last-mile delivery, with international corporations such as Amazon and Google already showcasing the feasibility of drone logistics. For Malaysia, integrating UAS into the logistics sector is consistent with the Malaysia Aerospace Industry Blueprint 2030, the Twelfth Malaysia Plan (RMK-12) and the Thirteen Malaysia Plan (RMK-13) which highlight advanced aviation technologies, automation, and sustainability [3–5]. In addition, the National Industrial Master Plan 2030 (NIMP 2030) emphasizes industrial modernization, digitalization, and advanced manufacturing, creating a strategic foundation for the adoption of unmanned aerial systems in logistics and supply chain operations [6]. However, large-scale deployment of UAS requires a structured fleet management system to ensure operational safety, regulatory compliance, and public confidence [2].

2. Fleet Management and Control (UFMC) System

2.1 Core Functions

The Fleet Management and Control (UFMC) system serves as the technical backbone for coordinating multiple drones in both urban and rural airspace. In line with recent studies that integrate optimization and task allocation frameworks such as the Grey Wolf Optimizer (GWO) and Consensus-Based Bundle Algorithm (CBBA), the UFMC system enables dynamic scheduling, efficient task distribution, and cost-effective fleet utilization [7,8] By combining real-time monitoring, safety tracking, secure communication, and mission management, UFMC ensures that unmanned aerial vehicles can operate reliably while minimizing conflicts with manned aviation. Furthermore, the integration of predictive maintenance and data-driven resource management enhances scalability and operational resilience, demonstrating how advanced scheduling approaches contribute to robust and efficient multi-UAV delivery networks [9].

2.2 International Standards

At the international level, the International Civil Aviation Organization (ICAO) provides the principal framework guiding the development of fleet management systems for unmanned aerial systems. Annex 19 introduces the Safety Management System (SMS), which requires UAS operators to implement structured processes for identifying hazards and mitigating risks during operations. In addition, Annex 6, Part IV outlines operational procedures for remotely piloted aircraft systems, including fleet-related requirements such as maintenance schedules, operational control, and crew management. Safe integration into civil airspace is further addressed through the work of the Remotely Piloted Aircraft Systems Panel (RPASP), which develops standards to ensure that fleet operations are compatible with existing air traffic management and do not interfere with manned aviation. Finally, Annex 10, Volume VI establishes data and communication protocols, particularly for command-and-control (C2) links, which are critical for secure operator communication and effective fleet management. Collectively, these provisions ensure that unmanned aerial system operations are harmonized with global aviation practices while maintaining a strong emphasis on safety, communication reliability, and regulatory compliance.

2.3 Malaysian Regulations

In Malaysia, the Civil Aviation Authority of Malaysia (CAAM) has issued CAD 6011 directives to regulate unmanned aircraft operations. Part I covers the certification of Remote Pilot Training Organizations, Part II establishes standards for agricultural UAS, and Part V governs special projects such as Beyond Visual Line of Sight (BVLOS) missions[10,11]. While these directives demonstrate Malaysia's commitment to drone governance, they remain insufficient to support widespread package delivery. A comprehensive UFMC system that integrates ICAO standards with CAAM regulations will be required to ensure safe, efficient, and scalable implementation.

3. Challenges of Unmanned Aerial Systems Fleet Management and Control Deployment in Malaysia

Despite the potential of unmanned aerial systems, several challenges remain before drone delivery can be fully integrated into Malaysia's logistics ecosystem. The regulatory framework is still fragmented, with existing Civil Aviation Directive 6011 covering only pilot training, agricultural applications, and special projects, but not yet addressing urban commercial delivery. The safety ecosystem also requires strengthening, particularly through the wider integration of International Civil Aviation Organization–compliant Safety Management Systems, which are vital for risk-based oversight. Infrastructure readiness

is another barrier, as Malaysia has yet to establish nationwide unmanned aerial systems traffic management systems and reliable communication networks capable of supporting dense drone operations. Public acceptance further complicates implementation, with ongoing concerns regarding noise, privacy, and community safety.

To address these challenges, it is vital to develop a residential fleet management and control system prototype. This prototype aims to test how a structured system can ensure operational safety, regulatory compliance, and community acceptance in a controlled environment. Furthermore, alignment with the Malaysian Drone Technology Action Plan 2030 (MDTAP30) strategic missions such as strengthening governance, developing infrastructure readiness, and enabling commercial adoption will be critical for ensuring that fleet management and control systems are not only technically viable but also nationally scalable[12]. The lessons derived from this initiative are expected to inform the development of a broader national framework for drone delivery operations, helping Malaysia move toward safe and sustainable integration.

4. Conclusions

The fleet management and control system represents a cornerstone for the safe, efficient, and scalable deployment of unmanned aerial systems package delivery services. For Malaysia to fully realize the benefits of drone logistics, the regulatory ecosystem must be strengthened by aligning with the standards of the International Civil Aviation Organization, expanding the directives of the CAAM, and embedding fleet management and control principles into national aerospace strategies. The development of a residential fleet management and control system prototype marks an important step toward readiness, demonstrating that drone delivery can be implemented responsibly. By prioritizing safety, governance, and social acceptance, Malaysia can establish a drone delivery sector that is not only technologically feasible but also socially and economically sustainable.

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3.9 Pembentang 6

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Engineering method to prevent parents left kid/toddler in vehicle

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ABSTRACT

The tragic and preventable fatalities of young children left unattended in vehicles have garnered increasing international attention in recent years. Once perceived primarily as an isolated concern in Malaysia and similar tropical regions, this issue has now emerged as a significant public health and safety challenge in various parts of the world, including temperate countries during warmer seasons. Numerous studies have highlighted the rapid temperature rise inside parked vehicles, which can lead to fatal hyperthermia, especially in young children who possess underdeveloped thermoregulatory systems and are unable to exit the vehicle independently. According to the American Academy of Pediatrics (2021), internal vehicle temperatures can increase by more than 20°C within just 10 minutes, even in moderately warm weather, posing severe risks to child occupants. In response to these alarming statistics, various technological, legal, and behavioral interventions have been proposed globally. This paper focuses on an innovative engineering approach that utilizes existing in-vehicle technologies—such as sensor systems, automatic climate control, and alert mechanisms—to prevent these tragedies. By integrating safety systems with intelligent monitoring and response capabilities, this research aims to contribute a practical and scalable solution to enhance child passenger safety in vehicles.

1. Introduction

The tragic and often fatal consequences of leaving young children unattended in parked vehicles have become a pressing global concern. While such incidents were once perceived as localized to hot climates—such as Malaysia, where average vehicle cabin temperatures can rise rapidly due to intense solar radiation—they are now widely reported in temperate and even colder countries during warmer months. Numerous empirical studies have demonstrated that the temperature inside a closed vehicle can increase by approximately 20°C within just 10 minutes, even when the ambient temperature is as low as 22°C [1].

For young children, whose bodies heat up three to five times faster than adults and who are less capable of regulating core body temperature, this can lead to life-threatening hyperthermia in a matter of minutes. Furthermore, infants and toddlers lack the physical and cognitive ability to escape from a locked car or call for help, making them entirely dependent on caregivers for their safety. These incidents are not merely the result of negligence; they often stem from routine disruption, stress, or cognitive lapses—known in behavioral science as "forgotten baby syndrome."

According to data from the U.S. National Safety Council, over 900 child fatalities due to vehicular heatstroke were recorded between 1998 and 2023, with many more narrowly avoided [2]. Traditional awareness campaigns, legal penalties, and behavior-change interventions have had limited success in

fully preventing such tragedies. As a result, there is a growing consensus among researchers, engineers, and safety advocates that technological intervention is essential.

This paper proposes an innovative engineering solution that leverages existing automotive systems—including motion sensors, cabin temperature monitors, seat pressure detection, and onboard communication interfaces—to detect the presence of a child left in the vehicle and activate appropriate safety responses. These responses may include visual and auditory alerts, mobile phone notifications to caregivers, or even automatic window ventilation or climate control activation. By harnessing and integrating available vehicle technologies into a cohesive safety framework, this study aims to advance a proactive, reliable, and scalable system that significantly reduces the risk of pediatric vehicular heatstroke worldwide.

2. Problem Statement

2.1 Formal Rules & Informal Rules

Despite increasing public awareness and advocacy efforts, the disturbing trend of children being accidentally left unattended in vehicles continues to claim lives globally. Year after year, statistics reveal a persistent number of fatalities resulting from vehicular heatstroke, highlighting the inadequacy of current preventive strategies and the need for more robust interventions. The majority of these incidents occur not due to deliberate neglect but as a result of cognitive failure, often when a parent or caregiver unintentionally forgets the presence of a child in the rear seat after turning off the vehicle.

This phenomenon—commonly referred to in behavioral science as "forgotten baby syndrome"—is frequently linked to changes in routine, stress, or distractions, which impair memory and decision-making. In Malaysia, such incidents have prompted legal action and policy responses. Under Section 33 of the Child Act 2001, it is an offence to leave a child without reasonable supervision, and violators may face a fine of up to RM50,000 or imprisonment for a term not exceeding five years, or both [3]. This legislative provision reflects the seriousness with which child endangerment is regarded. However, while punitive measures serve as a deterrent, they do not directly prevent the occurrence of such incidents.

Therefore, it is essential to complement legal frameworks with proactive, technology-based safety solutions that can detect the presence of a child in a vehicle and alert caregivers or emergency services before a tragedy occurs. This paper argues that the integration of smart vehicle technologies offers a viable and scalable path forward in addressing this persistent public safety issue.

2.2 Existing technological interventions and case studies from other countries

In response to the alarming frequency of heatstroke-related fatalities among children left in vehicles, a range of technological interventions has been developed and implemented in various countries. In the United States, several automobile manufacturers have introduced Rear Seat Reminder Systems—such as those by General Motors and Hyundai—which prompt drivers with audible or visual alerts to check the back seat upon exiting the vehicle. These systems typically function by detecting the opening and closing of rear doors prior to ignition and issuing alerts when the ignition is turned off. Some newer vehicles incorporate more advanced occupant detection systems using motion sensors, weight sensors embedded in child safety seats, or even in-cabin radar technologies that can detect micro-movements such as a child's breathing.

In 2021, the U.S. Congress passed the Hot Cars Act as part of the Infrastructure Investment and Jobs Act, requiring all new vehicles to be equipped with child detection technologies by 2025 [4]. Similarly, South Korea has mandated the use of child presence detection systems in certain categories of school and daycare transportation, using both infrared sensors and camera-based monitoring to trigger emergency responses if a child is left behind. These advancements signal a growing recognition that behavioral interventions and legal deterrents alone are insufficient. Instead, effective solutions must integrate intelligent systems capable of identifying and responding to potential risks autonomously, often

in real-time. The integration of such smart technologies represents a critical shift from reactive to proactive safety management and serves as a foundation for this paper's proposed engineering solution, which seeks to adapt and localize these innovations within the Malaysian context.

3. Propose Solution

This paper proposes the development of a smart alert system that enhances existing vehicle safety features to prevent the accidental entrapment of children in parked vehicles. The core innovation involves leveraging and modifying current seatbelt monitoring systems to detect the presence of an occupant—particularly a child—after the vehicle has been turned off. The system architecture consists of four main components.

First, sensor integration: using pressure sensors embedded in seats and seatbelt latch detectors, the system will identify whether seatbelts remain fastened upon engine shutdown [5]. This functionality mirrors current safety systems but extends their logic beyond motion status to post-ignition conditions.

Second, the alert mechanism: if seatbelt engagement is detected after the vehicle is turned off, the system will trigger an immediate multi-channel alert. This may include visual cues on the dashboard, auditory warnings inside the cabin, and push notifications sent to a paired mobile device via Bluetooth or a cloud-based application [6].

Third, the system will be fully compatible with child car seats, incorporating specific adaptations to recognize whether a child restraint system is occupied and latched. Research has shown that occupant detection systems—especially those designed for child safety—are more effective when integrated with weight and motion sensors capable of detecting small movements such as breathing [7]; [8]. This ensures that even when a child is properly secured—as required by law—the system remains active and responsive.

Finally, the system prioritizes user-friendly design, requiring minimal user intervention. It will operate automatically without requiring drivers to activate or deactivate it manually, reducing the likelihood of user error or misuse [9]. By implementing such an intelligent, adaptable, and accessible technology, this solution offers a practical approach to reducing the risk of heat-related fatalities among young children left unattended in vehicles, aligning with global efforts to advance child vehicular safety [10].

4. Conclusions

The increasing incidence of child fatalities resulting from thermal injuries in parked vehicles is a serious and growing public safety concern that demands immediate and effective intervention. Young children, due to their physiological vulnerability and inability to self-rescue, are especially at risk when left unattended in enclosed vehicles where internal temperatures can rise to lethal levels within minutes [1]. Addressing this issue requires a shift from reactive awareness campaigns to proactive technological solutions.

By adapting and enhancing existing vehicle systems—such as seatbelt sensors, cabin monitors, and communication interfaces—it is possible to develop a reliable safety mechanism that detects the presence of a child after the vehicle has been turned off and issues timely alerts to caregivers. This engineering proposal not only addresses a critical gap in current vehicle safety features but also offers a scalable and cost-effective method to prevent entirely avoidable tragedies. The implementation of such systems across new vehicle models, and potentially as aftermarket solutions for older vehicles, could significantly reduce the occurrence of heatstroke-related deaths.

Beyond its life-saving potential, this innovation would alleviate emotional and psychological burdens on parents and caregivers, promote peace of mind, and contribute to broader child safety initiatives within transport policy frameworks. As such, this proposal represents an important step forward in the global effort to ensure a safer vehicular environment for children.

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3.10 Pembentang 7

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Cabaran Ergonomik di Malaysia Masa Kini

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ABSTRACT

Ergonomik berasal dari kata Yunani "ergon" (kerja) dan "nomos" (undang-undang), ia bertujuan untuk meningkatkan keselesaan, keselamatan, dan produktiviti di tempat kerja. Kepentingannya termasuk mengurangkan risiko kecederaan, mencegah masalah kesihatan seperti sakit belakang dan ketegangan otot, serta meningkatkan kecekapan pekerja. Menurut data Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP) pada tahun 2021, terdapat 9,822 kes penyakit dan keracunan pekerjaan dengan kadar kecederaan 1.43 per 1,000 pekerja dan 301 kes kecederaan maut. Cabaran ergonomik di Malaysia meliputi keselamatan di tempat kerja, masalah kesihatan pekerja, persekitaran kerja yang tidak sesuai, kurangnya kesedaran dalam pengurusan organisasi, kesedaran pendidikan ergonomik yang rendah, dan cabaran bekerja dari rumah pasca pandemik. Kesimpulannya, ergonomik penting untuk kesejahteraan pekerja dan produktiviti negara, memerlukan tindakan proaktif dari pembuat dasar untuk menggalakkan amalan ergonomik yang lebih baik, yang dapat meningkatkan kesihatan pekerja, produktiviti, serta mengurangkan kos perubatan dan kadar ketidakhadiran.

1. Pengenalan

Ergonomik berasal dari dua perkataan Yunani: "ergon" yang bermaksud kerja, dan "nomos" yang bermaksud undang-undang atau peraturan. Ergonomik adalah sains yang mengkaji interaksi antara manusia dan elemen lain dalam sistem kerja, serta menerapkan prinsip, data, dan kaedah untuk merancang tempat kerja yang lebih baik.

Tujuan kajian terhadap isu ergonomic adalah bagi memastikan persekitaran kerja yang selesa untuk mengurangkan ketidakselesaan dan keletihan. Selain itu, ia juga mengurangkan risiko kecederaan dan kemalangan di tempat kerja. Disamping itu, ergonomic juga mampu meningkatkan kecekapan dan prestasi pekerja dengan menyediakan persekitaran kerja yang sesuai.

Antara Kepentingan Ergonomik adalah mengurangkan risiko kecederaan dan kemalangan di tempat kerja dengan memastikan peralatan dan persekitaran kerja sesuai dengan keperluan fizikal pekerja. Ergonomic juga, mampu mencegah masalah kesihatan seperti sakit belakang, ketegangan otot, dan masalah penglihatan yang sering berlaku akibat postur kerja yang tidak betul serta mampu meningkatkan kecekapan dan prestasi pekerja dengan menyediakan persekitaran kerja yang selesa dan sesuai.

Secara asasnya statistik penyakit pekerjaan terkini seperti berikut:

1. Jumlah Kes Penyakit Pekerjaan: 9,822 kes pada tahun 2021.
2. Kadar Kecederaan Pekerjaan: 1.43 per 1,000 pekerja.
3. Jumlah Kecederaan Maut: 301 kes pada tahun 2021.

Penyakit Berkaitan Ergonomik yang biasa dihadapi dikalangan pekerja seperti dilaporkan adalah :

1. Sakit Belakang: Akibat postur membongkok, duduk lama, atau mengangkat beban berat.
2. Sindrom Terowong Karpal: Akibat pergerakan tangan atau pergelangan tangan yang berulang-ulang.
3. Tendinitis: Keradangan pada tendon akibat penggunaan berulang.
4. Kecederaan Tegangan Berulang : Cedera pada otot, saraf, atau tendon akibat pergerakan yang berulang.
5. Sakit Leher dan Bahu: Akibat posisi kerja yang tidak ergonomik.
6. Gangguan Otot dan Tulang (MSDs): Menjejaskan otot, sendi, dan tulang akibat kerja fizikal yang berat atau postur yang tidak sesuai.

2. Cabaran masa kini

Cabaran ergonomik di Malaysia masa kini semakin rumit seiring dengan pesatnya perkembangan sektor perindustrian dan teknologi. Keperluan untuk menyesuaikan tempat kerja dengan keperluan fizikal pekerja menjadi isu utama, terutama di sektor perkilangan dan pembinaan yang melibatkan kerja fizikal yang berat dan pengulangan gerakan. Pekerja dalam sektor ini sering terdedah kepada postur yang tidak selesa, seperti membongkok atau mengangkat beban berat secara berulang-ulang tanpa sokongan yang mencukupi. Amalan ini mengundang masalah kesihatan serius seperti sakit belakang, masalah sendi, dan kecederaan akibat beban kerja berlebihan. Sebagai contoh, dalam industri pembinaan, pekerja mungkin terpaksa bekerja dalam posisi yang tidak ergonomik selama berjam-jam, mengakibatkan ketegangan otot dan kecederaan kronik. Penggunaan alat yang tidak direka untuk menyokong keselesaan tubuh juga menyumbang kepada masalah ini, seperti penggunaan pemutar skru atau alat berat yang tidak sesuai dengan postur kerja semulajadi tubuh manusia.

Selain sektor perkilangan dan pembinaan, cabaran ergonomik juga semakin ketara dalam sektor pejabat. Kemajuan teknologi telah mengubah gaya kerja dengan penggunaan komputer dan peralatan digital yang semakin meluas. Pekerja yang bekerja dalam suasana pejabat sering menghadapi masalah ketegangan mata akibat terlalu lama menatap skrin, sindrom karpal terowong kerana penggunaan tetikus dan papan kekunci yang tidak ergonomik, serta masalah postur tubuh yang salah akibat kerusi dan meja yang tidak disesuaikan dengan ketinggian dan bentuk tubuh individu. Sebagai contoh, postur tubuh yang buruk ketika duduk di meja komputer boleh menyebabkan tekanan pada tulang belakang dan menyebabkan kesakitan yang berpanjangan. Masalah-masalah ini memperburuk lagi keadaan kesihatan pekerja, mengurangkan produktiviti, dan meningkatkan kos perubatan.

Selain isu fizikal, budaya kerja yang cenderung mengutamakan produktiviti tanpa memperhatikan kesejahteraan pekerja juga menjadi cabaran besar dalam meningkatkan kesedaran ergonomik di Malaysia. Banyak organisasi masih belum memberi penekanan yang cukup terhadap pentingnya amalan kerja yang sihat, dan pekerja seringkali berisiko terdedah kepada keletihan fizikal dan mental yang tinggi. Dalam banyak kes, tekanan untuk mencapai sasaran kerja dalam tempoh yang singkat menyebabkan pekerja tidak mempunyai waktu yang cukup untuk berehat, serta terpaksa bekerja dalam keadaan yang tidak ergonomik. Kurangnya pendidikan dan latihan mengenai ergonomik di kalangan majikan dan pekerja menyebabkan ramai yang tidak menyedari kesan buruk yang timbul akibat amalan kerja yang salah. Pekerja seringkali mengabaikan postur tubuh yang betul, menggunakan peralatan yang tidak sesuai, dan terus bekerja meskipun mengalami kesakitan, kerana kurangnya pengetahuan tentang langkah pencegahan.

Faktor demografi juga memainkan peranan penting dalam cabaran ergonomik ini. Dengan peningkatan usia dalam kalangan pekerja di Malaysia, terdapat keperluan untuk menyesuaikan tempat kerja dengan perubahan fisiologi pekerja yang lebih tua. Pekerja yang lebih berusia cenderung menghadapi masalah kesihatan yang lebih banyak, seperti sakit sendi atau penurunan kekuatan otot, yang memerlukan perhatian khusus dalam reka bentuk tempat kerja. Pekerja yang lebih tua mungkin lebih sensitif terhadap postur yang salah atau alat yang tidak sesuai, dan oleh itu, reka bentuk tempat kerja perlu lebih fleksibel dan disesuaikan dengan keadaan fizikal pekerja yang berbeza.

Selain daripada masalah fizikal, cabaran ergonomik juga melibatkan faktor psikologi. Tekanan kerja yang semakin meningkat, terutama dalam persekitaran yang mengutamakan produktiviti, boleh menyebabkan stres yang berterusan. Pekerja yang berasa tertekan dan terdesak untuk memenuhi matlamat kerja sering bekerja dalam keadaan mental yang tegang, yang turut memberi kesan kepada kesihatan fizikal mereka. Stres ini boleh memperburuk keadaan seperti ketegangan otot, migrain, atau masalah tidur, yang kesemuanya menjejaskan produktiviti dan kualiti hidup pekerja.

Bagi menangani cabaran ergonomik ini, penyelesaian yang komprehensif diperlukan. Salah satu pendekatan utama adalah dengan meningkatkan kesedaran mengenai ergonomik di kalangan pekerja dan majikan. Pendidikan dan latihan ergonomik yang lebih menyeluruh perlu diberikan kepada semua lapisan pekerja, daripada sektor industri hingga ke pejabat. Reka bentuk tempat kerja juga perlu diberi perhatian yang lebih besar dengan penggunaan peralatan yang ergonomik dan susun atur ruang yang memudahkan pekerja untuk bekerja dalam postur yang betul. Di samping itu, program kesejahteraan pekerja yang menyokong kesihatan mental dan fizikal, seperti latihan regangan, waktu rehat yang mencukupi, dan sokongan psikologi, perlu diperkenalkan. Penciptaan budaya kerja yang lebih prihatin terhadap kesejahteraan pekerja juga penting, di mana majikan memberi perhatian kepada kesihatan jangka panjang pekerja dan menyediakan persekitaran yang lebih seimbang antara produktiviti dan kesejahteraan.

Selain itu, penambahbaikan dalam dasar dan peraturan kesihatan dan keselamatan pekerjaan juga perlu diperkukuhkan. Kerajaan dan pihak berkuasa perlu memperkenalkan undang-undang yang lebih ketat berkaitan dengan ergonomik di tempat kerja dan memastikan pematuhannya, serta memberi insentif kepada syarikat yang melaksanakan amalan terbaik dalam ergonomik. Dengan pendekatan yang lebih menyeluruh ini, Malaysia dapat menangani cabaran ergonomik yang semakin kompleks ini dan mewujudkan persekitaran kerja yang lebih selamat, sihat, dan produktif untuk semua pekerja.

3. Cadangan Penyelesaian

Untuk menyelesaikan isu ergonomik di Malaysia secara komprehensif dan tuntas, satu pendekatan yang melibatkan pelbagai pihak dan merangkumi aspek fizikal, psikologi, sosial, dan perundangan adalah diperlukan. Langkah-langkah berikut dapat diambil untuk menangani cabaran ini secara menyeluruh:

Pendidikan kepada Majikan dan Pekerja. Langkah pertama dalam penyelesaian adalah meningkatkan kesedaran mengenai kepentingan ergonomik melalui pendidikan dan latihan yang meluas. Pekerja perlu diberi latihan mengenai postur yang betul, penggunaan peralatan yang ergonomik, dan cara untuk mengelakkan kecederaan di tempat kerja. Program latihan ini harus diperkenalkan pada peringkat awal pekerjaan dan dijalankan secara berkala untuk memastikan pekerja sentiasa mengikuti amalan ergonomik yang terbaik. Majikan juga perlu dilatih untuk memahami kepentingan kesihatan pekerja dan mengambil langkah proaktif dalam menyediakan persekitaran kerja yang ergonomik. Ini termasuk memahami faktor risiko kesihatan yang mungkin dihadapi oleh pekerja dan cara untuk menyesuaikan tempat kerja bagi mengurangkan risiko tersebut.

Setiap tempat kerja, baik dalam sektor perindustrian mahupun pejabat, perlu direka dengan mengambil kira aspek ergonomik. Bagi sektor perkilangan dan pembinaan, susun atur tempat kerja dan penggunaan peralatan harus mengurangkan ketegangan fizikal pada pekerja. Ini termasuk menyediakan peralatan yang direka untuk meminimumkan kecederaan dan beban fizikal, serta memastikan ruang kerja selesa dan sesuai dengan postur tubuh manusia. Di pejabat, penggunaan kerusi dan meja yang boleh disesuaikan, serta peralatan teknologi yang ergonomik seperti tetikus dan papan kekunci yang menyokong pergerakan tangan dengan lebih baik, adalah langkah penting. Tempat kerja juga harus memperkenalkan ruang rehat dan senaman untuk pekerja bagi mengurangkan keletihan. Bagi pekerja yang lebih berusia, reka bentuk tempat kerja perlu lebih fleksibel dengan menyediakan peralatan dan kemudahan yang dapat mengurangkan beban fizikal, seperti kerusi yang menyokong tubuh dengan lebih baik atau ketinggian meja yang boleh disesuaikan.

Penciptaan budaya kerja yang lebih berfokus pada kesejahteraan pekerja adalah langkah penting. Pekerja harus diberi masa yang mencukupi untuk berehat dan bersenam, serta diberi sokongan dalam menguruskan stres. Budaya ini harus diterapkan dari pihak pengurusan tertinggi dan dikomunikasikan secara jelas kepada pekerja di semua peringkat. Program kesejahteraan mental seperti kaunseling dan sokongan psikologi di tempat kerja harus dipertingkatkan untuk mengurangkan kesan stres yang dihadapi pekerja. Ini termasuk menyediakan ruang untuk relaksasi, latihan pengurusan stres, dan membina persekitaran kerja yang menyokong kesihatan mental pekerja.

Kerajaan perlu memperkenalkan dan menguatkuasakan undang-undang yang lebih ketat mengenai ergonomik di tempat kerja. Ini termasuk mewajibkan syarikat untuk melakukan penilaian risiko ergonomik dan memperkenalkan peraturan yang menetapkan standard reka bentuk tempat kerja yang selamat dan selesa. Undang-undang ini harus mencakup semua sektor, dari perkilangan hingga perkhidmatan pejabat. Selain penguatkuasaan undang-undang, kerajaan juga boleh memberi insentif kepada syarikat yang melaksanakan amalan terbaik dalam ergonomik, seperti pengecualian cukai atau bantuan kewangan untuk membiayai penambahbaikan tempat kerja yang ergonomik. Ini dapat memberi motivasi kepada syarikat untuk melabur dalam kesihatan pekerja mereka.

Untuk memastikan penyelesaian yang diterapkan tetap relevan, penyelidikan berterusan dalam bidang ergonomik perlu dijalankan. Ini termasuk penyelidikan tentang teknologi baru yang dapat membantu mencipta persekitaran kerja yang lebih ergonomik dan memahami cabaran ergonomik yang lebih spesifik, seperti kesan bekerja dalam keadaan stres atau masalah kesihatan yang dihadapi oleh pekerja tua. Teknologi terkini seperti alat pemantauan kesihatan pekerja atau aplikasi yang mengingatkan pekerja untuk menukar postur boleh digunakan untuk memastikan pekerja sentiasa berada dalam keadaan yang ergonomik. Alat seperti meja berdiri dan kerusi yang dapat disesuaikan juga perlu diperkenalkan dengan lebih meluas.

Syarikat perlu menjalankan audit ergonomik secara berkala untuk menilai keberkesanan langkah-langkah yang diambil dan mengenal pasti kawasan yang memerlukan penambahbaikan. Ini termasuk mendapatkan maklum balas daripada pekerja mengenai keselesaan dan kebajikan mereka di tempat kerja. Selain daripada penilaian ergonomik, pemantauan kesihatan pekerja yang terdedah kepada risiko ergonomik juga penting. Ini termasuk pemeriksaan kesihatan secara berkala untuk mengenal pasti sebarang masalah kesihatan awal yang mungkin disebabkan oleh kerja yang tidak ergonomik.

Penyelesaian yang komprehensif memerlukan kerjasama antara majikan, pekerja, dan kerajaan. Pekerja perlu diberi peluang untuk menyuarakan kebimbangan mereka mengenai kesihatan dan keselamatan di tempat kerja, sementara majikan perlu bersedia untuk melaksanakan langkah-langkah yang diperlukan untuk meningkatkan keselesaan pekerja. Kerajaan pula perlu menyediakan garis panduan, sokongan kewangan, dan penguatkuasaan undang-undang yang relevan.

Dengan mengambil langkah-langkah ini secara serentak, isu ergonomik di Malaysia dapat diselesaikan secara komprehensif dan tuntas, mencipta persekitaran kerja yang lebih selamat, sihat, dan produktif untuk semua pekerja, di samping meningkatkan kesejahteraan sosial dan ekonomi negara.

4. Kesimpulan

Ergonomik adalah penting untuk keselamatan, kesihatan, dan produktiviti pekerja. Dengan memahami dan mengaplikasikan prinsip ergonomik, kita boleh mencipta persekitaran kerja yang lebih selesa, selamat, dan produktif.

Pembuat dasar perlu mengambil langkah proaktif untuk menggalakkan amalan ergonomik di tempat kerja bagi memastikan kesejahteraan pekerja dan meningkatkan produktiviti negara.

Isu ergonomik di Malaysia, terutamanya dalam sektor pembinaan, pembuatan, dan perkhidmatan, memerlukan perhatian yang serius. Kekurangan kesedaran, penggunaan peralatan yang tidak sesuai, postur kerja yang tidak ergonomik, dan persekitaran kerja yang kurang kondusif telah menyumbang kepada peningkatan kes kecederaan seperti gangguan muskuloskeletal (MSDs). Meskipun terdapat garis panduan dan undang-undang berkaitan keselamatan pekerjaan, penguatkuasaan yang lemah serta kurangnya pelaburan dalam alat-alat ergonomik menyebabkan cabaran ini berlarutan.

Namun, dengan langkah-langkah seperti meningkatkan kesedaran ergonomik, menyediakan latihan yang berkaitan, mengutamakan penggunaan peralatan yang ergonomik, dan penguatkuasaan undang-undang yang lebih tegas, cabaran-cabaran ini boleh diatasi. Kesimpulannya, pelaksanaan amalan ergonomik yang lebih baik bukan sahaja dapat meningkatkan kesihatan pekerja tetapi juga meningkatkan produktiviti, mengurangkan kos rawatan perubatan, dan menurunkan kadar ketidakhadiran pekerja di tempat kerja..

Penghargaan

Kertas ilmiah ini telah di bentangkan di Simposium Kluster Kejuruteraan 2024 bertarikh 17 November 2024 bersamaan 16 Jamadilawal 1446 H di Kompleks Kejiranan Presint 16 Putrajaya tanpa sebarang pembiayaan

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3.11 Pembentang 8

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Applying Lean into Daily Work life: Strategies for Home and School Continuous Improvement

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School Lean, Home Lean.

ABSTRACT

This paper explores the application of Lean Culture into non-industrial environment, specifically focusing on daily routines within homes and schools. While Lean principles such as 5S, Kanban, Poka-Yoke, and 7 waste have proven effective in manufacturing and service industries, their use in personal and educational contexts remains limited. Addressing this gap, the study introduces a structured four-phase intervention involving teachers, students, and parents at a Malaysian private school, aimed at cultivating Lean habits both in classrooms and at home. Through awareness events, training, parental engagement, and simulated evaluation, the intervention demonstrates potential improvements in time efficiency, safety, task clarity, and workload reduction. Simulated results showed reductions in morning preparation time, forgotten items, and safety incidents, alongside enhanced teacher efficiency and student punctuality. Despite only moderate parental engagement, the findings suggest that Lean Thinking when paired with digital and AI tools can meaningfully enhance micro-level operations in everyday life and support long-term behavioral change.

1. Introduction and Problem Statement

While Lean principles have long been well established for transforming efficiency in manufacturing and factory, their adaptation in everyday personal environments particularly in homes and school's environment remains a rare case.

At home, many families face daily operational challenges including disorganized room & spaces, repetitive item misplacements, forgotten routines, and unsafe environments where tasks like cooking, cleaning, are being performed without principle of Poka-Yoke. Common household incidents such as forgetting to switch off irons, or unsafe storage of hazardous items, could be prevented thru basic Lean safeguards.

While in schools, both students and teachers also struggle to manage time, tasks, and learning materials. The absence of simple visual tools such as Kanban boards results in poor task tracking, missed assignments, and uneven learning rhythms. Teachers face manual administrative overload, such as repetitive grading and scheduling, while students lack clarity on what to be prioritized.

Compounding these issues is the under-utilization of existing AI tools exist in this 4.0 industrial revolution world. Despite the availability of AI-assisted learning platforms, auto-scheduling, or homework feedback note, many schools in Malaysia and beyond still rely on fully manual systems, leaving teachers overburdened and students unsupported.

Although Lean methodologies such as 5 waste, 5S, Poka-Yoke, and Kanban offer almost zero-cost but offer high-impact solutions, there is currently no structured framework or research guiding their application in non-industrial micro-environments like homes and schools.

This paper addresses this critical gap by exploring how Lean thinking can be reimagined to improve safety and order in homes, enhance workflow transparency in schools, and bridge Lean with digital and AI technologies to reduce time waste, improve task ownership, and support both teachers and students more effectively.

2. Literature Review

2.1 Overview of Lean Philosophy

Lean thinking originated from Japan, where Toyota Production System (TPS) with core principles outlined by Womack and Jones (1996), in value specification, value stream mapping, flow, pull, and perfection. These principles aim to minimize waste, continuously improve process flow, and create value efficiently. While traditionally associated with manufacturing, Lean methodologies have evolved and been adapted into sectors like healthcare, education, and public service.

2.2 Lean in School and Home

The application of Lean in education has primarily targeted administrative processes and institutional efficiency. Antony et al. (2012) demonstrated how Lean Six Sigma could improve examination processing and class scheduling in universities. Similarly, institutions participating in the Lean Education Academic Network (LEAN) have employed Lean to streamline enrolment procedures and curriculum delivery (Radnor & Bucci, 2007).

In terms of school application, Lean tools such as 5S have been implemented to enhance classroom organization and reduce transition time between activities (Sullivan, 2015). However, these implementations largely focus on systemic or structural operations, rather than students' personal time management or daily workflows.

Outside of formal institutions, some people have explored the use of Lean in domestic settings. Jim Womack (2011), co-founder of the Lean Enterprise Institute, has written informally about applying Lean thinking in family life including organizing kitchens using 5S and standardizing morning routines.

The concept of Personal Kanban (Benson & DeMaria Barry, 2011) adapts Lean's pull system and visual workflow into personal task management. Although not originated from academic research, Personal Kanban has been widely used in productivity communities and provides conceptual parallels to Lean tools like value stream mapping and flow analysis.

A conference case study presented by the Lean Global Network (2018) described a family's use of Lean to manage chores, schedules, and minimize waiting and rework in their daily lives. However, the study was descriptive in nature and lacked rigorous evaluation.

3. Methodology

This study adopts an action research framework to explore the introduction and cultivation of Lean principles within the daily routines of kindergarten and primary school environments, with an intentional extension into students' homes. The methodology is grounded in participatory engagement, iterative feedback, and real-world integration, enabling a multi-stakeholder approach involving students, teachers, parents, and industry professionals.

The study will be conducted in collaboration with a private educational institution in Malaysia that offers both kindergarten who ages 4 to 6 and primary education ages 7 to 12. The selected school is characterized by its flexible administrative culture, openness to pedagogical innovation, and an engaged parent community. The participant cohort will comprise approximately 80 to 100 students, along with 15 to 20 teachers and support staff. Parents of participating students will also be included in the extended outreach activities.

The intervention was structured across four progressive phases to foster Lean awareness, application, and sustainability within kindergarten and primary school, while also extending into students' homes. Phase 1 involved a Lean Exposure Event where industry-certified professionals introduced foundational Lean tools such as 5S, Kanban, Standard Work, Poka-Yoke, through relatable demonstrations tailored to young learners and school teachers. In Phase 2, teachers underwent targeted training to implement Lean tools in classrooms, including layout optimization, visual task tracking, Poka yoke mechanisms, and routine standardization. These tools were applied over 8 to 12 weeks with continuous coaching and reflection to ensure meaningful integration.

Phase 3 focused on engaging parents by distributing Lean flyers and infographics that encouraged Lean practices at home, such as organizing school items, managing chores with Kanban boards, and adopting daily routines with safety reminders. This phase aimed to align home environments with school based Lean habits. The final phase, Phase 4, involved evaluating the intervention's effectiveness using mixed methods such as observations, student reflections, teacher and parent surveys, and photo documentation. The collected data provided insights into behavioral changes, task efficiency, and stakeholder engagement, informing future efforts to scale and sustain Lean practices in similar educational settings.

4. Simulated Result

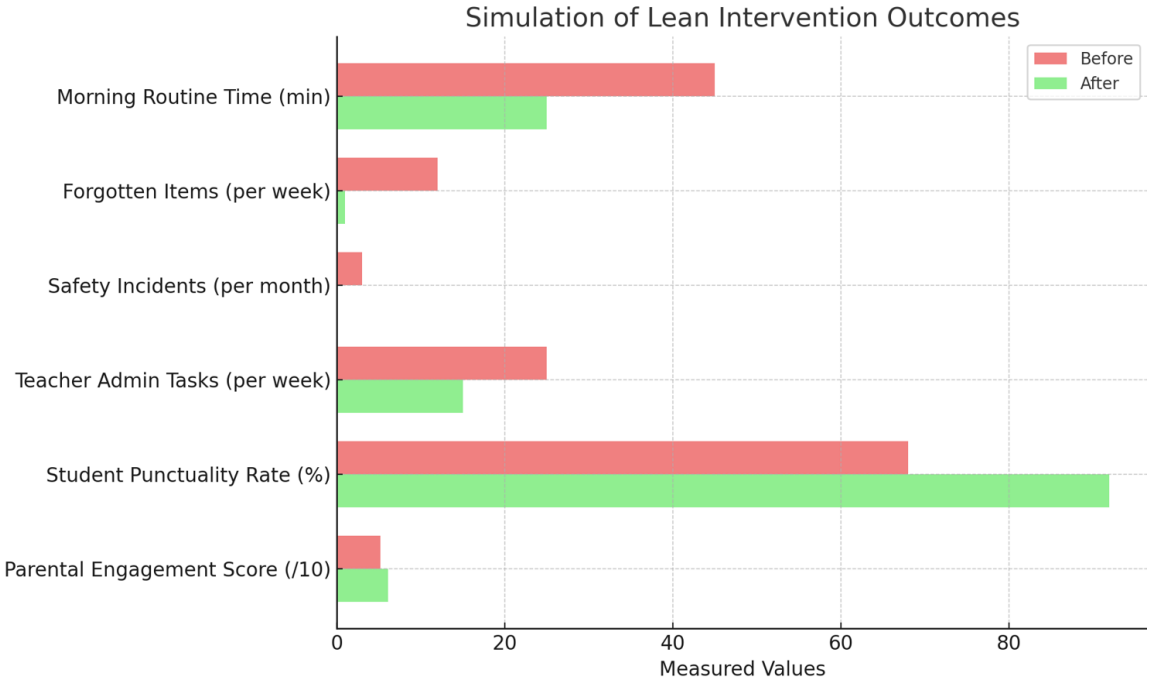

Table 1.0: Comparison between before and after intervention of Lean to School and Home

Metric	**Before Intervention**	**After Intervention**	**Examples**
Morning Routine Time	45 minutes children searching for shoes, missing items	25 minutes visual checklists and organized routines	Checklist by door: shoes, bag, bottle
Forgotten Items per Week	Avg. 12 forgotten items/week (homework, bottles)	Only 1 item forgotten home/school Kanban used	Fridge magnets for reminders classroom Kanban
Safety Incidents per Month	~3 unsafe events per month (iron left on, tools misplaced)	Zero incidents Poka Yoke systems implemented	Child locked drawers, unplug reminders
Teacher Administrative Tasks per Week	More than 25 tasks perweek (manual grading, tracking, printing)	Reduced to 15 tasks with AI tools and templates	Auto-marking apps, digital attendance forms
Student Punctuality	68% students ready by assembly	92% punctuality with visual routine aids	Color-coded morning timetable at home
Parental Engagement Score	Score: 5.2/10, passive engagement	Score: 6.1/10 mini-challenges and flyers used	5S your study space flyer challenge

Note: The results presented in this section are derived from a simulation model based on the proposed methodology and expected behavioural responses. They are not sourced from actual field data but serve to illustrate potential outcomes of the Lean intervention.

5. Analysis

The simulated results indicate that applying Lean principles in home and school settings can make significantly improvement into daily efficiency and safety. As stated in table 1.0, the morning routine time was reduced from 45 to 25 minutes through the use of visual checklists and standardized tasks, while forgotten items dropped from 12 to just one per week with the help of Kanban boards and home reminders. Safety incidents, such as improperly stored tools or appliances left on, were eliminated entirely through simple Poka-Yoke mechanisms.

Teachers also benefited, with administrative tasks reduced from 25 to 15 per week after adopting AI tools for grading and scheduling, along with standard work procedures. Student punctuality improved from 68% to 92% due to structured routines and visual cues, showing that even young learners can respond well to Lean tools when adapted to their level.

However, while the intervention was effective across most areas, parental engagement saw only a modest rise from a score of 5.2 to 6.1. This suggests that flyers and infographics helped raise awareness, more hands on or interactive methods may be needed to foster stronger participation and alignment at home. Overall, the simulation shows strong potential for Lean to improve daily operations, though success may depend on sustained involvement across all stakeholders.

6. Conclusions

This study explored the feasibility and impact of applying Lean principles originally developed for industrial settings within the context of daily routines at home and school. Through a structured intervention targeting kindergarten and primary school, complemented by outreach to students' homes, the research illustrated how Lean tools such as 5S, Kanban, and Poka-Yoke can be adapted to promote order, reduce waste, and enhance safety. The simulated results demonstrated notable improvements in

routine efficiency, reduction of forgotten items, and elimination of safety incidents. Teachers benefited from reduced administrative workloads, while students showed greater punctuality and task ownership. Although parental engagement showed only modest gains, the findings suggest that with sustained multi-stakeholder involvement and more interactive outreach strategies, Lean thinking has significant potential to improve micro-level efficiency in non-industrial contexts. These insights provide a foundation for future empirical research and pilot implementations in broader educational and domestic settings.

Acknowledgement

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3.12 Pembentang 9

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Kesedaran Keselamatan : Langkah Menangani Kematian Akibat Kenderaan Tenggelam

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ABSTRAK

Kajian ini bertujuan meningkatkan kesedaran keselamatan dalam kalangan pengguna kenderaan terhadap risiko kemalangan melibatkan kenderaan tenggelam di dalam air. Dengan meneliti statistik kematian, fungsi komponen kenderaan, dan teknologi keselamatan, kajian ini mencadangkan pendekatan menyeluruh merangkumi pengetahuan asas, penambahbaikan infrastruktur, dan penggunaan alat keselamatan. Hasil kajian menunjukkan bahawa pemahaman terhadap prosedur kecemasan dan penggunaan teknologi terkini mampu mengurangkan risiko kematian akibat lemas dalam kenderaan tenggelam.

1. Pengenalan

Kemalangan melibatkan kenderaan tenggelam merupakan ancaman keselamatan yang sering diabaikan. Di Amerika Utara, lebih 400 kematian direkodkan setiap tahun akibat insiden ini (Giesbrecht et al., 2017). Di Malaysia, walaupun statistik rasmi masih belum lengkap, laporan media menunjukkan insiden ini semakin membimbangkan, terutama semasa banjir kilat. Kekurangan pengetahuan asas dan reaksi panik semasa kecemasan menjadi faktor utama yang menyumbang kepada kadar kematian.

Kajian awal telah mengenal pasti beberapa isu utama yang memberi impak kepada keselamatan pengguna jalan raya dan keberkesanan sistem tindak balas kecemasan. Pertama, didapati bahawa tahap pengetahuan pengguna terhadap fungsi komponen keselamatan dalam kenderaan masih rendah. Ramai pemandu dan penumpang tidak menyedari kewujudan atau cara penggunaan ciri-ciri keselamatan penting seperti sistem brek kecemasan, pengesan titik buta, atau pengaktifan beg udara, yang sepatutnya dapat mengurangkan risiko kecederaan semasa kemalangan.

Kedua, ketiadaan prosedur operasi standard (SOP) kecemasan yang jelas, ringkas, dan mudah diakses turut menyumbang kepada kelewatan dan kekeliruan semasa insiden berlaku. SOP yang tidak mesra pengguna menyukarkan tindakan segera dan boleh menjejaskan peluang menyelamatkan nyawa, terutama dalam situasi kritikal seperti kemalangan atau bencana alam.

Ketiga, aspek infrastruktur jalan raya juga menjadi perhatian serius. Banyak jalan di kawasan berisiko tinggi seperti berhampiran sungai, tasik, dan kawasan yang kerap dilanda banjir didapati tidak diselenggara dengan baik. Kerosakan pada permukaan jalan, kekurangan papan tanda amaran, dan sistem saliran yang lemah menambah lagi risiko kemalangan dan menyukarkan operasi menyelamat apabila berlaku insiden.

Akhir sekali, kekurangan alat keselamatan asas dalam kenderaan turut dikenal pasti sebagai isu yang perlu diberi perhatian. Kebanyakan kenderaan tidak dilengkapi dengan peralatan penting seperti

pemecah cermin, pemotong tali pinggang keselamatan, dan pelampung kecemasan. Ketiadaan alat ini boleh membataskan peluang menyelamatkan diri semasa kecemasan, terutamanya jika berlaku kemalangan di kawasan air atau situasi di mana kenderaan terbalik atau tenggelam.

Kesemua isu ini mencerminkan keperluan mendesak untuk pendekatan yang lebih holistik dalam meningkatkan kesedaran, menyediakan garis panduan yang jelas, serta mempertingkatkan infrastruktur dan kelengkapan keselamatan demi kesejahteraan pengguna jalan raya.

2.0 Permasalahan

Kajian ini mengenal pasti beberapa isu utama yang secara langsung menyumbang kepada risiko keselamatan dalam insiden melibatkan kenderaan tenggelam. Isu-isu ini bukan sahaja melibatkan kekurangan pada aspek individu, tetapi turut melibatkan kelemahan pada tahap sistemik yang memerlukan perhatian segera oleh pelbagai pihak berkepentingan. Antara permasalahan yang dikenal pasti termasuklah:

2.1 Kekurangan Pengetahuan Pengguna Terhadap Fungsi Komponen Keselamatan Kenderaan

Sebahagian besar pengguna tidak mempunyai pemahaman yang mencukupi mengenai fungsi sebenar komponen keselamatan dalam kenderaan. Ciri-ciri keselamatan seperti sistem brek anti-kunci (ABS), kawalan kestabilan elektronik (ESC), beg udara (airbags), dan penguncian automatik pintu sering dianggap sebagai elemen pasif, sedangkan ia memainkan peranan penting dalam mengurangkan impak kemalangan. Lebih membimbangkan, ramai juga tidak menyedari bahawa power window hanya boleh berfungsi dalam fasa awal tenggelam dan tidak dapat digunakan apabila sistem elektrik kenderaan gagal. Kekurangan pendedahan ini menyebabkan pengguna gagal mengambil tindakan yang betul dalam detik-detik kecemasan, lalu meningkatkan risiko kehilangan nyawa.

2.2 Ketiadaan SOP Kecemasan Yang Mudah Difahami dan Diakses

Salah satu punca utama kelewatan atau kegagalan menyelamat diri ketika kecemasan ialah ketiadaan prosedur operasi standard (SOP) yang jelas dan mudah difahami oleh pengguna awam. Kebanyakan panduan keselamatan sama ada terlalu teknikal, tidak disebarluaskan secara efektif, atau tidak mengambil kira psikologi pengguna yang sedang panik. SOP yang wujud pula selalunya tidak disesuaikan dengan konteks tempatan seperti keadaan jalan banjir atau sistem bantuan kecemasan yang terhad di kawasan pedalaman. Tanpa garis panduan yang praktikal dan mudah dicapai (seperti melalui infografik dalam kenderaan, latihan simulasi, atau aplikasi mudah alih), pengguna cenderung untuk panik dan gagal mengambil tindakan yang betul dalam masa yang kritikal.

2.3 Infrastruktur Jalan Raya Yang Tidak Diselenggara Dengan Baik

Keadaan infrastruktur jalan raya di Malaysia, terutamanya di kawasan berisiko tinggi seperti berhampiran sungai, tasik, empangan dan kawasan mudah banjir, sering kali tidak berada pada tahap optimum. Jalan yang berlubang, tidak rata, atau tidak mempunyai sistem saliran yang efisien menyumbang kepada peningkatan risiko kenderaan tergelincir atau terperangkap dalam limpahan air. Tambahan pula, ketiadaan ciri keselamatan seperti penghadang konkrit (guardrail), papan tanda amaran banjir, atau lampu amaran solar menyebabkan pemandu tidak dapat menjangka bahaya dengan lebih awal. Kelemahan ini bukan sahaja meningkatkan risiko kemalangan, tetapi juga menyukarkan operasi menyelamat apabila berlaku insiden.

2.4 Ketiadaan Alat Keselamatan Asas Dalam Kenderaan

Walaupun alat-alat keselamatan seperti pemecah cermin (glass breaker), pemotong tali pinggang (seatbelt cutter), pelampung kecemasan, dan lampu suluh adalah murah dan mudah diperoleh, kebanyakannya masih belum dianggap sebagai keperluan standard oleh pengguna mahupun pengeluar kenderaan. Akibatnya, apabila kenderaan terperangkap dalam air atau sistem keselamatan kenderaan

gagal, pengguna tidak mempunyai peralatan asas untuk menyelamatkan diri. Ketiadaan alat ini memberi impak besar dalam insiden kenderaan tenggelam kerana masa menyelamat yang efektif hanya sekitar satu hingga dua minit pertama sebelum tekanan air meningkat dan menyukarkan usaha keluar dari kenderaan.

3. Cadangan Penyelesaian

Bagi menangani isu-isu yang dikenal pasti, beberapa langkah strategik dan berimpak tinggi dicadangkan agar aspek keselamatan pengguna jalan raya dan kecekapan tindak balas kecemasan dapat dipertingkatkan secara menyeluruh.

3.1 Peningkatan Pengetahuan Asas dan SOP Kecemasan

Pendidikan pengguna mengenai prosedur keselamatan dalam kenderaan perlu diberi keutamaan. Pengguna harus didedahkan kepada dua fasa utama semasa menghadapi insiden kenderaan tenggelam:

Fasa separa tenggelam, di mana sistem elektrik kenderaan masih berfungsi dan tingkap masih boleh diturunkan secara automatik. Dalam fasa ini, tindakan segera membuka tingkap dan keluar dari kenderaan adalah sangat penting.

Fasa tenggelam penuh, apabila komponen elektrik gagal berfungsi sepenuhnya. Dalam keadaan ini, tingkap perlu dipecahkan secara manual menggunakan alat seperti headrest atau car glass breaker bagi membolehkan pengguna keluar dengan selamat.

Latihan atau simulasi keselamatan secara berkala, serta penyediaan panduan bergambar di dalam kenderaan, boleh membantu meningkatkan tahap kesiapsiagaan pengguna terhadap situasi kecemasan ini.

3.2 Penambahbaikan Infrastruktur Jalan Raya

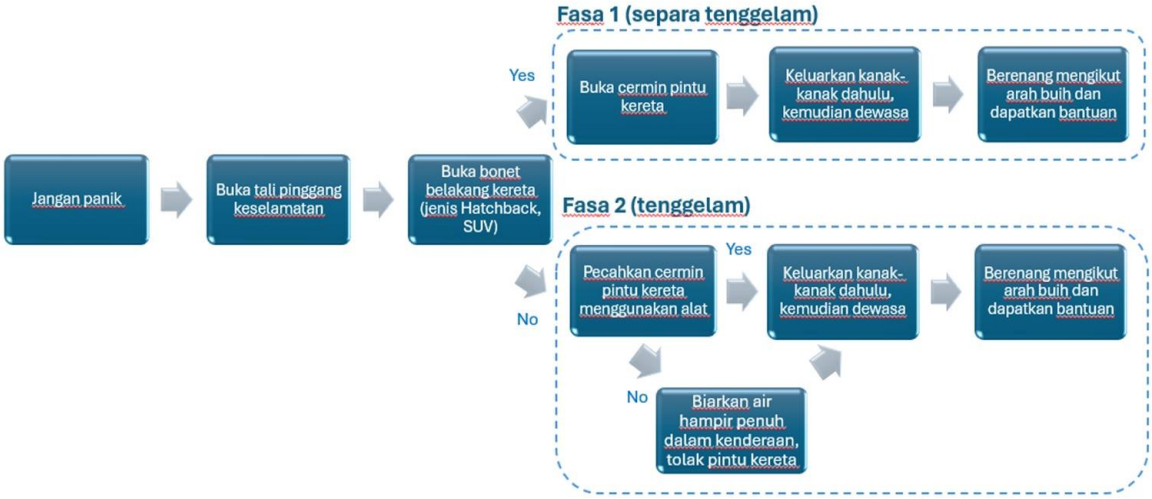
Kerajaan dan pihak berkuasa tempatan disarankan untuk melaksanakan program penyelenggaraan jalan raya secara berkala, khususnya di kawasan berisiko tinggi seperti berhampiran sungai, tasik, dan kawasan yang sering dilanda banjir. Langkah-langkah penambahbaikan termasuk: Membaiki permukaan jalan yang rosak atau berlubang, Menyediakan penghadang keselamatan konkrit (barrier) di lokasi strategik, Memasang papan tanda amaran awal dan lampu amaran solar untuk meningkatkan kesedaran pemandu, Meningkatkan sistem saliran bagi mengurangkan risiko limpahan air ke atas permukaan jalan.

3.3 Penyediaan Alat Keselamatan dan Teknologi Terkini

Setiap kenderaan disarankan untuk dilengkapi dengan alat keselamatan asas seperti car glass breaker, seatbelt cutter, pelampung kecemasan, dan lampu suluh (torch light). Pihak pengeluar kenderaan juga digalakkan untuk mempertimbangkan integrasi alat-alat ini sebagai kelengkapan standard dalam setiap model keluaran mereka.

Selain itu, penggunaan teknologi moden perlu digalakkan. Aplikasi GPS dengan fungsi perkongsian lokasi masa nyata boleh membantu mempercepatkan bantuan kecemasan. Di samping itu, inovasi kenderaan seperti YangWang U8 dari China, yang mampu terapung dan bergerak di permukaan air, boleh dijadikan inspirasi oleh pengeluar tempatan dalam membangunkan kenderaan yang lebih selamat dan sesuai dengan keadaan geografi Malaysia.

4. Prosedur Menyelamatkan Diri daripada Kenderaan Tenggelam: Pendekatan Berasaskan Fasa Kecemasan.



Rajah 1: Prosedur Menyelamatkan Diri daripada Kenderaan Tenggelam

Kemalangan melibatkan kenderaan yang tenggelam dalam air merupakan situasi kecemasan yang berisiko tinggi dan memerlukan tindakan pantas serta tepat. Dalam kebanyakan kes, kelewatan bertindak atau kekeliruan semasa insiden boleh menyebabkan kehilangan nyawa. Oleh itu, pemahaman terhadap prosedur menyelamatkan diri secara sistematik adalah amat penting, terutamanya dalam konteks banjir kilat atau kemalangan jalan raya berhampiran kawasan berair.

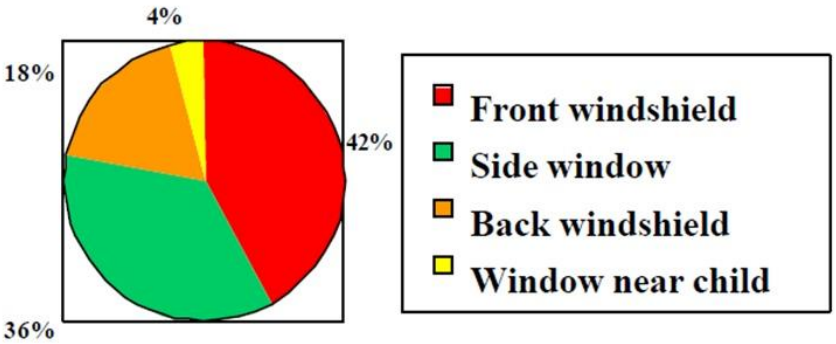
Rajah 1menunjukkan procedure menyelamatkan diri daripada kenderaan tenggelam. Carta alir membahagikan situasi kecemasan kepada dua fasa utama: Fasa Separa Tenggelam dan Fasa Tenggelam Penuh. Sebelum memasuki mana-mana fasa, terdapat tiga langkah asas yang perlu diambil segera: tidak panik, membuka tali pinggang keselamatan, dan membuka bonet belakang kereta (jika menggunakan kenderaan jenis hatchback atau SUV). Langkah ini bertujuan untuk memudahkan laluan keluar dan mengelakkan kekangan fizikal semasa menyelamatkan diri.

Dalam Fasa Separa Tenggelam, tingkap kenderaan masih boleh dibuka secara automatik kerana sistem elektrik belum gagal sepenuhnya. Dalam keadaan ini, penumpang perlu segera membuka tingkap, mengutamakan penyelamatan kanak-kanak terlebih dahulu, diikuti oleh orang dewasa. Arah buih udara boleh dijadikan panduan untuk berenang ke permukaan dan mendapatkan bantuan.

Sekiranya kenderaan telah memasuki Fasa Tenggelam Penuh, sistem elektrik biasanya tidak lagi berfungsi, menyebabkan tingkap tidak dapat dibuka. Dalam situasi ini, penumpang perlu menggunakan alat seperti pemecah cermin (car glass breaker) atau bahagian logam pada head rest untuk memecahkan cermin pintu (bukan cermin hadapan). Jika berjaya, prosedur penyelamatan adalah sama seperti fasa sebelumnya. Namun, jika gagal, penumpang perlu menunggu sehingga tekanan air di dalam dan luar kenderaan seimbang — iaitu apabila air hampir memenuhi ruang dalaman — sebelum menolak pintu untuk keluar.

Pendekatan berasaskan fasa ini bukan sahaja praktikal, malah boleh disampaikan kepada masyarakat umum melalui latihan keselamatan, kempen kesedaran, dan dimasukkan dalam modul pendidikan pemandu. Ia juga boleh dijadikan asas kepada pembangunan sistem keselamatan kenderaan yang lebih responsif terhadap insiden tenggelam, termasuk sistem pelepasan automatik tingkap atau alat keselamatan terbina dalam.

5.0 Analisis Peratusan Jenis Tingkap Kenderaan dalam Konteks Keselamatan Kecemasan



Rajah 2: Agihan peratusan empat jenis tingkap utama dalam kenderaan.

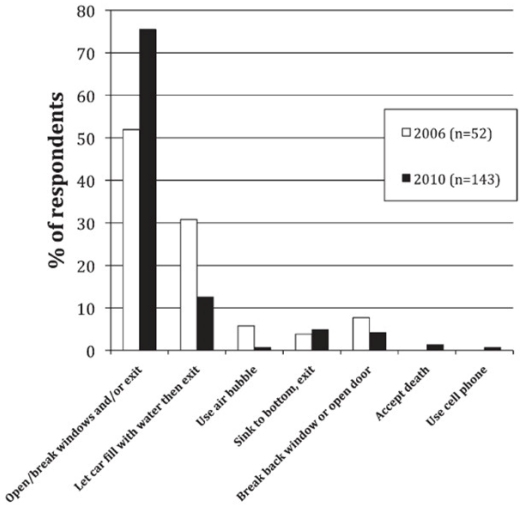
Carta pai dari Rajah 2 menunjukkan agihan peratusan empat jenis tingkap utama dalam kenderaan, iaitu cermin hadapan, cermin sisi, cermin belakang, dan tingkap berhampiran kanak-kanak. Cermin hadapan mewakili 42% daripada struktur tingkap kenderaan. Walaupun ia merupakan komponen terbesar dan paling kukuh, ia tidak sesuai untuk dipecahkan semasa kecemasan kerana diperbuat daripada kaca berlapis yang tahan hentakan. Sebaliknya, cermin sisi yang merangkumi 36% adalah pilihan terbaik untuk laluan keluar kerana ia lebih mudah dipecahkan dan berada dalam jangkauan penumpang.

Cermin belakang pula menyumbang 18%, dan walaupun ia boleh dijadikan laluan alternatif, kedudukannya yang jauh dari tempat duduk hadapan menjadikannya kurang praktikal dalam situasi panik. Tingkap berhampiran kanak-kanak hanya mewakili 4%, menunjukkan bahawa ia bukan laluan utama tetapi tetap penting untuk dipertimbangkan dalam strategi penyelamatan kanak-kanak.

Dari perspektif kejuruteraan keselamatan, data ini menyokong keperluan untuk memfokuskan latihan kecemasan dan reka bentuk alat keselamatan kepada cermin sisi. Penggunaan alat seperti pemecah cermin (car glass breaker) harus disasarkan kepada tingkap ini. Selain itu, pengeluar kenderaan boleh mempertimbangkan untuk menambah ciri keselamatan automatik seperti sistem pelepasan tingkap kecemasan pada cermin sisi, terutamanya untuk kenderaan yang digunakan di kawasan berisiko banjir.

Secara keseluruhannya, analisis ini menekankan bahawa pemahaman terhadap struktur tingkap kenderaan bukan sahaja penting dari sudut reka bentuk automotif, tetapi juga dari segi pendidikan keselamatan awam dan pengurusan risiko kecemasan.

6.0 Analisis Perbandingan Tindakan Kecemasan dalam Senario Kenderaan Tenggelam: Kajian Empirikal Berdasarkan Persepsi Awam



Rajah 3: Analisis Perbandingan Tindakan Kecemasan dalam Senario Kenderaan Tenggelam

Rajah 3 menunjukkan analisis perbandingan tindakan kecemasan dalam senario kenderaan tenggelam Kajian perbandingan antara tahun 2006 dan 2010 menunjukkan perubahan ketara dalam pilihan tindakan responden apabila berhadapan dengan senario hipotetikal kenderaan tenggelam. Melalui analisis graf bar, dapat dilihat bahawa tindakan "pecahkan tingkap dan keluar" meningkat daripada sekitar 60% kepada hampir 75%, menjadikannya pilihan paling dominan dan logik dari sudut sains dan kejuruteraan.

Secara saintifik, tindakan ini disokong oleh prinsip mekanik bendalir, di mana tekanan air luar yang tinggi menghalang pintu kenderaan daripada dibuka sehingga tekanan dalam dan luar seimbang. Oleh itu, memecahkan cermin sisi yang lebih nipis dan mudah diakses adalah kaedah paling berkesan untuk keluar dari kenderaan yang sedang tenggelam. Tambahan pula, dari sudut fisiologi manusia, masa tindak balas adalah terhad kerana paras oksigen dalam paru-paru akan berkurang dengan cepat apabila berada dalam air, menjadikan tindakan segera sebagai keutamaan.

Pilihan lain seperti "biarkan kereta penuh air kemudian keluar" dan "gunakan gelembung udara" menunjukkan kekeliruan terhadap prinsip tekanan dan kapasiti paru-paru. Sementara itu, tindakan seperti "terima kematian" dan "gunakan telefon bimbit" mencerminkan tindak balas emosi dan kebergantungan kepada teknologi, yang secara praktikal tidak berkesan dalam persekitaran tenggelam.

Perubahan positif dalam data 2010 menunjukkan bahawa kesedaran awam terhadap langkah keselamatan telah meningkat, berkemungkinan hasil daripada kempen pendidikan, liputan media, dan penyebaran maklumat melalui platform digital. Ini menekankan kepentingan pendidikan keselamatan berasaskan sains, termasuk simulasi kecemasan dan latihan penggunaan alat keselamatan seperti pemecah cermin dan pemotong tali pinggang.

Secara keseluruhannya, analisis ini membuktikan bahawa pendekatan saintifik dalam memahami tingkah laku manusia semasa kecemasan boleh membantu merangka dasar keselamatan yang lebih berkesan, serta menyokong pembangunan teknologi automotif yang responsif terhadap risiko tenggelam.

7. Kesimpulan

Keselamatan pengguna kenderaan semasa kecemasan air memerlukan pendekatan holistik yang merangkumi pendidikan, teknologi dan dasar. Pengetahuan asas tentang fungsi komponen dan langkah menyelamatkan diri mampu mengurangkan risiko kematian. Pihak berwajib perlu mengambil langkah proaktif dalam menyediakan infrastruktur dan kemudahan keselamatan demi kesejahteraan masyarakat.

Penghargaan

Kajian ini tidak dibiayai oleh sebarang geran. Saya ingin merakamkan setinggi-tinggi penghargaan kepada Jabatan Profesional Pemuda, Dewan Pemuda PAS Malaysia atas peluang yang diberikan untuk menyumbang dalam penulisan kertas ini.

Rujukan

[1] Giesbrecht, G. G., et al. (2017). [Kajian kematian akibat kenderaan tenggelam di Amerika Utara].

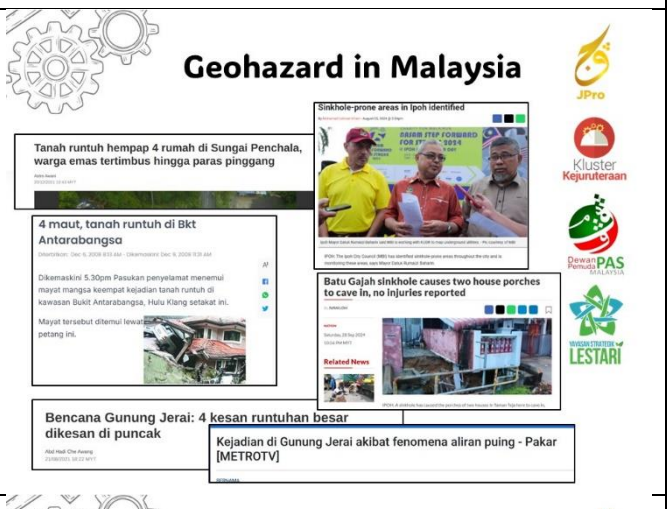
[2] Muhammad Aidid Azman et al. (2021). [Laporan media berkaitan kemalangan banjir kilat di Malaysia].

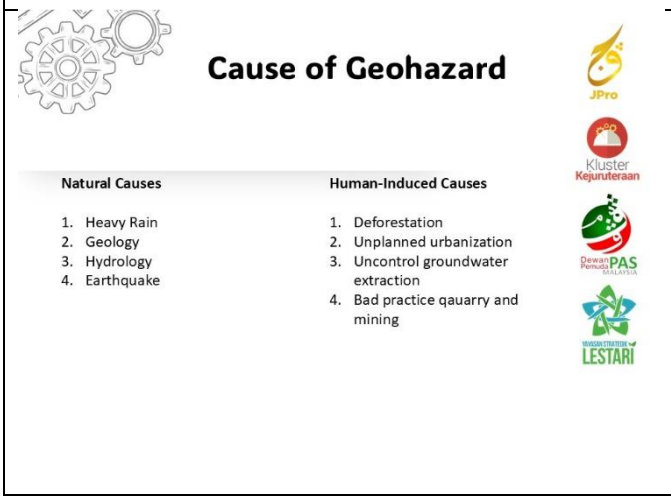
3.13 Pembentangan Slaid

(Pembentang 10)

Geohazard in Malaysia: Situation and Future Recommendation

P.Geol. Ahmad Zulqurnain Bin Ghazali[1,2]
[1]Geoventure Solution Sdn Bhd
[2]Jpro DPPM





Future Recommendation

1. Identifying Susceptible Areas (PBRC)
2. Developing 3D Subsurface Models
3. Implementing wireless monitoring systems
4. Activating role of "Pusat Bencana Geologi Negara"
5. Increase budget allocation
6. Strengthening policy frameworks
7. Promoting community awareness and training

PBRC-NATSIS

3D Subsurface Model

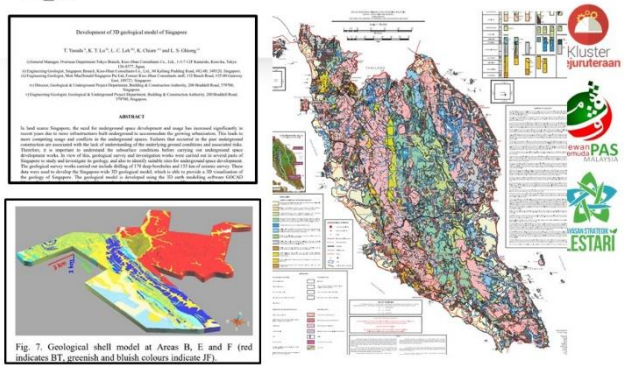


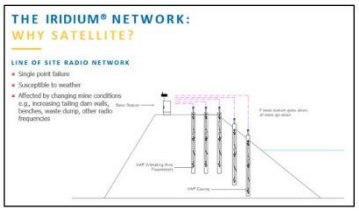
Fig. 7. Geological shell model at Areas B, E and F (red indicates BT, greenish and bluish colours indicate JF).

Wireless monitoring system

KKR kenal pasti 1,577 cerun berisiko sangat tinggi di seluruh negara

Sistem amaran aliran puing dipasang di Gunung Jerai

"Selain itu, tiga *Robotic Total Station*(RTS) dan sebuah *Global Navigation Satellite System*(GNSS) telah dipasang di Seksyen 44 dan 46, Laluan FT185 Jalan Simpang Pulai-Lojing-Gua Musang bagi memantau pergerakan permukaan cerun di lokasi berkenaan," menurut kenyataan itu.



Pusat Bencana Geologi Negara

Pusat Bencana Geologi Negara ditubuhkan akhir tahun ini

(Gambar fail) Foto hiasan - NSTP/ZULIATY ZULKIFFLI

KUALA LUMPUR: Pusat Bencana Geologi Negara akan ditubuhkan pada akhir tahun ini bagi memantau tahap keberkesanan sistem amaran awal bencana tsunami, banjir dan tanah runtuh.

Datuk Seri Anwar Ibrahim berkata, penubuhan pusat itu juga bertujuan meningkatkan kecekapan tindak balas bencana demi memastikan keselamatan rakyat.

"Kerajaan prihatin dengan bencana banjir serta tanah runtuh yang acap kali berlaku, dan akan terus memberi tumpuan terhadap usaha-usaha untuk melindungi rakyat," katanya ketika membentangkan Kajian Separuh Penggal Rancangan Malaysia Ke-12 (KSP RMK-12) di Dewan Rakyat, hari ini.

Conclusion

1. **Malaysia is highly prone to geohazards** due to its unique geological and environmental conditions.
2. It's not too late to act **– proactive measures can minimize risks** and protect lives.
3. There is an **urgent need for sustainable practices** in development and resource management to mitigate these risks effectively.
4. **Collaboration is key** – government, industries, researchers, and communities must work together to address geohazard challenges and build resilience.

"Telah **timbul berbagai kerosakan dan bala bencana** di darat dan di laut dengan sebab apa yang telah **dilakukan oleh tangan manusia**; (timbulnya yang demikian) kerana Allah hendak merasakan mereka sebahagian dari balasan perbuatan-perbuatan buruk yang mereka telah lakukan, **supaya mereka kembali (insaf dan bertaubat)**"
(Ar Rum : 41)

Q&A

Organizer: JPro, Kluster Kejuruteraan, Dewan Pemuda PAS Malaysia

Co-Organizer: Yayasan Strategik LESTARI

Thanks

Organizer: JPro, Kluster Kejuruteraan, Dewan Pemuda PAS Malaysia

Co-Organizer: Yayasan Strategik LESTARI

4.0 KESIMPULAN

Bidang kejuruteraan di Malaysia menghadapi pelbagai isu kritikal, termasuk jurang gaji antara syarikat tempatan dan antarabangsa, kekurangan bakat dalam industri semikonduktor, serta peningkatan permintaan untuk jurutera berkemahiran tinggi dalam sektor penerbangan. Insiden keselamatan dan kemalangan pekerjaan juga menekankan keperluan untuk langkah-langkah keselamatan yang lebih ketat. Simposium Kluster Kejuruteraan yang dianjurkan oleh JPro Dewan Pemuda PAS Malaysia bertujuan untuk membincangkan isu-isu ini dan mencari solusi melalui perkongsian pengetahuan, dengan harapan dapat menghasilkan idea-idea baru yang menyumbang kepada pembangunan negara dan mengukuhkan jaringan antara profesional muda dalam bidang kejuruteraan. Melalui symposium ini, perbelanjaan sejumlah RM6,691.25 tiada ketirisan dengan perolehan lebihan kewangan.

5.0 RUJUKAN

[1] Harakahdaily 17 November 2024. 2024. Simposium Kejuruteraan JPro: Teroka cabaran, solusi; https://harakahdaily.net/index.php/2024/11/17/simposium-kejuruteraan-jpro-teroka-cabaran-solusi/

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[3] Harakahdaily 17 November 2024. 2024.SG4 peneraju utama dalam peralihan tenaga. https://harakahdaily.net/index.php/2024/11/17/sg4-peneraju-utama-dalam-peralihan-tenaga/

6.0 PENGHARGAAN

Pihak penganjur merakamkan setinggi-tinggi penghargaan dan terima kasih kepada semua penaja atas sokongan padu yang diberikan dalam menjayakan Simposium Kluster Kejuruteraan 2024 sehingga dapat menerbitkan buku Proceeding ini. Sumbangan dan kerjasama yang dihulurkan telah menjadi pemangkin utama kepada kelancaran penganjuran serta penerbitan ilmiah ini. Semoga jalinan kerjasama ini akan terus berkekalan dan memberi manfaat bersama pada masa hadapan.

Perintis Professional Muda	**RINTIS**	RINTIS	https://rintisofficial.wordpress.com
Persatuan Graduan United Kingdon dan EIRE, Malaysia	**iPRO**	iPRO	https://ipro.my
Pertubuhan Muslim Profesional Malaysia	**iMPROF**	MProf	https://professionalmuda.wordpress.com
Yayasan Strategik Lestari	**YSL**	YAYASAN STRATEGIK LESTARI	https://www.yslestari.org.my
Techno-X Automation Sdn Bhd	**Techno-X**	Automation Techno-X	https://www.txasb.com
Eastern Pacific Industrial Corporation Berhad	**EPIC**	EPIC	https://www.epicgroup.com.my

Kluster Kejuruteraan	**KKj**		https://jpro.org.my/kluster-kejuruteraan
Jabatan Profesional Muda	**JPro**		https://jpro.org.my
Pertubuhan Jaringan Profesional Muslim Malaysia	**JP**		-
Dewan Pemuda PAS Malaysia	**DPPM**		https://pemudapas.org.my

MENGENAI JABATAN PROFESIONAL MUDA

Jabatan Profesional Muda (JPro) merupakan salah sebuah jabatan di bawah Dewan Pemuda PAS Malaysia yang menghimpunkan dan memposisikan golongan profesional muda untuk membina dan menyumbang kepakaran dalam bidang masing-masing bagi membentuk negara Malaysia yang lebih baik dan maju. JPro mempunya empat objektif iaitu menghimpunkan dan memposisikan profesional muda, untuk membina serta menyumbang kepakaran dalam bidang masing-masing kepada PAS dan Malaysia, dengan efektif dan signifikan, Menjalankan usaha-usaha menyatukan profesional muda dalam PAS agar tenaga dan idea mereka dapat dimanfaatkan, Mengembangkan ‘networking’ para profesional bukan ahli PAS,Menonjolkan DPPM sebagai organisasi yang profesional dan didokong oleh golongan profesional. Bagi mencapai objektif ini, Simposium Kluster Kejuruteraan menjadi wadah.