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URBANAID BUSINESS MODEL: URBAN LIVING DIGITAL MARKETPLACE, CONNECTING CUSTOMERS AND TRUSTED SERVICE PROVIDERS

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ABSTRACT: This conceptual paper introduces UrbanAid, an innovative platform providing on-demand services to urban apartment and condominium residents' needs including service providers. This study investigates the challenges experienced by these residents such as difficulties in finding trusted and timely service provided, inconsistency in the quality of service, and the inconvenience of managing multiple vendors for daily household tasks and multiple vendors for daily chores. A comprehensive market research study, as well as benchmarking and user studies, have found that convenience, transparency, and reliability are of utmost importance to apartment-dwelling consumers when it comes to outsourcing domestic needs. UrbanAid suggests a centralized, multi-sided platform to link residents to verified professionals and community-based freelancers offering different kinds of services, such as babysitting, plumbing, laundry, housekeeping, etc. This approach not only provides gains such as streamlined service access, improved user trust, and secure digital transactions but also fosters a sustainable micro-economy by ensuring fair wages and flexible job opportunities for service providers. Furthermore, the platform promotes inclusive participation by encouraging skill development and entrepreneurship among freelancers, particularly those from underrepresented communities. The paper outlines the development of the Urban Aid business model in conjunction with validation through business modelling tools, including Value Proposition Design Canvas (VPC), Business Model Canvas (BMC), and Environmental Map (EM). Insight-gathering through surveys and market analysis focuses on the pain points, needs, and behavioural patterns of residents to enable the model to evolve responsively. Finally, this paper aims to present UrbanAid as a socially governed platform and an economically empowering one, while also serving the dual purpose of enhancing urban quality of life, social cohesion, and community-driven growth through the integration of intelligent digital services.

KEY WORDS: *On-Demand Services; UrbanAid; Smart Apartment Living; Business Model; B40 Development*

1. INTRODUCTION

Wascher (2025) mentioned that nowadays many employers are struggling to balance their work needs with personal duty. Their multiple roles at work, school, and home make this problem worse. Moreover, according to Phinney and Haas (2003, as cited in Preet, 2019), it is said that students experienced stressful situations as a result of challenging financial conditions, household duties, and a demanding academic schedule. This motivates us to build a startup company serving urban residents in the apartments and condominiums, due to a large number of professionals, families, students, and expatriates with a hectic lifestyle residing here. Due to their hectic lifestyle, they are often left with limited time for other activities, including household tasks, making these tasks prone to procrastination, which will further increase their stress level and affect their quality of life. This type of pressure, if seen negatively, adversely affects an individual's overall physical health and specifically their mental health (Preet, 2019). Therefore, UrbanAid's primary job-to-do for these residents is to improve their quality of life and ease their mind by providing a practical, reliable, and efficient way of handling these responsibilities without requiring them to make significant time or energy sacrifices. Since this customer segment suffers from time constraints, lack of reliable and comprehensive service providers platform, inconsistent service quality, and difficulty to get service providers for urgent tasks, the gains they are looking for include convenience, reliability, consistent service quality, and a single platform that can fulfill all household needs in a hassle-free manner.

Besides the apartment and condominium residents, service providers such as technicians, cleaners, runners, babysitters, and teachers are also facing significant challenges in maintaining financial stability. According to Choudary (2018, as cited in Surie, 2020), some labour platforms will offer attractive incentives such as lower commission percentages on their side, hourly-based payments, and competitive pricing for customers during the early days of their business in hope of attracting the service providers. However, as Surie (2020) states, once their company grows, they tend to change the policies to the ones that benefit them in terms of profits and sustainability. Therefore, UrbanAid's important job-to-do for this customer segment is to maximize their income while making sure that they can offer a top-notch service quality, which will build customer loyalty for repeat jobs. Next, the extreme pain of this customer segment is that many existing platforms take a big portion of the service fee as commission and offer them with a low payment that does not reflect their time, work and skill. This leads to financial instability that makes it challenging for them to depend on this job as their long-term source of income, especially if they are the sole breadwinner of the family. Therefore, this customer segment is looking for a solution that can offer them fair wages with improved work management.

Currently, there are several businesses in the marketplace that have addressed similar needs. Among the well-known ones are Grab, MaidEasy, KiddoCare, GoGet, Lalamove, HappyFresh, and Urban Company. These platforms' important job-to-do is to provide time-pressed people with options to outsource various daily tasks. Reducing the amount of time customers need to spend on completing these duties is one of the pain relievers these services offer. On the other hand, offering time-saving, flexible, and convenient solutions that improve the customers' quality of life is their gain creators. Most of these businesses use a platform model in which

customers pay per service and make bookings via their applications, which is very much convenient. Nonetheless, the market still has major key gaps. Most of these services do not offer a one-stop solution for all household needs. They are mostly specialised in a single field or niche, requiring customers to switch between applications to have all their needs fulfilled. Besides, customers might be frustrated since the service quality can be inconsistent. Most importantly, niche needs like technical services and tutoring are difficult to find on the current platforms. On the other side, the service providers working under these companies are also suffering due to the unreasonable payment that does not reflect their time and effort, as a result of the big portion of commission that these companies took from the service fee that they charge to their customers.

Therefore, a more innovative and relevant solution that can offer consumers a more comprehensive, reliable, and user-friendly platform, while providing a fair payment to the actual service providers is desperately needed to fill the gap left by these existing solutions that no longer adequately address the extreme pains and important gains of the consumers. UrbanAid, our startup business aims to fill this gap by being a comprehensive intermediary platform that provides a wide range of services under one roof for the customers while maintaining a fair payment to the actual service providers. Among the services we offer are house cleaning, laundry, grocery shopping, technician services, babysitting, tutoring, and beyond. Last but not least, our platform will be built to deliver a seamless experience that tackles the extreme pains faced by our customer segments, allowing the urban residents to concentrate on their family and hectic life while leaving the other tasks to our service providers.

2. PROBLEM STATEMENT/OBJECTIVES

UrbanAid has 2 customer segments which are apartment and condominium residents, and service providers. The key problems faced by apartment and condominium residents are their hectic daily lives due to work, studies, business, etc, making them struggle to allocate time to fulfill other tasks such as cleaning, home maintenance, laundry, grocery shopping, and child care. What makes it worse is that, oftentimes, finding trustworthy service providers with consistent work quality on one platform is almost impossible. Therefore, there is a demand for a convenient, reliable, and consistently high-quality one-stop solution for all of their household needs. Besides, service providers are also facing comparable challenges since finding a reliable platform that offers reasonable payment can be a headache. These platforms usually take a big portion of the commission from the service fee, leaving the actual service providers with unreasonably cheap payment. This urges us to provide a solution that can ease customers' minds and maintain the good welfare of our service providers while generating profits for our startup company.

Therefore, the primary goal of this paper is to create a conceptual multi-sided business model, including a digital platform or application that tackles the major issues that our customer segments confront on a daily basis. The platform aims to offer trusted services that act as pain relievers and gain creators, including:

a. To offer a wide range of services on a single platform to allow customers to fulfill their needs without having to utilise multiple apps.
b. To enhance the user experience by designing an application that is easy to navigate and provides useful features that improve customer satisfaction and loyalty.
c. To create employment opportunities for the service providers like technicians, plumbers, teachers, cleaners, and runners, enabling them to earn extra income while offering our customers reliable, consistent, and high quality services.
d. To fill the gap in the market by addressing niche needs such as teaching and technical services which are not addressed adequately by the existing platforms in the market.

3. METHODOLOGY

In order to address the issues that the apartment and condominium residents and service providers face, this paper uses the Design Thinking technique to develop a conceptual business model for UrbanAid. Additionally, literature review, survey, and an interview is conducted to gain a more comprehensive understanding of the job-to-do, extreme pains, and essential gains of these customer segments. By implementing these methodologies, we are able to gather feedback on the proposed digital platform, which offers a one-stop solution for various household services. Other than that, we are using business modeling tools like the Business Model Canvas (BMC) and Value Proposition Canvas (VPC) to create UrbanAid's conceptual business model. Key stakeholders are also interviewed in order to validate the initial BMC and guarantee their endorsement of the platform's potential utility. Meanwhile, the VPC was validated through inputs and feedback from different customer segments. Lastly, to ensure that our business model is sustainable and successfully meets customers' needs, we developed a Strategy Canvas. This iterative process gives UrbanAid a competitive edge in the market by ensuring that our solution is both sustainable and relevant.

4. LITERATURE REVIEW

4.1. 4IR and On-Demand Service Platform

On-demand service platforms line up to major changes across the globe such as the Fourth Industrial Revolution (4IR) and the COVID-19 pandemic. Urbanization, consequently, creates a rising demand for safe and convenient modes of living, which are satisfied through such platforms.

The 4IR infuses business processes with Artificial Intelligence (AI), Internet of Things (IoT), and cloud-based computing to proffer better efficiencies with service delivery and improve customer experiences (Fioravanti et al., 2023). With this integration, the on-demand service industry guarantees seamless connectivity between the service provider and customers, thereby enhancing transparency,

reliability, and quality of service offered. AI-matching systems and IoT monitoring tools further optimize urban service ecosystems.

The pandemic of COVID-19 fast-tracked the adoption of digital platforms, with their users increasingly concerned with safety (Yewei, 2018). On-demand services satisfy this need with the provision of basic services that do not require much physical interaction, but the industry also continues to be very fragmented. Digital platforms have closed the gaps of uncoordinated services, providing reliability and enhancing the convenience matrix.

National Entrepreneurship Policy 2030 (NEP 2030) professes sustainable growth and inclusivity, and on-demand platforms foster local entrepreneurship and job opportunities (Abbas, 2022). These platforms also provide cheaper services and help reduce socio-economic disparities, thus allowing for wider economic participation.

4.2. Growing Demands & Supply on Services

On-demand service platforms are growing in urban areas due to increased consumer preference for convenience and efficiency in household tasks. This trend has been accelerated by the COVID-19 pandemic and intensified urbanization, which both highlight the need for reliable, integrated service platforms (Fioravanti et al., 2023; Puranik et al., 2023).

Urban demands for a holistic set of household services are quite likely to grow, particularly with the convenience and expediting factor brought in by COVID-19 (Fioravanti et al., 2023). The big service providers such as Grab and MaidEasy provide very specific niche services (Yewei, 2018), leaving the market fragmented. The growing urbanization puts an increasingly intense requirement for integrated solutions to manage the different daily commotions (Puranik et al., 2023). Thus, the demand that is known to have increased due to urbanization and COVID-19 is heightened, marking a clear demarcation for the need for integrated on-demand service platforms, as providers today only provide niche services, leaving the market highly fragmented.

4.3. Improving Job Access for B40

After the COVID-19 pandemic, people have been affected in many ways, especially in their jobs. The pandemic has had a great impact towards the economy of many households, primarily the B40 group. Abdul Kadir, E (2020) mentioned that 31.4% of 2 million B40 households are business owners, and they were at risk of experiencing poverty during the Movement Control Order (MCO) period. Up until 2021, surveys have shown that families with lower income or B40 experiencing a higher percentage of heads of household unemployment, with 12% indicating two and a half times more than before the pandemic (Families on the Edge Issue 4, 2021).

Finding labour work is important for many of them to overcome these issues. In order to have a secure life and earn more money, they chose to work many jobs at the same time. Livia (2025) claims that this group is more likely to pursue service-

oriented careers in manufacturing, construction, retail, hospitality, agriculture, and plantation. Additionally, she says that since B40 groups typically live paycheck to paycheck, it would be more beneficial to provide them with skills training. Therefore, to help this group, service-oriented job opportunities are a better and more realistic option.

To address this issue, the gig economy has emerged as a growing trend, characterized by short-term employment facilitated through digital platforms (Charlton, 2024).The gig economy holds significant promise due to its durability and adaptability, which are reinforced by digital advancements, workforce flexibility, and rising consumer demand (Sharon, 2024). This model helps ensure that B40 communities have access to employment and equitable opportunities to earn income by leveraging their skills and abilities.

4.4. Regulations on On-Demand Service

The rapid growth of on-demand service platforms in Malaysia highlights the industry's digital transformation, but the regulatory environment remains unclear. While countries with established laws have made progress in regulating e-hailing and home services, overregulation, worker protection issues, and competition laws hinder industry evolution (Jais & Marzuki, 2020). These regulatory policies need to be harmonized in terms of sustenance, growth rate of industry, labour rights, and consumer protection.

E-hailing services benefit from regulations governing Transportation Network Companies (TNCs), but states over regulations may hurt smaller players that would limit innovations and affordable services (Jais & Marzuki, 2020). Tailored regulations should apply to the household service platforms that have different operational models.

Most on-demand services face a major hurdle concerning worker protection, as the majority of providers have independent contractor status without access to social security or benefits (Makhtar et al., 2024). Such countries as Spain and the UK have introduced legislation to re-classify gig workers as employees, which could serve as a model for Malaysia. Worker protection must strike a balance between protection and flexibility in ensuring quality service and affordability.

Thus, from an easily visible aspect of high commissions, mispricing, and bad quality of service, a fresh list of problems emerges in Malaysia's digital marketplace conforming to the Competition Act of 2010 (Lee & Ong, 2023). Consumers are continuously complaining about erratic price changes and their non-provision for resolution in the event of bad service. Such platforms may, however, run monopolistically, since these entrenched websites could erect very high entry barriers. It is believed that the development of stronger regulation, coupled with steps taken to increase transparency in the fulfilment of consumer needs, will work towards dissipating these barriers against unfair practices.

4.5. Benchmark of Similar Business Model

4.5.1. GoGet (https://goget.my/)

GoGet is a labor market platform that was founded in 2014 in Malaysia. This platform connects the customer with part-time workers or freelancers, who are known as GoGetters. GoGet covers various tasks that cover many aspects from logistics, operations, administration, sales, marketing, house helper, and personal helper. Besides that, they also aim to be an inclusive platform that gives work opportunities to everyone regardless of their background. The platform operates in both a mobile app and a website, where customers can find assistance and it will be matched to a trusted and trained GoGetter that were rated based on their previous performance. This platform believes that they are a trusted solution for both individuals and businesses that seek assistance, as well as freelancers and part-timers that are seeking job opportunities. See Fig 1.

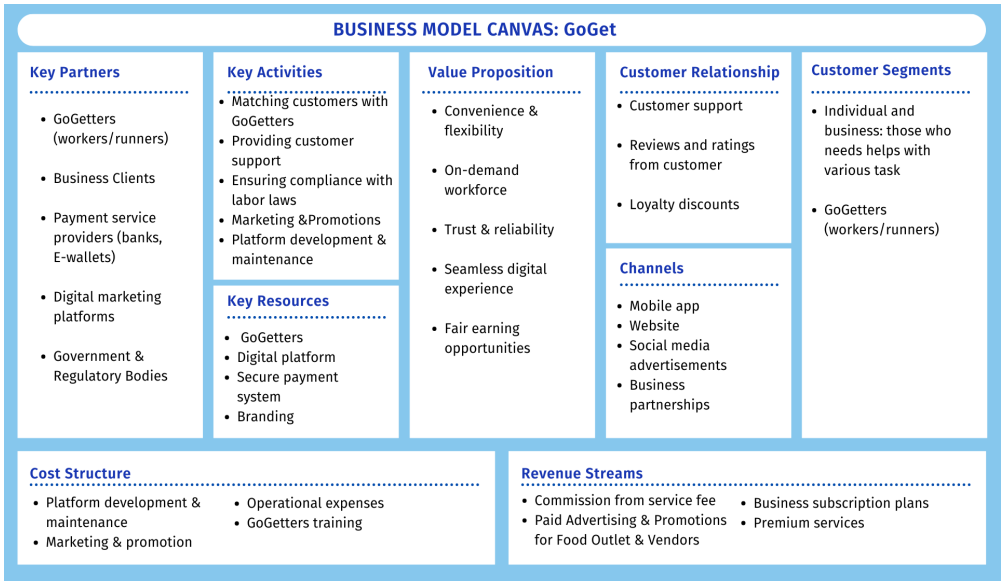


Fig.1. GoGet Business Model

4.5.2. Urban Company (https://www.urbancompany.com/)

Urban Company is a home services platform that was founded in 2014 in India and formerly known as UrbanClap. Urban Company is a platform that connects customers with trained professionals who offer various types of services like beauty treatments, appliance repairs, home cleaning, plumbing, electrical work, and fitness training. This platform can be accessed through a mobile app and a website, making it a flexible platform with standardised pricing and real-time booking. One of the main advantages of this platform is it ensures the safety and quality of the services through background checking and professional training for its service providers. Urban Company has become one of the platforms that support the gig economy and a trusted platform that offers various services to the customers and opportunities for the service providers. See Fig 2.

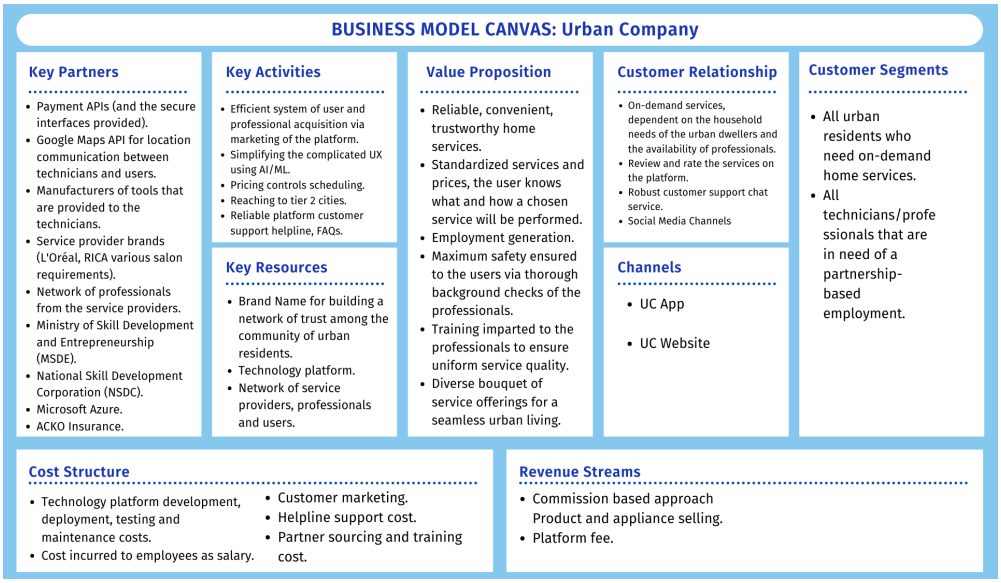


Fig.2. Urban Company Business Model

4.5.3. KiddoCare (https://www.kiddocare.my)

KiddoCare is a platform that was founded in Malaysia that focuses on on-demand caretaker services for parents in Malaysia. KiddoCare allows parents to book a trained babysitter to look after them through their mobile app and website. This is because working parents usually have difficulties finding trusted people or institutions to look after their kids, especially those who live far from other family members. With the latest urban lifestyle, there are many unfortunate incidents related to babysitters. To fill in the gaps of this busy lifestyle, KiddoCare offers a convenient way for parents to find a solution to tackle this problem. With KiddoCare, parents can rest assured because they ensure that all the babysitters are well-trained. Besides that, KiddoCare also opens opportunities for babysitters to gain trust from the customers because they will be reviewed and rated by their customers. This platform also gives a chance for babysitters to have a fair chance to generate income like others. KiddoCare believes that they provide the best solution to parents with busy lifestyles and also open up opportunities for babysitters. See Fig 3.

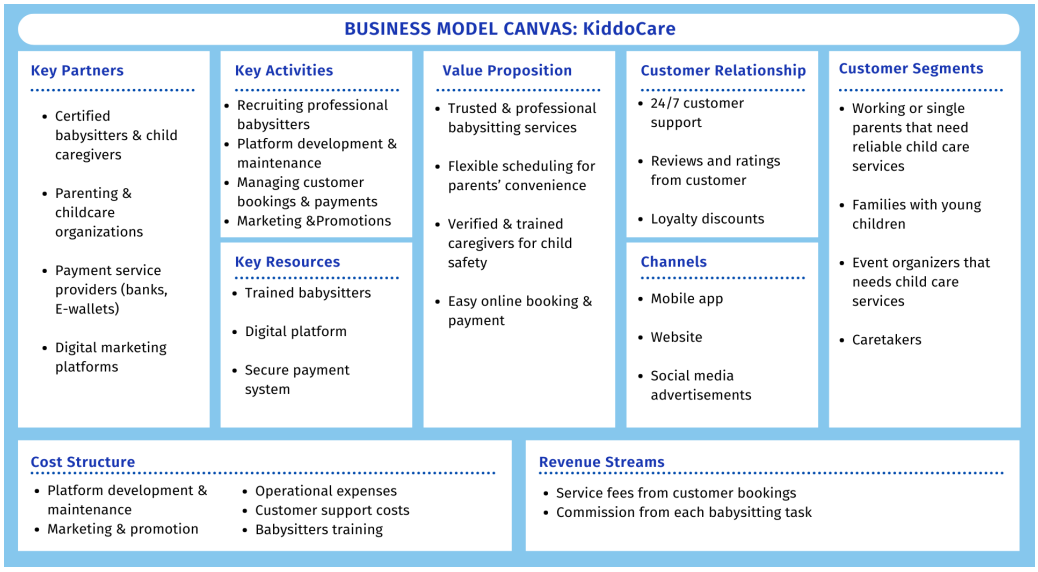


Fig.3. KiddoCare Business Model

4.5.4. MaidEasy (https://www.maideasy.my)

MaidEasy is another digital platform that was founded in Malaysia, which focuses on home-cleaning services. MaidEasy connects homeowners with trained maids or cleaners for an optimal solution to household maintenance problems. MaidEasy offers various cleaning services like basic cleaning, spring cleaning and move-in or move-out cleaning. This platform operates through a mobile app and a website that allows customers to book a cleaning session or schedule regular sessions based on their needs. Additionally, MaidEasy gives workers the chance to earn the trust of their clients by allowing them to be evaluated and rated by their clients. Besides that, this platform offers maids and cleaners an equal opportunity to earn money like everyone else. MaidEasy have successfully helped those who need cleaning services and those who offer cleaning services. See Fig 4.

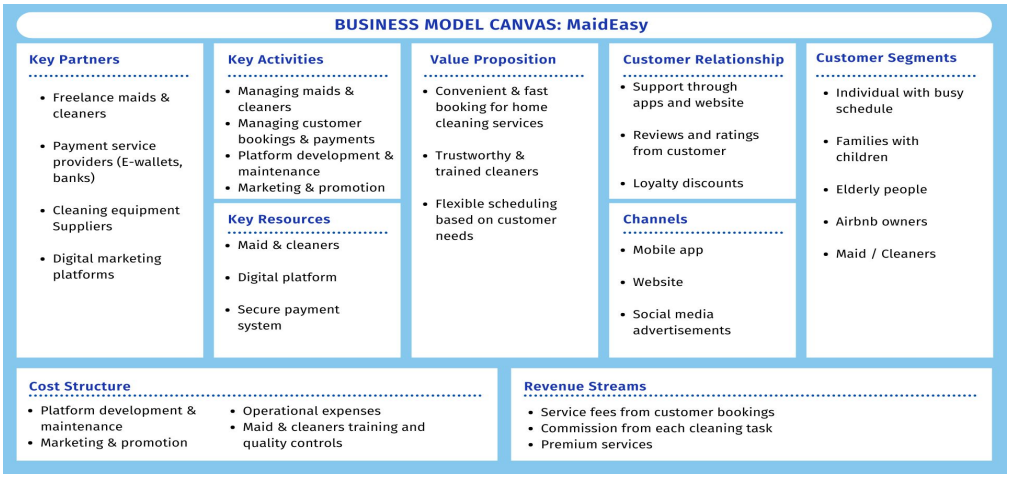


Fig.4. MaidEasy Business Model

5. INITIAL BUSINESS MODEL (BM)

Based on the Literature Review conducted above, the initial UrbanAid Business Model was established as shown in Fig. 5.

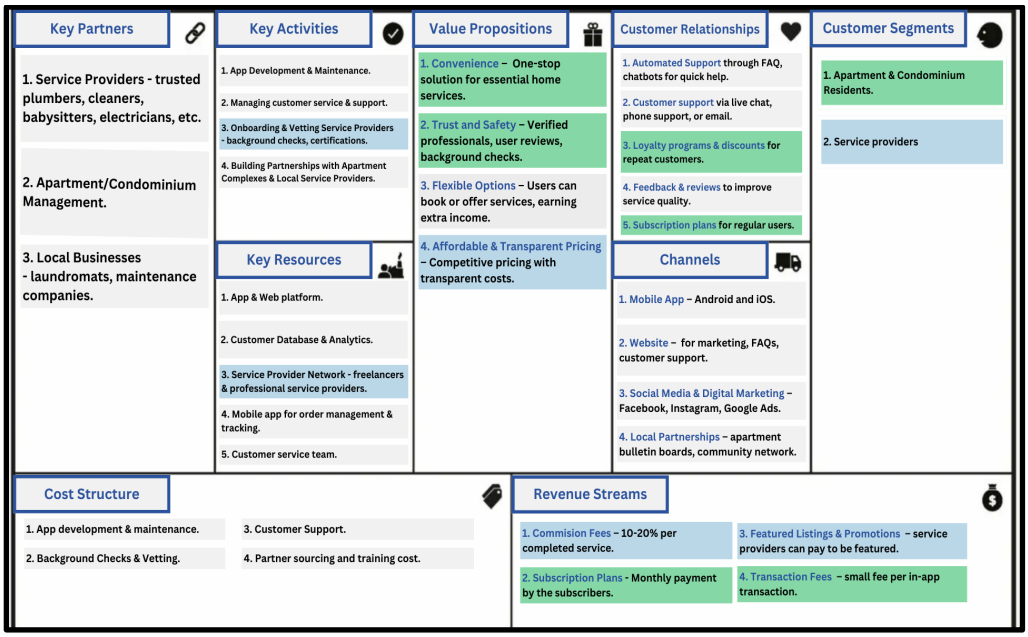


Fig.5. Initial UrbanAid Business Model

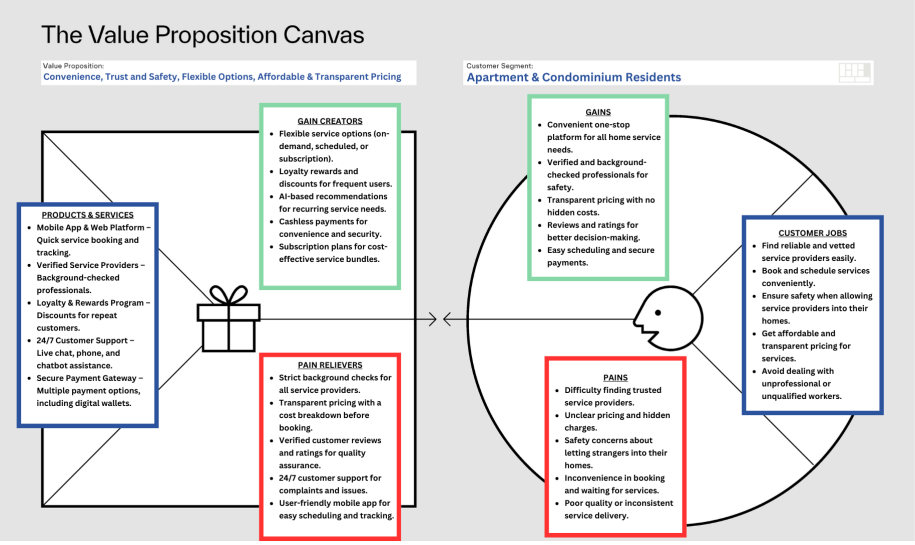


Fig.6. UrbanAid Value Proposition Canvas (VPC) - Apartments & Condominium Residents

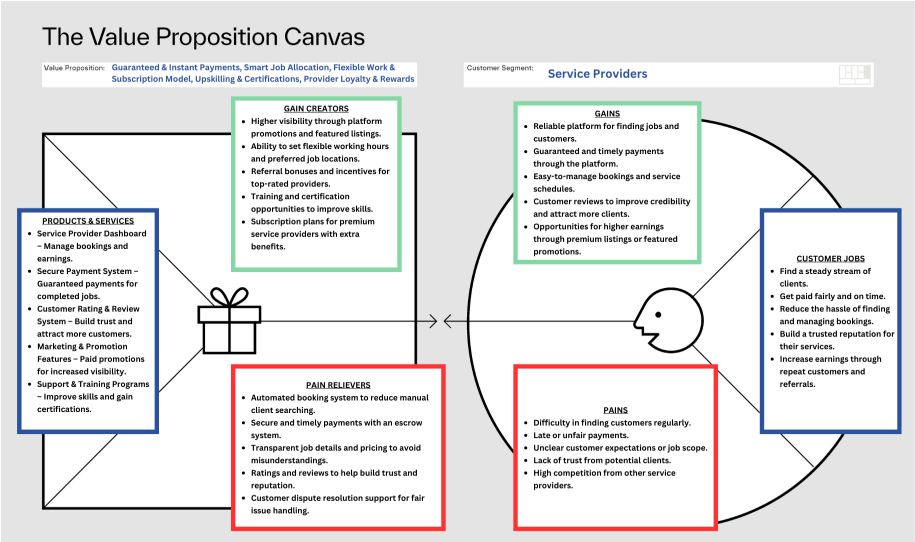


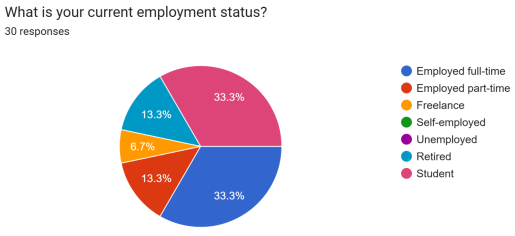
Fig.7. UrbanAid Value Proposition Canvas (VPC) - Service Providers

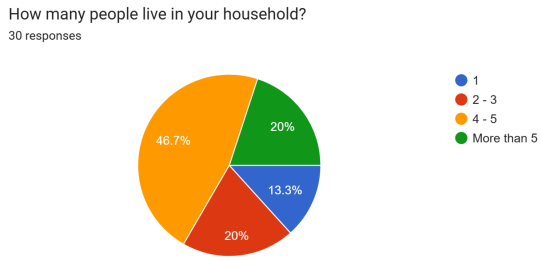
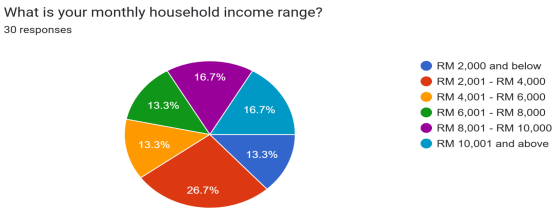
6. CONDUCT VALIDATION OF INITIAL BM & KEY FINDINGS

An online survey was conducted using Google Forms to validate UrbanAid's initial business concept and gather insights from two key target groups: apartment and condominium residents, as well as potential service providers. The first survey aimed to understand the needs, preferences, and pain points of urban residents regarding on-demand household services, and successfully collected responses from 30 participants. The second online survey focused on identifying the expectations, challenges, and motivations of service providers, and managed to gather responses from 15 participants. The summary of the responses is as follows:

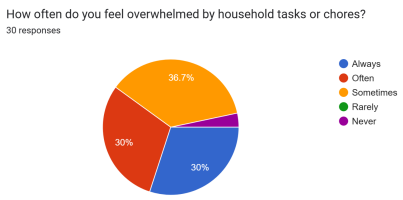
Apartment/Condominium Residents Survey:

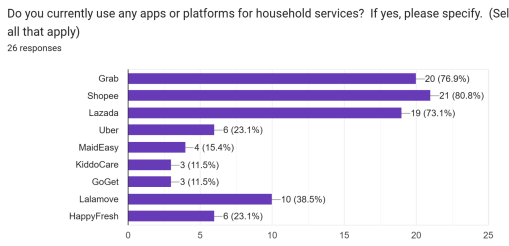
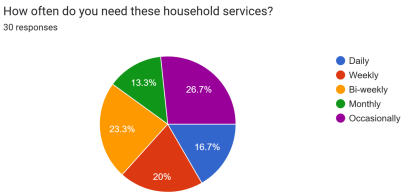
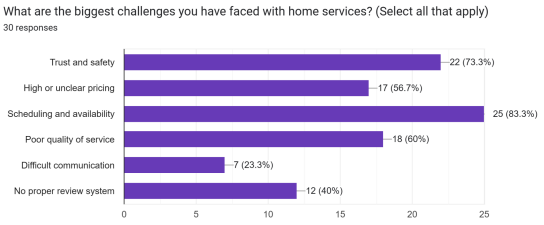
Background

Responses	Elaboration
 Fig.8. Question 3	In assessing lifestyle, availability, and willingness for potential involvement with UrbanAid, this question aimed to concentrate on the employment status of respondents. As illustrated in Fig. 8, 33.3% are employed in full-time work, while another 33.3% are students. Part-time employees and retirees comprise 13.3% each, whereas freelance workers represent 6.7% of respondents. Such a diverse employment distribution proves the

	necessity of accommodating a variety of user needs on the platform.
 Fig.9.Question 4	This question aimed to gather information on household size to understand potential demand for UrbanAid's services. As shown in Fig. 9, 46.7% of respondents live in households of 4 - 5 people, indicating moderate domestic activity. Additionally, 20% live in households of 2 - 3 members, another 20% in households with more than 5, while 13.3% live alone. These insights help identify household dynamics that may influence service needs and usage patterns.
 Fig.10. Question 5	A look at the monthly household income of respondents was asked to evaluate purchasing power over UrbanAid services. The bulk (26.7%) earn between RM 2,001 and RM 4,000, with income brackets falling below RM 2,000, RM 4,001-RM 6,000, and RM 6,001-RM 8,000 accounting for 13.3% each, while 16.7% earned RM 8,001-RM 10,000 or above RM 10,001. These insights can thus inform the pricing and packaging of services so that they can be offered affordably.

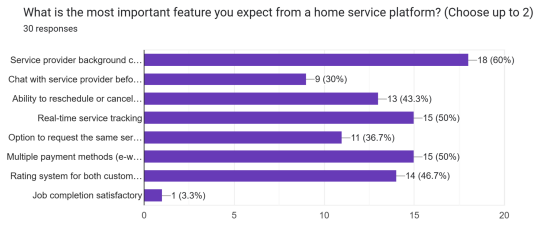
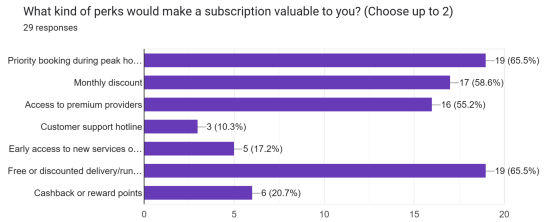
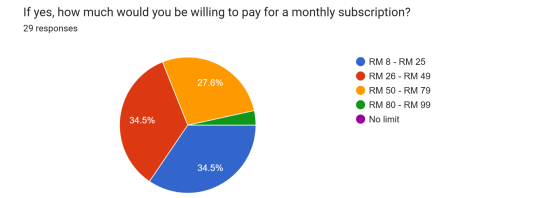
Pain Points and Behavior

Responses	Elaboration
 Fig.11. Question 6	Questioning the household task overwhelm was intended to provide the information on the needs of domestic support services. As can be seen in Fig. 11, 36.7% of the respondents sometimes feel overwhelmed whereas 30% often and another 30% always do. Only 3.3% do not feel overwhelmed at

	all. These results prove access requirements for services like UrbanAid towards easing the daily household burden.
 Fig.12. Question 9	To discover the familiarization to the existent platforms, the respondents were asked if, at the moment, they uploaded applications. As seen in Fig. 13, the most-used applications showed Shopee, 80.8%, Grab, 76.9%, and Lazada, 73.1%, followed by Lalamove, Uber, and others. High usage would be indicated across digital platforms but shows an additional opportunity for a centralized solution such as UrbanAid.
 Fig.13. Question 12	Respondents were also asked about how often they require household services. According to Fig. 13, some of the answers include 26.7% stated they require services occasionally, 23.3% bi-weekly, 20% weekly, 16.7% daily, and 13.3% monthly. The diverse nature may merit flexible scheduling options from UrbanAid to meet the variety of user needs.
 Fig.14. Question 16	To know the pain points respondents identified key service problems as shown in Fig. 14: More than three-quarters (83.3%) said scheduling, 73.3% said trust issue, 60% poor service, and 56.7% unclear pricing. These results suggest the importance of reliable scheduling and certain trust-building features in UrbanAid.

Platform Features and Preferences

Responses	Elaboration

 Fig.15. Question 19	The probe on key platform features for development in UrbanAid direction, users shed priority on service provider background checks (60%), real-time tracking and multiple payment methods (50%), and a rating system (46.7%). The three distinguished safety, transparency, and convenience as priorities.
 Fig.16. Question 21	Subscriptions were defined based on user preferences for bonuses. They are shown in Fig. 16 below: top-draw options priority booking (55.2%), discounts on monthly dues (51.7%), access to premium providers (48.3%), and cashback/reward points (44.8%). Evidence of concern amounts to associated savings and access.
 Fig.17. Question 22	To determine pricing expectations, respondents were asked about monthly subscription costs. Fig. 17 shows RM 8-25 and RM 26-49 were equally favored (34.5%), followed by RM 50-79 (27.6%). Most users expect pricing below RM 50, emphasizing affordability as key.

Service Provider Survey

Background

Responses	Elaboration

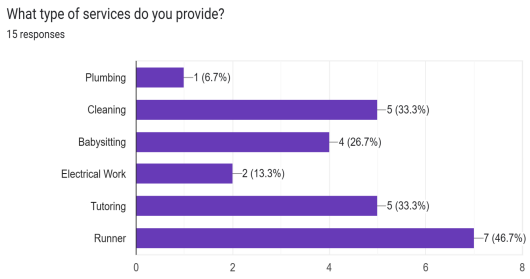


Fig.18. Question 3

The question concerning services offered by providers sought to elicit the integration potential for UrbanAid. Figure 18 shows runner services were the most preferred category (46.7%); cleaning and tutoring (33.3%), babysitting (26.7%), electrical (13.3%), and plumbing (6.7%) services followed closely behind, thus inscribing a powerfully favorable background for a multi-service platform.

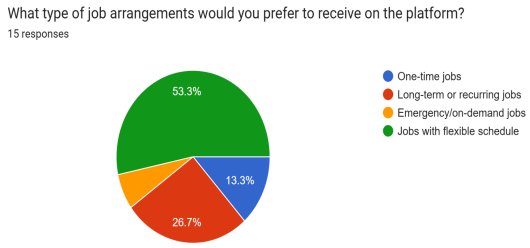


Fig.19. Question 6

To further customize jobs for their capabilities, the providers were asked for their preferences for engagement arrangements. As illustrated in Fig. 19, the majority preferred flexible scheduling (53.3%), followed by long-term jobs (26.7%). One-off (13.3%) and emergency jobs (6.7%) received less preference, indicating the need for flexibility-oriented, stable job opportunities.

Pain Points and Behavior

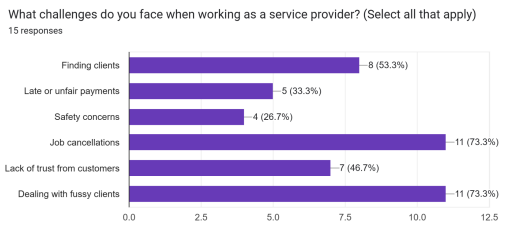
Responses	Elaboration
	Service providers identified the most pressing challenges in Fig. 20, with job cancellation and fussy clients coming top (73.3% each), followed closely by difficulty in finding clients (53.3%) and lack of trust from customers (46.7%). Other issues were also raised, such as unfair payments (33.3%) and safety concerns (26.7%); there is clear indication from these contributions that UrbanAid needs strong intervention in terms of job reliability and trust.

Fig.20. Question 13

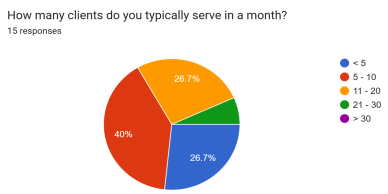


Fig.21. Question 15

From the client volume perspective, it was observed that 40 percent of the providers serve 5-10 clients a month, while 26.7 serve less than 5 or between 11-20 clients. Only 6.7 percent of the providers serve client numbers between the range of 21-30 while the rest run on a very moderate performance pace considering that they would have earned even more by increasing the number of job opportunities through UrbanAid.

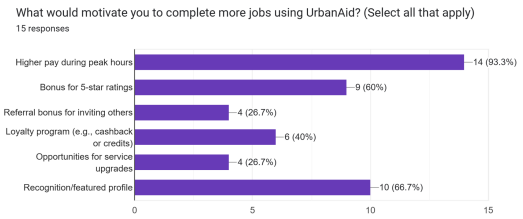


Fig.22. Question 19

The biggest motivators for carrying out more jobs are as outlined in Fig. 22, namely; high pay in peak hours (93.3%); recognition by profile (66.7%); and 5-star bonus (60%). It was also seen that loyalty rewards (40%) also mattered; thus pay and recognition were strong motivators for provider engagement.

Platform Features and Preferences

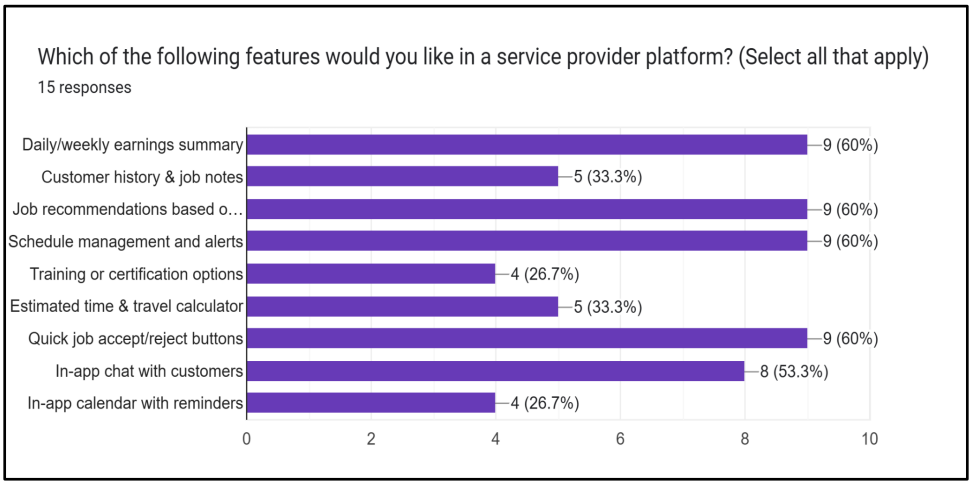


Fig.23. Question 20

This question identified the most useful platform features for service providers. As demonstrated in Fig. 20, the highest preferences earned earnings summary, location-based jobs recommendations, schedule alerts, and quick job accept-or-reject buttons (all at 60%). In-app chat (53.3%) and customer/job history (33.3%) also scored some important preference. These results indicate that UrbanAid should focus on developing tools that facilitate efficiency, clarity, and real-time interaction.

7. VALIDATED BM - BMC FRAMEWORK

7.1. Validated BM

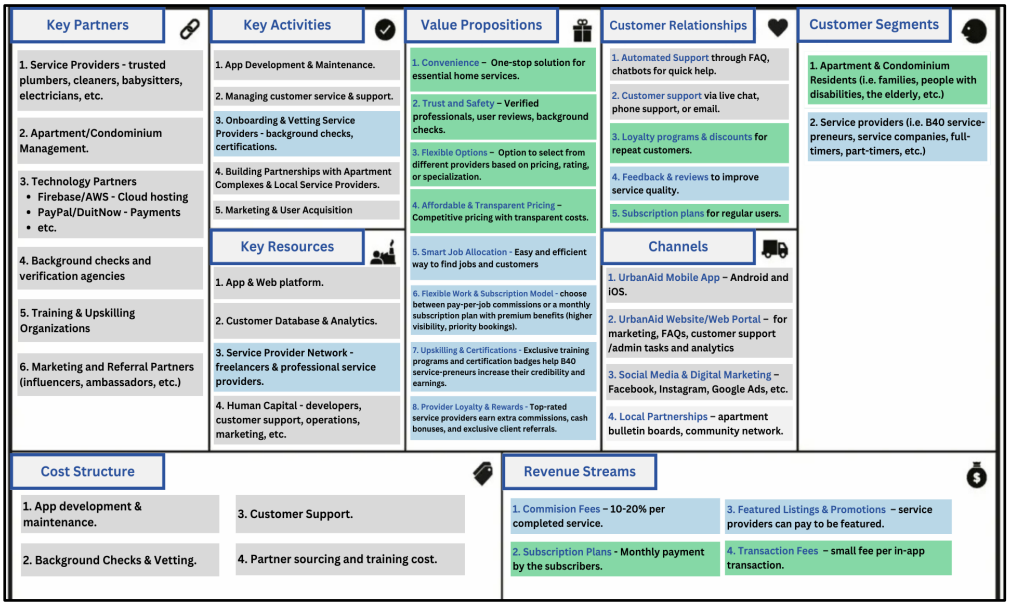


Fig.24. Validated UrbanAid Business Model

7.1.1. Customer Segments

Based on Fig 24, one of the significant customer segments of UrbanAid is the Apartment and Condominium residents. Many people from various backgrounds are starting to opt for city life for its better lifestyle and job opportunities. However, the living costs in cities are not so favorable especially when it comes to hiring service providers to maintain their high-rise homes. Thus, high-rise residents, especially those with disabilities and the elderly, can truly benefit from UrbanAid to provide them convenience in searching trustworthy and reliable services (i.e. cleaning, plumbing, babysitting, electricians, etc.) that can ease the burden of performing mundane everyday tasks or maintaining their lovely homes.

On the other hand, the service providers also gain much benefit as they are provided an easy and convenient platform to find potential customers, improving their presence and credibility in the over-saturated market of service providers in urban areas. From professionals, established service companies, full/part timers to even B40 service-preneurs, all are welcome to pursue their business via UrbanAid's one-stop platform while also upskilling the B40 service-preneurs especially to provide them equal opportunities to gain sufficient experience and improve business in the long run.

7.1.2. Value Propositions

Based on Fig 24, UrbanAid provides several significant value propositions, which are highlighted in different colors to indicate its value to both the apartment and condominium residents (green) as well as the service providers (blue).

For the apartment and condominium residents, UrbanAid ensures convenience by providing a single mobile app that serves as a one-stop solution in booking multiple essential services such as cleaning, babysitting, electrical, plumbing, and more, eliminating the need to search on social media, ask neighbors, or deal with unknown contractors. Next, trust and safety of hiring service providers is one of many concerns that need to be taken into account, which UrbanAid can always assure as all service providers are vetted, background-checked, and rated by other users through the app. Besides that, residents are also given flexible options where they can either book one-time services or recurring schedules based on pricing, rating, or specialization. Lastly, via the app, the residents will always be given transparent & affordable pricing upfront, preventing any doubts regarding hidden costs or bargaining.

For the service providers, UrbanAid provides access to clients without high marketing costs where there is no need to spend money on ads or cold-calling since jobs will be delivered directly to their dashboard, most helpful or new or less digitally-savvy providers. Next, service providers are able to opt for various work and subscription models such as pay-per-job commissions or a monthly subscription plan with premium benefits (i.e. higher visibility, priority bookings, etc). Furthermore, service providers who have proven their credibility and expertise can earn extra commissions, cash bonuses, and exclusive client referrals, further improving their business ventures. Last but not least, UrbanAid can help to provide exclusive training programs and certification badges to help B40 service-preneurs increase their credibility and earnings.

7.1.3 Revenue Streams

Based on Fig 24, UrbanAid generates revenue through multiple streams. Its primary income comes from commission fees, where 10–20% is deducted from each completed service such as, for an RM80 cleaning job, RM12 goes to UrbanAid. The platform also offers subscription plans to high-rise residents, providing perks like priority booking and discounts. Additionally, service providers can pay for featured listings to increase their visibility, such as a RM10 banner placement during promotional periods. Lastly, UrbanAid charges a small transaction fee per booking (e.g., RM2) to cover payment gateway and operational costs.

7.1.4. Cost Structure

Based on Fig 24, UrbanAid operates as a tech-enabled service marketplace connecting high-rise tenants with local service providers, and its primary costs revolve around technology, customer support, provider management, and partnerships. Key expenses include app development and maintenance which covers platform updates, performance optimization, and developer or SaaS tool costs like Firebase and AWS. To ensure trust and safety, resources are also allocated to background checks, identity verification, and provider training. Reliable 24/7 customer support adds to the cost, requiring staff, chatbot systems, or ticketing tools to handle user issues effectively. Lastly, sourcing and training service

providers, especially B40 service-preneurs, incurs costs through partnerships with training centers, helping providers gain certifications and improve professionalism.

7.1.5. Key Partners

UrbanAid relies on multiple key partners to deliver value, reduce risks, and scale efficiently. Service providers form the core supply side of the platform, and their quality, reliability, and loyalty are supported through incentives, training, and rating-based rewards. Apartment and condominium management teams act as gatekeepers to UrbanAid's target market, helping with endorsements, user access, and platform integration. Technology partners power the platform's backend, payments, and location services using tools like Firebase, AWS, and Google Maps APIs. Background check agencies are vital for provider verification, ensuring trust and safety, while training institutions such as NGOs and TVET centers help upskill B40 service-preneurs to improve service quality. Lastly, marketing and referral partners, such as influencers and community ambassadors, aid in growing the user base authentically and cost-effectively.

7.1.6. Key Activities

Based on Fig 24, one of UrbanAid's core activities is the development and ongoing maintenance of its mobile app, guided by the design thinking process, from understanding user pain points to prototyping and testing solutions. Once launched, the app will require continuous updates, bug fixes, and UX improvements based on user feedback. Another key activity is providing responsive customer service, which ensures user satisfaction and trust through timely support, dispute resolution, and feedback collection. Onboarding and vetting service providers is also crucial, involving background checks, identity verification, and training to guarantee safety and quality. UrbanAid also focuses on marketing and user acquisition through targeted campaigns on platforms like Facebook, Instagram, and Google, as well as influencer promotions to drive early-stage growth. Lastly, forming partnerships with apartment managers and local businesses helps UrbanAid promote the platform and integrate effectively within residential communities.

7.1.7. Key Resources

Based on Fig 24, one of UrbanAid's key resources is its mobile app and web platform, which acts as the core product for both residents and service providers to manage bookings, payments, communication, and reviews. The platform must be secure, user-friendly, and compatible with Android and iOS devices. Another vital resource is the customer database and analytics tools, such as CRM systems, which help track user behavior and support personalization, marketing, and service improvements. Additionally, the service provider network is essential, as their quality and availability directly impact user satisfaction and platform credibility. Lastly, UrbanAid's human capital, including developers, support staff, and marketing personnel, is critical to maintaining and growing the multi-sided marketplace efficiently.

7.1.8. Relationships

Based on Fig 24, UrbanAid's two-sided platform depends on strong, trust-based customer relationships to ensure user acquisition, satisfaction, and long-term loyalty. Automated support tools like FAQs and chatbots offer 24/7 assistance, while live customer support via chat, phone, or email helps resolve service or payment issues, especially for sensitive services like babysitting or home repairs. Loyalty programs and rewards encourage continued app usage and reduce churn, while feedback and review systems promote accountability and build community trust. Additionally, subscription-based relationships offer perks such as priority bookings for residents and increased visibility for service providers, further enhancing engagement on both sides.

7.1.9. Channels

Based on Fig 24, UrbanAid utilizes multiple channels to connect its value propositions with customers, supporting acquisition, service delivery, and retention. The primary channel is its mobile app (Android and iOS), used by residents to browse and book services, and by service providers to manage jobs, schedules, and income. The website serves as a secondary platform for desktop users, offering FAQs, support, and onboarding, while also providing service providers with tools for admin tasks and performance insights. Social media platforms like Facebook, Instagram, and TikTok are key for brand awareness and community engagement. Additionally, local partnerships with condos and apartments, through digital notice boards, QR codes, or concierge referrals, subsequently enhancing visibility and trust within residential communities.

7.2. Business Environmental Map

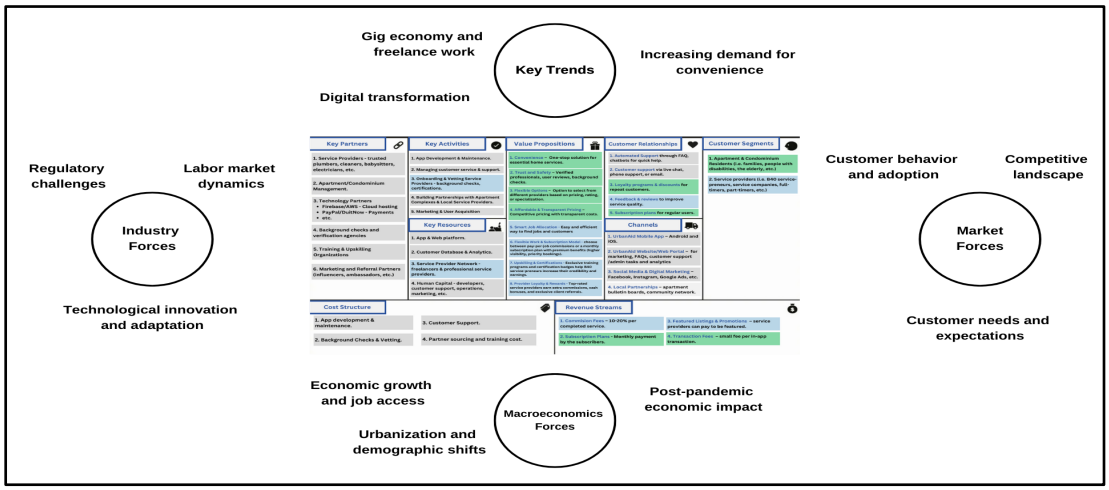


Fig.25. UrbanAid's Business Environmental Map

7.2.1. Market Forces

A) Customer needs and expectations

Our startup company, UrbanAid, is initiated to address the demands from city dwellers, especially the apartments and condominiums residents for consistent,

reliable, and convenient home services assistance under one roof. Everyone realises how hectic, busy, and stressful city lives can be, especially for working professionals, families, and expatriates. Dealing with traffic jams, long working hours, and piling work at the office can make most of them coming home tired, stressed, and have limited spare time. That is why these people are looking for a solution that can ease their pains. Because they do not want to go through the ordeal of dealing with several platforms in order for their needs to be met, they are going out of their way to get a single platform that will provide them with easy and reliable access to a range of services on one platform (Puranik et al., 2023). This aligns with our value proposition, which provides a single platform for a range of home services from childcare, housekeeping, home maintenance to runners, and more.

B) Customer behavior and adoption

The use of digital platforms for household services has become more common among customers since nowadays almost everyone owns mobile devices. UrbanAid's target market, which are the urban residents residing in apartments and condominiums, are among those who enjoy the perks of having digital platforms that make scheduling home services simple and quick. The demand for platforms that offer a wide range of services in a reliable and user-friendly way are rising significantly because customers are getting used to using digital platforms to fulfill their various daily needs (Fioravanti et al., 2023). Furthermore, customers demand for transparency and confidence in services, which is where UrbanAid provides a big advantage by integrating real-time service tracking and service provider authentication.

C) Competitive landscape

Business like UrbanAid, which offers services and connects service providers and customers is not the first in the industry. There are various existing platforms like Grab, GoGet, MaidEasy, and KiddoCare in the industry. However, the biggest difference between UrbanAid and these existing platforms is that these platforms specialize in particular services like food delivery, house cleaning, child care, etc (YeWei, 2018). But, in UrbanAid, we offer all of these services in a single platform to combat the market fragmentation. In short, the primary differentiator of UrbanAid is its capacity to provide a broad range of home services on a single platform.

7.2.2. Industry Forces

A) Regulatory challenges

The Gig economy regulations in Malaysia are evolving very rapidly as the government is still trying to find the best solution to create a comprehensive law that supports the gig economy. As a result, platforms like UrbanAid that provide domestic services are facing significant uncertainty in issues like workers' protections, service quality standard, and price regulations. So these businesses had no choice but to strike a balance between innovation and compliance which

caused them to face difficulties due to the absence of established laws regarding these matters. It is crucial to settle this issue as soon as possible to allow UrbanAid to expand without running afoul of the law and uphold its dedication to providing high-quality services and compensating the service providers fairly (Makhtar et al., 2024).

B) Labor market dynamics

The freelance labor has increased rapidly due to the gig economy, but this situation also highlights the important concerns regarding worker protections and equitable compensation. In general, dissatisfaction and turnover rate are high for service providers as the result of poor compensation, unstable income, and lack of employees' benefits like health care or retirement plans.Thus, to solve this issue, UrbanAid aims to ensure that this customer segment will receive fair compensation and employment stability. UrbanAid will establish a more sustainable work environment for them by providing fair remuneration, transparent pricing, and employment stability. This leads to improved customer experiences and increased retention rates (Surie, 2020).

C) Technological innovation and adaptation

In this 4IR era, technological innovations like AI-powered matching algorithms and Internet of Things-enabled service monitoring are revolutionizing the on-demand service industry. Platforms like UrbanAid are able to utilise these technologies by streamlining important procedures like real-time service tracking, choosing a service provider, and analysing customer feedback. By integrating these advances, service providers are given the resources they need to efficiently manage their work while users are guaranteed timely and top-notch service quality. These capabilities will be crucial in improving the overall customer satisfaction and UrbanAid's operational efficiency as we continue to implement cutting-edge technology, allowing the platform to scale successfully in a cut-throat market (Fioravanti et al., 2023).

7.2.3. Macroeconomics Forces

A) Economic growth and job access

Malaysia's macroeconomics has been expanding, but difficulties still exist, particularly for the lower income group, B40. This group is still struggling to make ends meet and facing financial instability despite general economic progress. Thus, UrbanAid's effort to give opportunities to people, especially those from this group, to earn extra income by collaborating in offering services with a flexible environment and fair compensation is hoped to close this gap. By providing customers with affordable solutions for their household needs and a platform that enables low-income individuals to obtain income whether as part-time or full-time, UrbanAid is

believed to be well-positioned to address these economic inequities and advance an inclusive economy (Kadir, 2020).

B) Urbanization and demographic shifts

The demand for domestic services like cleaning, home maintenance, and childcare is rising significantly as Malaysia urbanized and more people move into cities, particularly apartment and condominium complexes. Thus, the need for flexible, on-demand services that can satisfy the busy urbanites' needs is being driven by this urban migration. As this customer segment is looking for a more practical and time-saving solution compared to the existing solution, the demographic change suggests a rising reliance on digital platforms for daily tasks. Since this customer segment is looking for less cumbersome and time-consuming solutions compared to the existing fragmented solution, demographic change predicts an expansion in the utilisation of digital platforms for daily house chores. Consequently, UrbanAid capitalises on this trend by providing a wide range of services that address the evolving needs of urban residents, especially those residing in high-populated areas who have a strong preference for convenience and high-end domestic services (Puranik et al., 2023).

C) Post-pandemic economic impact

After the pandemic that happened in 2020 due to the covid-19, customer behaviour has seen to change very significantly. This pandemic has accelerated the transition to digital platforms and on-demand services. The demand for contactless services and solutions that could be accessed from home skyrocketed as customers were instructed by the government to adopt remote work and social distancing. This shift is advantageous to UrbanAid since UrbanAid offers a platform that enables customers to schedule services remotely without requiring in-person communication, which guarantees convenience and safety. Thus, platforms like UrbanAid are crucial in assisting people in managing their household chores while abiding by new norms, as the pandemic aftermath has reaffirmed the necessity for safe and efficient service delivery in urban areas (YeWei, 2018).

7.2.4. Key Trends

A) Gig economy and freelance work

Compared to 10 years ago, we can see more people choosing freelance work as their additional or even main source of income. Back then freelance work was limited to some sectors like creative arts, writing and content creation, and education only. But right now, we can see more freelancers from other sectors as well due to benefits like flexible working hours, freedom, and fair pay that they receive. This is one of the contributing factors to the explosive growth in the gig economy. Furthermore, this trend has brought UrbanAid a developing network of independent contractors and service providers (Sharon, 2024). Such workers seek

platforms that provide fair compensation and flexible work schedules, which UrbanAid aims to offer.

B) Digital transformation

After the pandemic that happened in 2020, the digitisation of services has accelerated very quickly. On-demand services, which not many people knew back then, have become customers' preference because of the convenience, accessibility, and safety that these services offer. In this 4IR era, it is becoming more crucial to match service providers with customers and monitor the service delivery in real-time by utilising technologies like Artificial Intelligence (AI), Internet of Things (IoT), and big data (Fioravanti et al., 2023). These technologies are planned to be integrated from time to time into UrbanAid's platform for the purpose of increasing productivity, customer satisfaction, and service quality.

C) Increasing demand for convenience

Customers are demanding for convenient and efficient access to services as a result of their hectic and busy urban lifestyle. They are actively looking for products or services that can alleviate their burden and, most importantly, save their precious time. But having market fragmentation does not help much. That motivates UrbanAid to fill the market demand for platforms with a wide range of services under one roof. By offering a multi-service platform, UrbanAid aims to solve this problem and get rid of the hassle of utilising many apps for various tasks. UrbanAid satisfies customers' need for convenience by providing a one-stop centre for all household necessities, including cleaning, maintenance, childcare, etc, which definitely increases productivity and service reliability (Puranik et al., 2023).

7.3. Strategy Canvas

The strategy canvas compares Urbanaid's business model with those of other existing companies, such as GoGet, Urban Company, KiddoCare, and MaidEasy. This canvas was created to gain a better understanding of the model. The key factors that differentiate these benchmarks from UrbanAid are Service Variety, Trust & Safety Features, Flexibility, Affordability, Scheduling Flexibility, Sustainability & SDG Alignment, Platform Support (Upskilling & Certification), Income Generating Potential (Focusing on B40). Based on Fig. 26, all these factors were analysed and compared among the companies that have a similar orientation to UrbanAid. This strategy canvas also introduces great opportunities for UrbanAid to strengthen the difference of this solution with something remarkable and unique or also known as 'Purple Cow' features.UrbanAid's niche features include the Platform Support (Upskilling & Certification) and Income Generating Potential

(Focusing on B40), where it is one of the initiatives to improve job access for B40, through prioritising the upskilling and training.

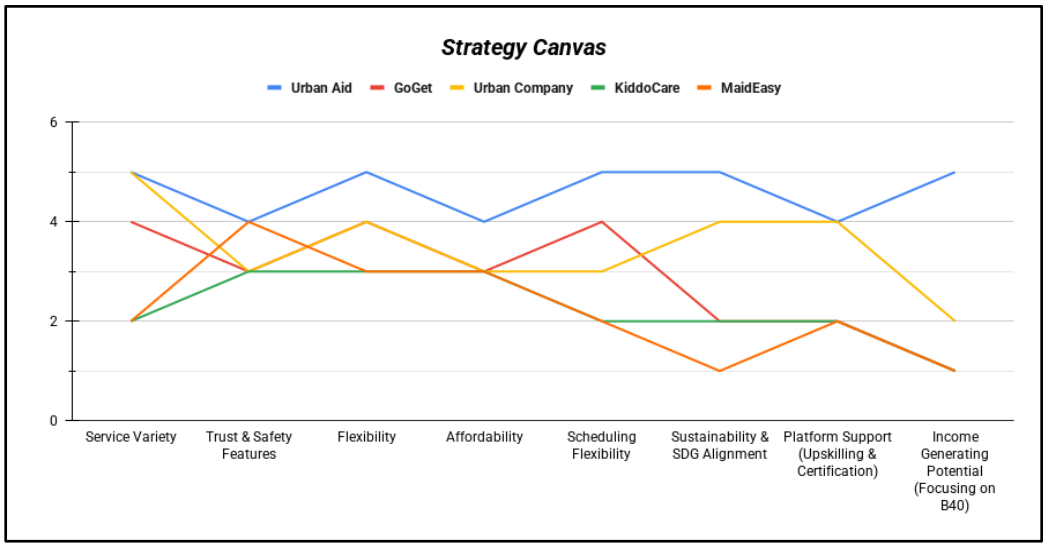


Fig.26. Strategy Canvas

7.4. High Fidelity Prototype

The high-fidelity prototype of the mobile apps created in the early phases of the design process is shown in Fig. 27, 28, 29 and 30. These prototypes enable testing and iterations of the design's functionality and layoutFig. 27, 28 and 29 are for interfaces where customers will be interacted. Fig 29 included the features of Artificial Intelligence (AI) featuring Automated Customer Support chat and AI matching services and Internet of Things (IoT) featuring service provider tracker.

Fig 30 is the interface the service providers will be interacting with. Both views share the tracker interface that features IoT in the application.

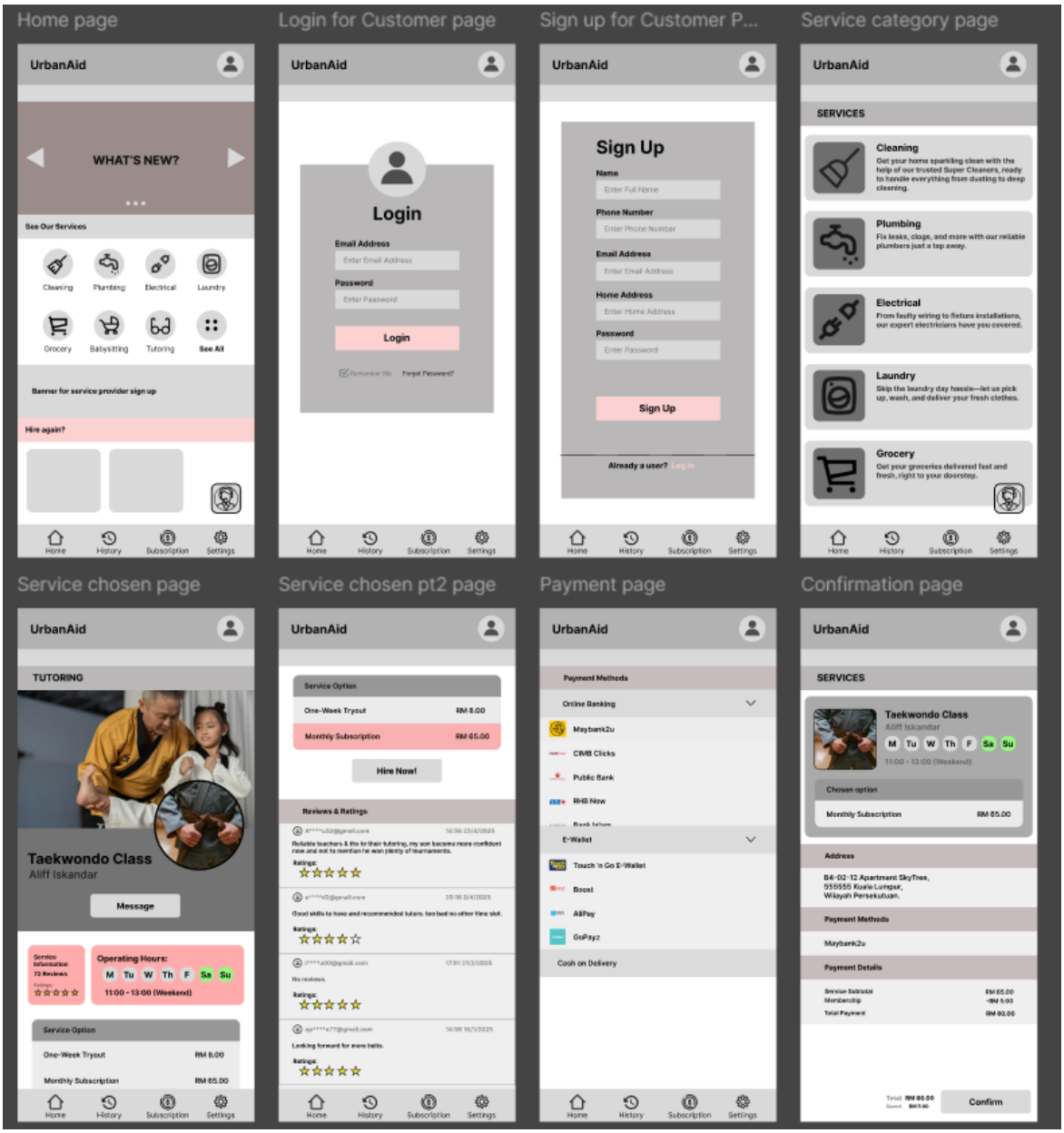


Fig.27. Prototype for Customer's View 1

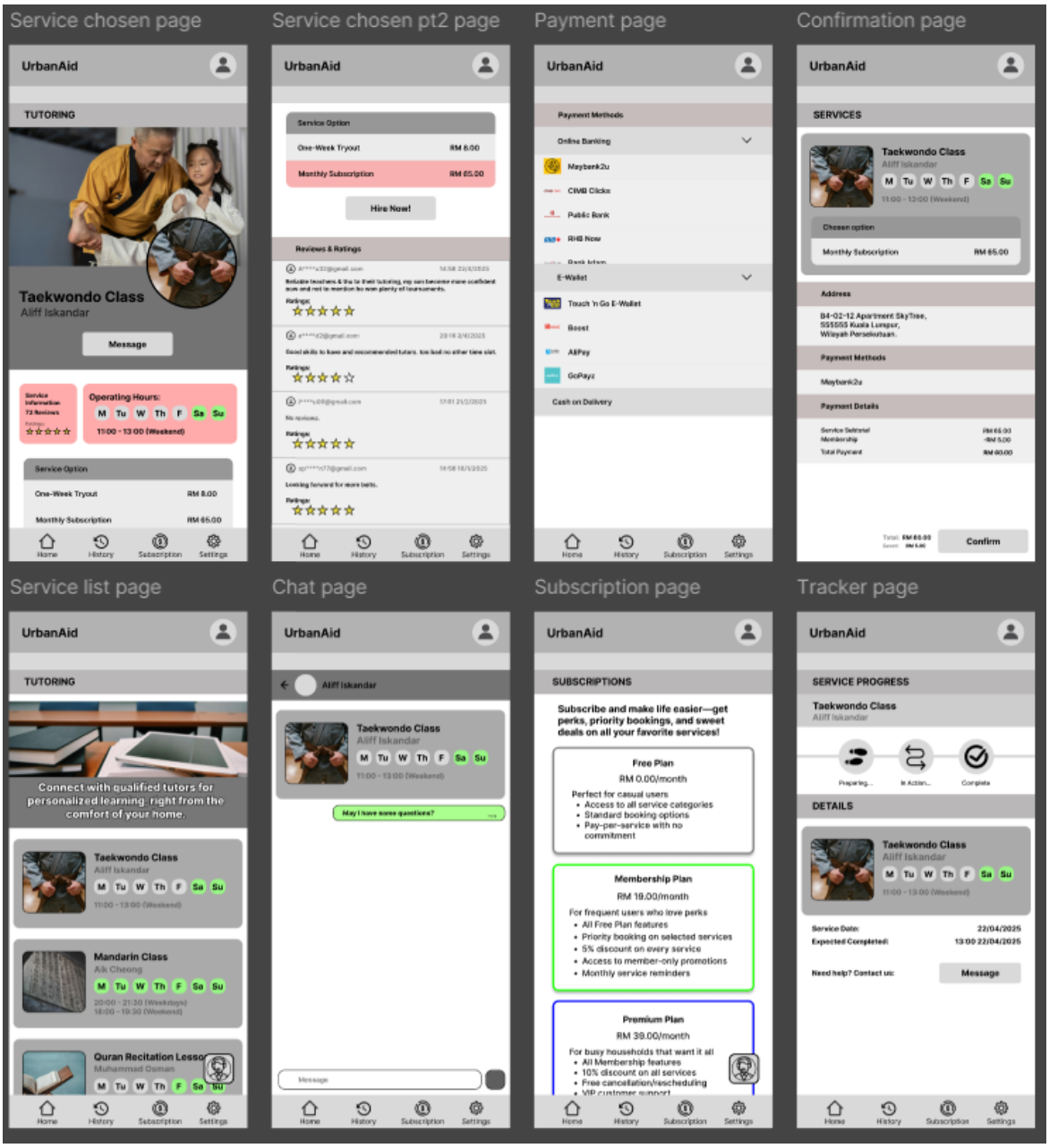


Fig.28. Prototype for Customer's View 2

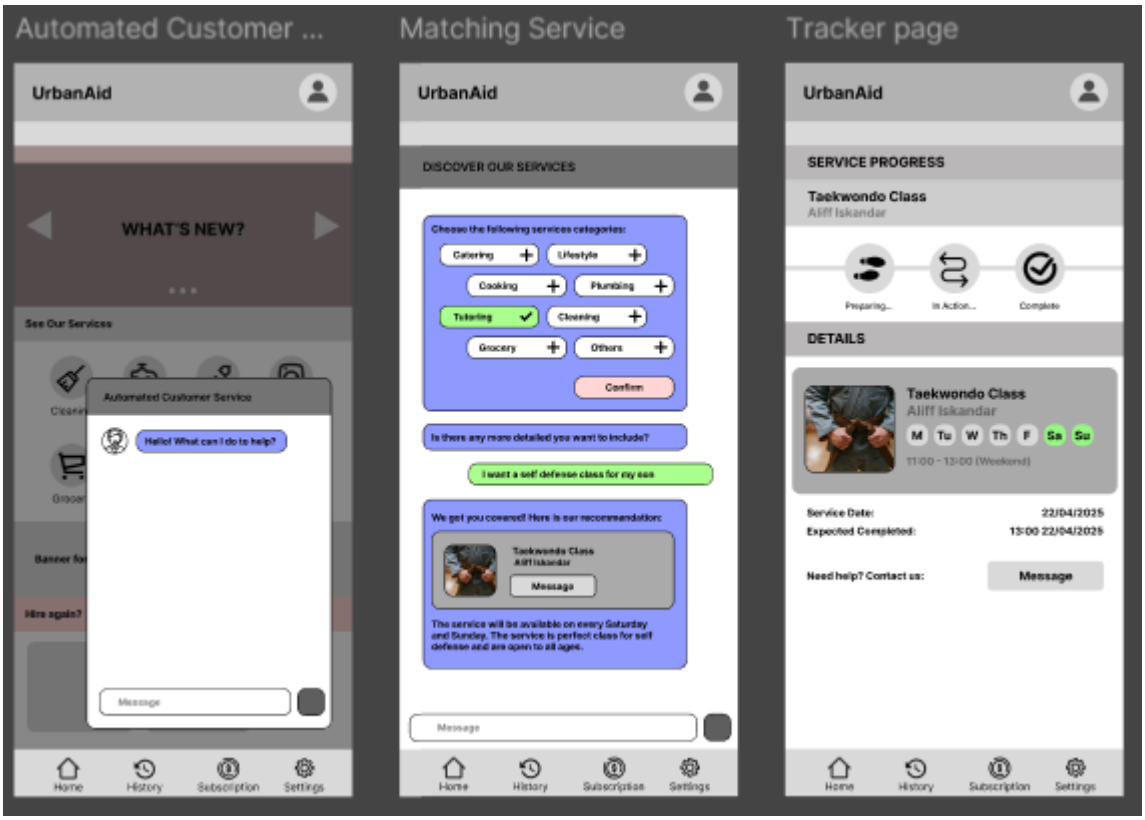


Fig.29. Prototype for Customer's View 3 (Automated customer support chat, AI matching services, and service provider tracker)

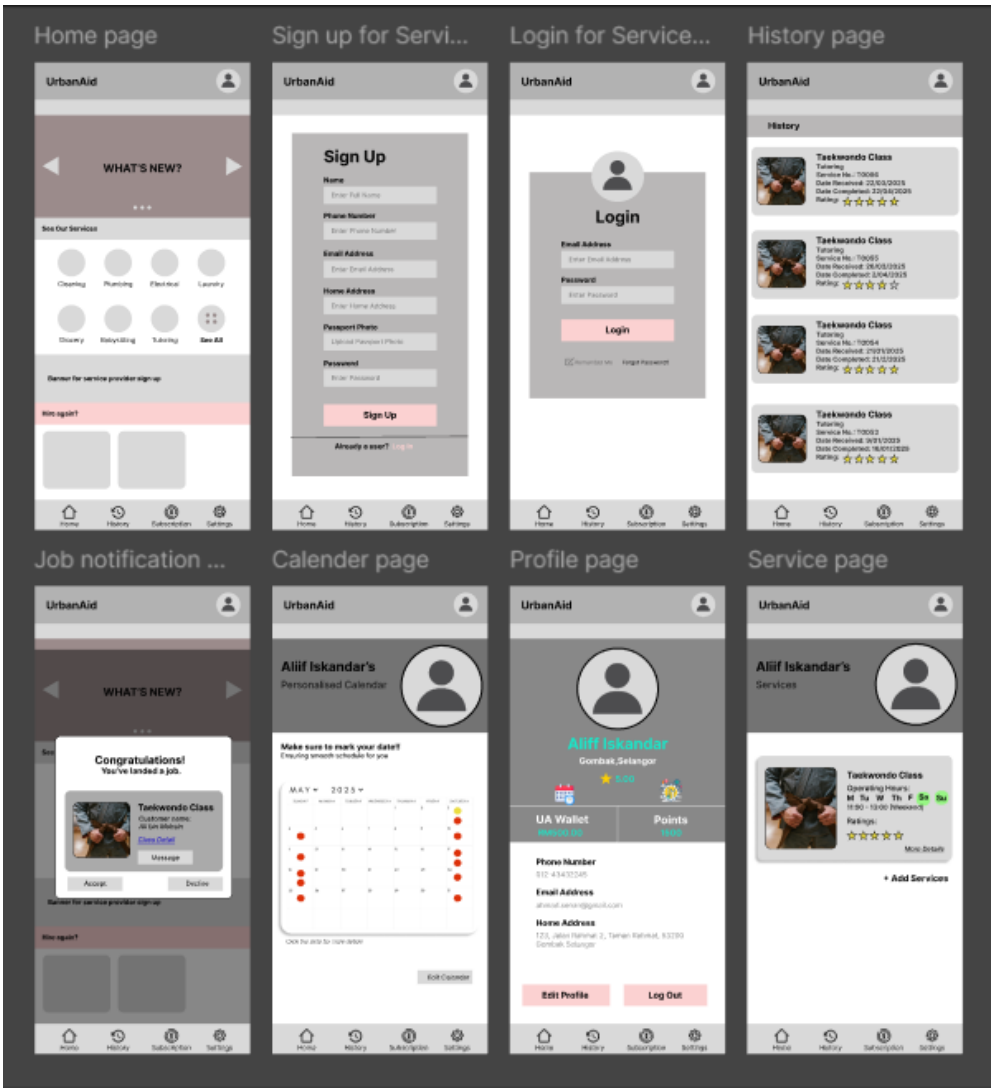


Fig.30. Prototype for Service Provider's View

8. CONCLUSION AND FUTURE WORKS

UrbanAid is a business that should help urban communities, particularly those with hectic schedules, complete time-consuming everyday duties. It should also help service providers who are having trouble gaining new clients. With a unique and reliable approach, this platform connects the customer with the service provider and creates a reliable, responsive and user-friendly channel. This platform counters poor customer experience, untrustworthiness issues towards service providers and the traditional service booking method. On the other hand, this platform offers convenience and a smooth experience for both customers. UrbanAid, with an innovative business model, uses a digital platform that offers customers a smooth, real-time booking experience, trustworthy service tracking, and delay prevention. Additionally, it gives the service provider a platform for producing revenue and

consistent client potential, guaranteeing value and relevance for every consumer category.

Building a thorough business plan using the knowledge gathered from our proven business model is the next stage for UrbanAid. The steps of development, like ideation, system design, testing, deployment, and continuous improvement, will be thoroughly outlined in the business plan. To create a platform that can fulfil its functionality and accomplish its development goal, a more comprehensive evaluation of user preferences is required. The platform's success also relies on how well it integrates with contemporary trends and technologies while maintaining its original goals to guarantee a complete influence on urban communities.

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ENHANCING TRUST & TRANSPARENCY IN WAQF DONATIONS THROUGH BLOCKCHAIN-BASED SMART CONTRACTS ALIGNED WITH SHARIAH PRINCIPLES

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ABSTRACT: Smart contracts using blockchain technology offer a more convenient and efficient way to execute transactions. Self-executing programs that automate activities independently, utilising the sophisticated features of blockchain to guarantee transparency, efficiency, and security. However, integrating smart contracts that do not adhere to Shariah principles may lead to non-compliance with Islamic ethical and legal standards, potentially resulting in mistrust, rejection by stakeholders, and invalidation of the contract within Shariah-compliant frameworks. Implementing smart contracts for waqf donations can be challenging due to technical, legal, and Shariah compliance issues. But the key advantage lies in enhancing trust and transparency throughout the donation process, ensuring accountability and delivering benefits at every stage of the process. The objective of this research is to explore the role of smart contracts in facilitating waqf donations. Using a descriptive qualitative approach, this study involves conducting a literature review and gathering relevant data to gain deeper insights into how blockchain-based smart contracts can contribute to improving the efficiency, transparency, and trust in the waqf donation process. The findings suggest that smart contracts offer promising opportunities for improving transparency, operational effectiveness, and Shariah compliance in waqf management, ultimately strengthening donor confidence and ensuring better governance of endowment assets.

KEYWORDS: *Smart contracts, Blockchain, Waqf donation, Shariah Príncipes*

1. INTRODUCTION

1.1. Smart Contracts in Fintech

The financial industry has been rapidly evolving due to continuous technological advancements, leading to significant growth and transformation over time. One of the most impactful innovations in this context is the introduction of smart contracts through blockchain technology, which has played a crucial role particularly within the fintech sector by enhancing automation, reducing operational costs, and increasing transparency and trust in financial transactions (Erika Rasure, 2024).The concept of smart contracts was first introduced by American computer scientist Nick Szabo in the 1990s (Stellar, 2024) that known as a digital agreements that operate on blockchain technology, enabling automatic execution of processes once predetermined terms and conditions are met. Their implementation facilitates

seamless, efficient, and convenient transactions by eliminating the need for intermediaries to interpret or enforce contractual terms.

According to T.J. de Graaf (2019), smart contracts serve multiple functions in the fintech industry. Deployed on an immutable and transparent blockchain, these contracts allow all participants to view terms and verify transactions, thereby increasing trust and enabling auditability for compliance purposes. Furthermore, the integration of smart contracts eliminates the need for third parties such as brokers or legal advisors, which helps reduce costs, minimize human error, and accelerate processing times. Additionally, smart contracts can trigger automatic actions in response to market conditions such as locking or liquidating collateral when specific thresholds are breached thus mitigating credit and counterparty risks.

1.2. The importance of Shariah compliance

Every aspect of daily activities, including financial sector, must adhere to Shariah principles and guidelines to ensure ethical and compliant conduct for Muslims. In the financial industry, compliance with Shariah principles fosters greater transparency, trust, security, and fairness between users and service providers. Islamic financial practices are grounded in key principles that promote ethical behavior, risk-sharing, and social justice while strictly prohibiting practices such as *riba* (interest), *gharar* (excessive uncertainty), and involvement in *haram* (forbidden) industries like alcohol, gambling, and conventional banking (Rosalia Mazza, 2025). Unlike conventional financial systems, which often rely on interest-based debt structures and speculative transactions, Islamic finance emphasizes asset-backed financing, equitable risk distribution, and socially responsible investments (Rosalia Mazza, 2025).

Incorporating Shariah principles into the smart contract approach requires that automated processes align with Islamic ethical guidelines. This includes automating profit-sharing agreements such as mudarabah and musharakah, ensuring that transactions are backed by tangible assets, and strictly avoiding activities that contravene Shariah law (Rosalia Mazza, 2025). By leveraging blockchain technology, these requirements can be embedded into the smart contract code, enhancing transparency, traceability, and trustworthiness. Blockchain's decentralized and immutable nature further supports compliance by providing a secure platform for executing contracts in a way that upholds Islamic financial principles (Nasrul, M. A. D et al, 2023).

1.3. Overview of Waqf

Waqf is a concept that is widely recognized across communities for its valuable contributions and support to society. The term waqf originates from the Arabic language, meaning "to withhold," "to forbid," or "to stop" (Jawhar,2021). According to the Shafi'i school of thought, waqf refers to the permanent dedication of a property, where the benefits or usage of the asset can be utilized for charitable or public purposes, while the ownership rights of the donor are relinquished permanently (Jawhar,2021). This is to ensures that the property remains intact and continues to generate ongoing benefits for the intended beneficiaries in accordance with Islamic principles. In Malaysia, the concept of waqf is recognized and governed under various state enactments, reflecting both general and specific interpretations

aligned with Shariah principles. While the core definition centers on the permanent dedication of property for religious or charitable purposes, variations exist across states in terms of scope and detail. Some states like Johor, Melaka, Selangor, Terengganu, Perak, and Negeri Sembilan provide more comprehensive definitions, including both movable and immovable assets(Jawhar,2021).

As highlighted by Jawhar (2021), the implementation of waqf must strictly adhere to Shariah principles which includes ensuring that waqf assets are not sold, transferred, or inherited. Once a property is dedicated as waqf, it becomes a perpetual endowment, and its ownership is no longer held by the donor, ensuring its continuous benefit for charitable or public use in accordance with Islamic law. Smart contracts, with their self-executing and immutable nature, can support the enforcement of these principles by automating compliance and safeguarding the integrity of waqf arrangements. Therefore, this paper explores how smart contracts can be used to manage waqf donations, with an emphasis on trust, transparency, and Shariah alignment.

2. LITERATURE REVIEW

The development of blockchain and smart contracts have become increasingly common and widely recognized in the financial sector. These technologies offer significant benefits by enhancing the efficiency, convenience, transparency, and accessibility of financial products and services for users. According to Zulkepli, Mohamad, and Azzuhri (2023), blockchain-based smart contracts are expected to provide even greater advantages in the future, particularly for tech-savvy individuals who rely on digital platforms for their everyday financial needs. These advancements also create opportunities for startup companies to adopt modern technologies, enabling them to compete alongside Islamic financial institutions and conventional financial systems. One of the key features of blockchain is its use of distributed ledger technology, which can significantly improve the transparency of transactions (Zulkepli, Mohamad, and Azzuhri, 2023). Smart contracts built on blockchain automatically execute and record agreements in a secure and transparent manner, allowing data to be accessed by all parties involved without the need for third-party intermediaries. These technologies can also help prevent operational errors or human mistakes that may compromise Shariah compliance. For example, tawarruq-based financing often involves multiple complex steps that carry the risk of Shariah non-compliant events if not executed properly (Zulkepli, Mohamad, and Azzuhri, 2023) which can lead to a lack of trust among users and create uncertainty in the overall process. By automating transactions through blockchain-based smart contracts, the likelihood of these errors is significantly reduced, thereby enhancing user confidence and ensuring greater compliance with Islamic financial principles (Ibrahim et al, 2024).

Despite the advantages offered by blockchain and smart contracts, many waqf institutions still rely on manual processes, which present various operational challenges. Traditional waqf management often suffers from issues such as lack of transparency, inefficient record-keeping, delayed processing times, and difficulties in monitoring the usage and distribution of waqf assets (Wan Ismail, Misba, & Mat Isa, 2025). In addition to operational inefficiencies, one of the major challenges in waqf management involves legal conflicts between Shariah courts and civil courts.

This issue is not only prevalent in Malaysia but also in other Muslim-majority countries which create conflicts create uncertainty in the governance and administration of waqf, zakat, and *baitulmal* funds and properties (Abd Jalil, 2020). These institutions are often subject to various enactments and legislative frameworks under different governing bodies, leading to overlapping jurisdictions, inconsistent interpretations, and delays in decision-making. These issues further contribute to inefficiencies in waqf management. Abas and Raji (2018) identified five key factors that hinder effective waqf administration in Malaysia which are financial constraints, a shortage of qualified waqf managers, numerous waqf lands that remain unregistered, outdated or incomplete data, and complications arising from the involvement of waqif (donor) heirs. Beside that, the lack of trained personnel and technical expertise poses significant difficulties, particularly when dealing with complex waqf property cases. These shortcomings weaken public confidence in the waqf system and reduce the perceived reliability and effectiveness of its services (IBRAHIM et al, 2024).

Given the several challenges that faced regarding waqf management, the need for standardized Shariah compliance frameworks becomes increasingly important. Institutions such as the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) and the Islamic Financial Services Board (IFSB) play a crucial role in providing regulatory standards and guidance for Islamic finance, including waqf practices. As stated by Kasim, Htay, and Salman (2013) there are 7 standards under governance standards for Islamic Financial Institution which issued by AAOIFI which are Shariah Supervisory Board, Shariah Review, Internal Shariah Review, Audit & Governance Committee for Islamic Financial Institutions, Independence of Shariah Supervisory Boards, Statement on Governance Principles for Islamic Financial Institutions and Corporate Social Responsibility Conduct and Disclosure for Islamic Financial Institutions. Although these standards were originally designed for Islamic banks and financial entities, they provide a valuable governance framework that can be adapted to the management of waqf institutions. By implementing similar structures such as an independent Shariah supervisory board and regular Shariah-compliant reviews waqf institutions can ensure their operations are conducted ethically, transparently, and in full compliance with Islamic law. Hence, these standards, waqf institutions can strengthen governance practices, reduce discrepancies, and foster public trust in the waqf system. Building upon these governance standards, various researchers have explored how smart contracts and blockchain-based solutions can enhance Waqf operations. Their perspectives are compared in the table below.

Table 1: Comprehensive Comparison Study

Author	Year	Tittle	Islamic Perspective	Key Finding
Puteri Aina Megat et al.	2024	Assessing the predictive benefits of Waqftech smart contracts on corporate waqf crowdfunding among Malaysian enterprises	Protection of Wealth, Corporate Social Responsibility, Maqasid al-Shariah principles	Malaysian SMEs adopt Waqftech for corporate/social value but not for environmental concerns.
Farrukh Habib & Abu Umar Faruq Ahmad	2020	Using Blockchain and Smart Contracts for Waqf Institutions	Protection of Wealth, Usul al-Fiqh: Legal	Smart contracts and blockchain can revive Waqf by solving

			justification for enhancing transparency	compliance, audit, and trust issues.
Siti Zulaikha & Sylva Arif Rusmita	2018	Blockchain for Waqf Management	Protection of Wealth, Encourages transparency & decentralized governance in waqf	Blockchain has strong potential to solve current Waqf management issues by enabling transparent, traceable, and decentralized systems.
Walaa J. Alharthi	2021	Using Blockchain in WAQF, Wills and Inheritance Solutions in the Islamic System	Protection of Wealth, Gharar avoidance in transaction certainty, Legal structure of Waqf (founder, asset, permanence)	Blockchain and smart contracts can enhance transparency, record reliability, and trust in Waqf management, ensuring long-term fulfillment of donor intent
Cory Vidiati, Endang Hendra, Selamet Santoso, & Izzul Faturrizky	2021	What Blockchain Technology Can Do to Contribute to Waqf	Protection of Wealth, Importance of Trust and Welfare, Potential for decentralized Waqf	Blockchain and smart contracts can optimize Waqf distribution and trust, especially in emergencies; government support and regulation are essential.
Seyedeh Hamideh Mousavi , Abolghasem Tohidinia, Seyed Mohamad Mousavi	2024	Transforming Islamic Finance: The Impact of Blockchain and Smart Sukuk	Protection of Wealth, Poverty Alleviation, Islamic contract validity, Transparency	Blockchain and smart contracts (via smart Sukuk) streamline Islamic financing, enhance social impact, and promote financial access while upholding Shariah values.
Bilal Khan et al.	2023	Proposing a Waqf-Based Ijarah Smart Sukuk Model for Development of Waqf Properties	Protection of Wealth & Welfare; Ijarah contract compliance; Shariah issues in Awqaf governance	Proposed a Waqf-based Ijarah Smart Sukuk model to develop idle Waqf assets, solve transparency issues, and align smart contracts with Shariah principles.

The objective of this paper is to explore the implementation of blockchain-based smart contracts in enhancing trust and transparency in Waqf management from the perspective of Islamic finance, particularly Maqasid al-Shariah. Based on the comparative analysis in Table 1, most of the scholars agree that blockchain and smart contracts offer strong potential to address the challenges of traditional Waqf administration, such as lack of transparency, idle assets, weak governance, and inefficiency. Studies by Farrukh Habib and Ahmad, as well as Siti Zulaikha and Rusmita, emphasize blockchain's ability to improve auditability, public trust, and perpetual fund tracking. Similarly, Khan et al. (2023) and Mousavi et al. (2024) demonstrate how Shariah-compliant smart contract models such as Ijarah-based Sukuk can revitalize Waqf properties and ensure sustainable development. The majority of findings suggest that when properly structured according to Islamic principles, smart contracts do not conflict with Shariah and can in fact support the goals of Maqasid al-Shariah by promoting wealth circulation, reducing misuse, and

ensuring donor intent is preserved. However, the literature also stresses the need for continuous Shariah oversight and standardization to ensure the legal and ethical soundness of these digital solutions.

3. METHODOLOGY

This research aims to understand and explore the implementation of smart contracts through blockchain technology in waqf donations, ensuring alignment with Shariah principles and compliance. To achieve this, a qualitative research methodology is adopted, focusing on an in-depth exploration of relevant literature, documents, and existing frameworks related to both smart contracts and Islamic finance. This approach involves collecting and analysing secondary data from academic journals, institutional reports, and credible online sources. By examining various case studies and interpretations, the research seeks to identify the opportunities, challenges, and potential solutions for implementing Shariah compliant smart contracts in the context of waqf management. The study applies the Maqasid al-Shariah as an evaluative framework, with particular emphasis on the protection of wealth (hifz al-mal) and transparency, to assess whether blockchain-based smart contracts can improve the governance, trust, and sustainability of waqf systems. By analysing selected case studies and scholarly interpretations, the research seeks to identify opportunities, challenges, and practical considerations for implementing Shariah compliant smart contracts in the management of waqf. This combined methodological approach offers both technical insight and Islamic legal grounding, ensuring the findings are relevant to both technological innovation and religious compliance.

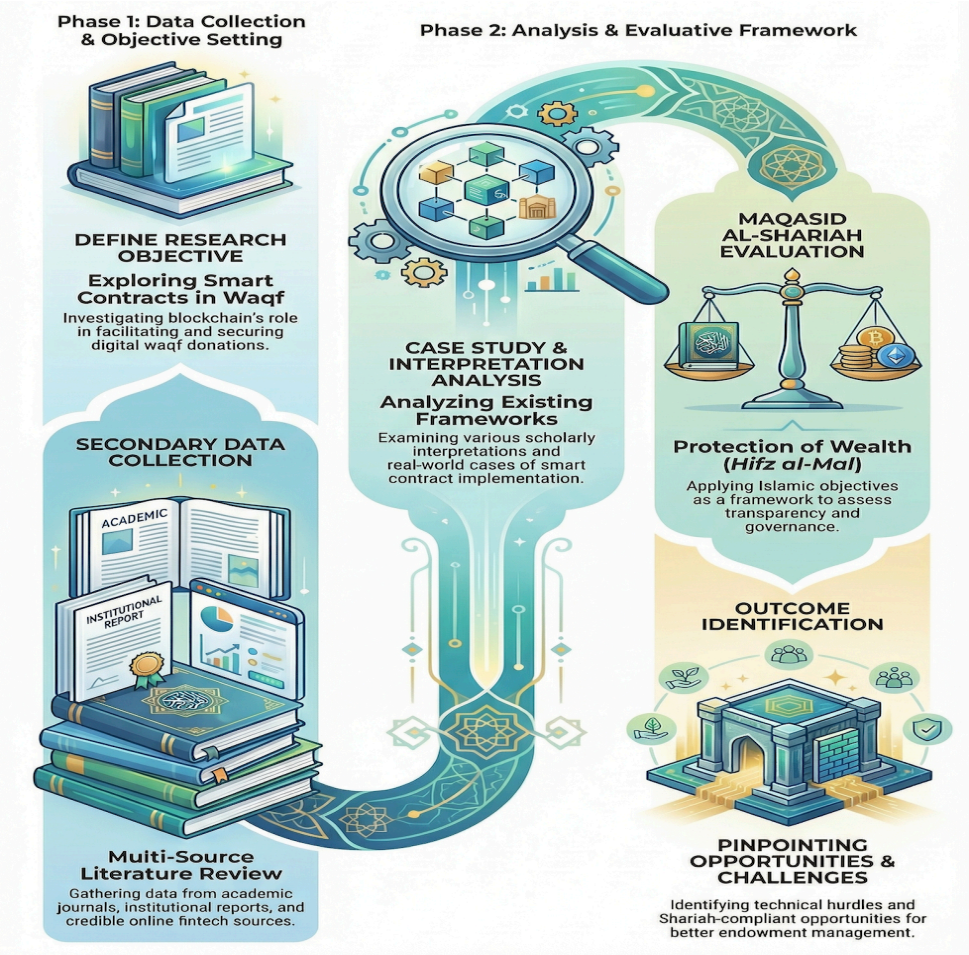

Fig.1. Research Roadmap: Evaluating Blockchain for Shariah-Compliant Waqf

Figure 1 showing how traditional Islamic charitable giving (Waqf) and contemporary blockchain technology can coexist harmoniously. The image's digital smart contract and networked, glowing blockchain nodes represent the automated, transparent, and safe execution of transactions without the need for middlemen. The constant and socially responsible flow of permanent endowments is demonstrated by these technical networks that channel into a depiction of a Waqf asset, such as a community building, agricultural land, or outstretched palms receiving charity. As a visual representation of how technology can protect a donor's original purpose (niyyah) and guarantee transparent fund distribution, the overall composition and lighting exude trust, security, and strict adherence to Shariah rules.

4. FINDINGS AND DISCUSSION

4.1. Shariah Framework & Principles

The prohibition of *riba* (interest), *gharar* (excessive uncertainty), and *maysir* (gambling) must be strictly observed in the financial industry, as these elements contradict the fundamental teachings of Islamic law. Engaging in such practices can lead to unethical financial transactions, exploitation, and injustice, which are not in line with the principles of fairness, transparency, and social equity promoted in

Islam. While riba and maisir are generally not applicable in waqf, it is important to ensure that blockchain-based smart contracts do not include such elements unintentionally. The primary concern is gharar, which could arise if smart contracts are coded unclearly, lack Shariah review, or allow for ambiguous execution. For example, if a donor establishes a waqf contract through a smart contract but fails to clearly define how the funds will be allocated, it can result in confusion and uncertainty. If a smart contract does not clearly identify key factors including beneficiary identities, the time and conditionality of distributions, and the intended use of funds, it may show shortcomings in transparency, governance, and operational clarity. The lack of such specifications could lead to unexpected consequences, disagreements, or inefficiencies that compromise the contract's dependability and credibility because blockchain-based execution is autonomous and unchangeable. This ambiguity not only undermines the effectiveness of the waqf but may also lead to mismanagement or disputes, ultimately compromising compliance with both Shariah principles and the donor's original intent.

According to Mohamed Fisol, Wan Nazjmi, and Muhammad Aizat Saad (2019), the adoption of advanced technology, when viewed through the lens of *Maqasid al-Shariah*, can be classified under necessities (daruriyyah) and needs (hajiyyah) as it upholds the five essential objectives: religion (al-din), life (al-nafs), intellect (al-'aql), progeny (al-nasl), and wealth (al-mal). Under the category of necessities, implementing transparent technologies is crucial to ensure Waqf governance adheres to Shariah principles by avoiding prohibited elements such as riba (interest), gharar (uncertainty), and maysir (gambling), thereby safeguarding both faith and financial integrity. From a Shariah perspective, such systems can reduce gharar (uncertainty) by making the terms of donation, disbursement, and use clear, traceable, and tamper-proof. While riba (interest) and maisir (gambling) are not central to Waqf, ensuring that smart contract models remain free from such elements is essential for full Shariah compliance.

Integrating smart contracts into Waqf administration should reflect key Islamic principles such as amanah (trust), tahqiq (transparency), and accountability. According to St John Robilliard et al (2019), Waqf has historically involved charitable or family endowments managed by trustees under the supervision of a local judge, ensuring the donor's intentions were fulfilled. In the modern context, blockchain-based smart contracts can reinforce these ethical foundations by automating execution, recording transactions immutably, and enhancing public trust. Additionally, smart contracts facilitate automated, Shariah-compliant execution of transactions, minimizing human error and ensuring the donor's intention (niyyah) is fulfilled with accuracy and transparency (tahqiq). This contributes directly to the preservation of wealth (al-mal) by guaranteeing that donations are managed and distributed effectively to rightful recipients. Integrating blockchain-based smart contracts into Waqf administration not only enhances the structure of Islamic social finance but also reinforces the ethical and legal soundness of donation management. This reflects a forward-thinking application of Shariah and Maqasid-based principles in addressing modern challenges.

4.2. Technical Overview of Smart Contracts

Smart contracts are automated programs that run on blockchain platforms such as Ethereum. These contracts are written using programming languages like Solidity and follow a basic rule: “if/when this happens, then do that” (IBM, 2024). This means once specific conditions are met, the contract will automatically execute the agreed action without needing any third party. In the context of Waqf management, for instance, a smart contract could be designed to automatically release funds to designated beneficiaries only after a certain date has passed or once a particular project milestone is verified. The implementation of smart contracts can significantly lower transaction costs, minimize human errors, and save both time and financial resources. It also helps to eliminate unnecessary third-party involvement, allowing processes to be carried out more efficiently. Furthermore, smart contracts enhance transparency, as all contract activities and payment records are stored on a public blockchain ledger, making transactions openly accessible and verifiable by anyone.

However, despite their advantages, smart contracts also present certain limitations. One key challenge is the technical complexity involved in coding them accurately (Erika Rasure,2024). Since smart contracts are immutable once deployed on the blockchain, any coding error or oversight whether technical or related to Shariah compliance cannot be modified or reversed. This poses a significant risk, especially in Waqf applications where legal, ethical, and religious requirements must be precisely upheld. Therefore, it is essential that smart contracts for Waqf purposes undergo thorough validation, involving both technical developers and Shariah scholars, to ensure that they are not only functionally correct but also fully aligned with Islamic legal and ethical principles prior to deployment.

4.3. Compliance Analysis

To assess the alignment of smart contracts with Islamic principles in Waqf, several critical aspects must be examined. One of these is the concept of trusteeship (*amanah*), which can be partially embedded within the logic of smart contracts. Through programmable rules, smart contracts can automate certain trustee responsibilities such as the disbursement of funds or the monitoring of project milestones thereby reducing dependence on human intermediaries. As noted by Robert Herian (2017), this introduces a new model of distributed trusteeship, supported by two key elements: cryptographic and computational validation of transaction sequences and the decentralized operation of the blockchain network, both of which can be utilized in Waqf administration. Nevertheless, oversight by Shariah scholars remains essential to ensure that the contract logic genuinely upholds the ethical and legal obligations of trustees as mandated by Islamic law.

In addition, smart contracts can help preserve a donor’s intention (niyyah) by executing transactions only when specific conditions are met. For example, a Waqf donor might require that funds be disbursed monthly to an orphanage, and a smart contract can ensure that this condition is fulfilled precisely, without delay or unauthorized modification. As highlighted by Warren Mille (2024), smart contracts introduce a new level of transparency in charitable giving by enabling real-time

tracking of donations. This direct, automated process eliminates traditional delays in reporting and ensures a transparent chain of custody, with every transaction publicly recorded on a tamper-proof blockchain ledger. As a result, donors can verify their contributions instantly and trace how every portion of their funds is allocated.

However, several challenges remain, one of which is that smart contracts are generally not designed with Shariah compliance in mind. These technologies often overlook the requirements of Islamic legal frameworks, including the proper formation of contracts and the resolution of disputes in accordance with Fiqh principles. To overcome these limitations, there is a growing need to develop Shariah-compliant smart contract templates that are specifically tailored to the legal and ethical requirements of Waqf governance. These play a crucial role in ensuring that the technology remains both functionally effective and religiously appropriate.

A qualitative analysis of secondary data gathered from scholarly publications, institutional reports, and case studies pertaining to blockchain, smart contracts, waqf management, and Islamic financial principles was used to arrive at the study's conclusions. In order to determine the possible advantages and restrictions of blockchain-based smart contracts in waqf donations, the study combined data on technological implementation, Shariah compliance, and governance issues using the Maqasid al-Shariah framework as an evaluation lens. The findings show that by automating fund disbursement, guaranteeing record immutability, and lowering human error, smart contracts can greatly improve trust, transparency, and operational efficiency. Crucially, incorporating Shariah rules into smart contract logic reduces gharar (uncertainty) and maintains donor intent, which is consistent with Islamic finance's moral objectives. To address legal and technological issues, the report also emphasises the need for continuous Shariah oversight and the creation of standardised, Shariah-compliant templates. Overall, the results show that although smart contracts present promising enhancements to waqf governance, their effective implementation necessitates the fusion of cutting-edge technology with strong religious and legal frameworks.

5. CONCLUSIONS

This study explores the integration of blockchain-based smart contracts in enhancing trust and transparency within Waqf donations, particularly through the lens of Shariah principles and Maqasid al-Shariah. The use of blockchain in Islamic finance, especially in Waqf, presents an innovative solution that supports accountability, minimizes human error, and ensures the preservation of donor intent (niyyah). Smart contracts offer automation and real-time tracking of donations, reducing the need for intermediaries while maintaining a transparent and immutable record of transactions. This aligns with key Islamic objectives such as the protection of religion (din), wealth (mal), and social welfare. However, the study also highlights challenges, including the absence of smart contracts specifically designed with Shariah compliance in mind and the need for oversight by Shariah scholars. There is a necessity for Shariah-compliant templates and the involvement of trusted Shariah oracles to ensure alignment with Islamic legal frameworks. Despite these limitations, blockchain technology holds great promise for improving Waqf governance by offering a system that is transparent, efficient, and aligned with

Islamic ethical standards. As Islamic financial technology continues to evolve, such innovations must be further researched, refined, and regulated to ensure their full compatibility with Fiqh and long-term sustainability.

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UNVEILING PUBLIC PERCEPTION OF TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) ON SOCIAL MEDIA USING A HYBRID SENTIMENT ANALYSIS APPROACH

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ABSTRACT: The public perception significantly impacts the effectiveness and societal acceptance of Technical and Vocational Education and Training (TVET) in Malaysia. Social media platforms such like Facebook becoming more important which makes it easier to get the real-time public input on education policy and programs. However, evaluating sentiment in informal and bilingual discussion poses significant challenges. This study presents a hybrid sentiment analysis approach that integrates lexicon-based approach (VADER, TextBlob, SentiWordNet, AFINN) with machine learning classifiers (Support Vector Machine, Naïve Bayes, Decision Tree, Logistic Regression, Random Forest and K-Nearest Neighbors) to classify and evaluate sentiments in 1,304 Facebook posts and comments related to TVET. The dataset was systematically pre-processed, translated, and subjected to feature extraction by Term Frequency-Inverse Document Frequency (TF-IDF). Accuracy served as the sole evaluation metric to ensure consistent comparison among lexicon-only, machine learning-only, and hybrid approaches. The hybrid combination of TextBlob and SVM achieved the highest accuracy at 72%, surpassing both standalone lexicon and machine learning approaches. This finding indicates that hybrid approaches are more effective in handling informal, code-switched sentiment data. The study offers a scalable framework for sentiment analysis in education policy, providing practical implications for TVET stakeholders aiming to evaluate public opinion and enhance engagement strategies.

KEY WORDS: *TVET, Sentiment Analysis, Hybrid Approach, Machine Learning, Lexicon-Based*

1. INTRODUCTION

Technical and Vocational Education and Training (TVET) is recognised as a significant policy initiative for workforce development and enhancing youth employability, particularly in terms of transforming career opportunities (UNESCO, 2016). In Malaysia, TVET has not yet achieved recognition as a favoured pathway for higher education. It is often viewed unfavourably, typically linked to thse who have not excelled in traditional academic routes (Omar & Mohd. Desa, 2023). Despite these initiatives, TVET continues to experience obstacles with public perception, including persistent issues of declining credibility, social stigma, and inadequate awareness of its values and outcomes (Okae-Adjei, 2017).

The growing prevalence of digital engagement has transformed social media platforms like Facebook into crucial platforms for the active generation and expression of public perspectives. These platforms offer unmediated, immediate feedback on educational policy and institutional practices, affording substantial resources for evaluating community sentiments (Gao, 2020). The informal, multilingual, and frequently code-switched characteristics of user-generated content on these platforms provide considerable analytical challenges for academics (Solorio et al., 2014).

Sentiment analysis offers a computer approach to understanding public sentiment by classifying text according to emotions polarity. Traditional approaches, whether lexicon-based or machine learning, struggle to sufficiently capture the complexity of informal and bilingual conversation (Medhat et al., 2014). Lexicon-based approaches, yet interpretable, sometimes lack contextual depth, whereas machine learning approaches often require labelled datasets and may struggle to generalise to unstructured real-world data (Chatterjee & Kumar, 2020).

To address these constraints, hybrid approaches that integrate rule-based sentiment analysis with statistical learning have gained significant prominence in recent studies. These approaches leverage the interpretability of lexicons alongside the adaptability of machine learning to enhance classification effectiveness (Chen et al., 2022; Medhat et al., 2014). This research utilises a hybrid sentiment analysis methodology that integrates lexicon-based polarity scores with machine learning classifiers to analyse Facebook comments concerning TVET in Malaysia. The objective is to identify sentiment trends, evaluate model correctness across various contexts, and develop insights that can inform targeted communication strategies, curriculum creation, and improved public engagement with TVET policy.

2. RELATED WORKS

2.1. Social Media as a Source of Public Sentiment

Social media platforms like Facebook, Twitter, and YouTube have emerged as significant platforms for public conversation, offering an abundance of user-generated content that expresses personal thoughts, attitudes, and collective sentiments. In the domain of education and policy, platforms such as Facebook are significant as they enable public participation in dialogues regarding curriculum reform, funding priorities, graduate employability, and the overarching societal value of educational opportunities like Technical and Vocational Education and

Training (TVET). In contrast to traditional methods like surveys or interviews, social media data are extensive, immediate, and collected in real time, providing more genuine insights into public perception (Gao, 2020). Simultaneously, these data sources provide challenges: they are frequently loud, informal, and marked by code-switching, which complicates sentiment analysis (Solorio et al., 2014).

2.2. Overview of Sentiment Analysis and Importance

Sentiment analysis, often known as opinion mining, is the computational approach for identifying and classifying opinions or emotions expressed in textual data. It has been widely utilised in various domains including marketing, politics, healthcare, and education. The main objective is to categorise text into polarity classifications, such as positive, negative, or neutral. In the field of education, sentiment analysis has been utilised to assess student feedback, evaluate public responses to educational reforms, and investigate opinions of vocational programs (Khan et al., 2022). Nonetheless, its use in the realm of Technical and Vocational Education and Training (TVET) is constrained, especially in the examination of public sentiment expressed through social media.

2.3. Lexicon-based Approaches

Lexicon-based approaches operate by comparing terms in a text to a set lexicon, giving each word an emotion score. These methods are valued for their simplicity, transparency, and autonomy from labelled datasets. VADER, TextBlob, AFINN, and SentiWordNet are some of the most commonly used lexicons. VADER is especially excellent at analysing social media material due to its incorporation of heuristics for punctuation, capitalisation, and emoticons (Hutto & Gilbert, 2014). Nevertheless, lexicon-based methods encounter significant obstacles, especially in addressing verbal ambiguity, sarcasm, domain-specific jargon, and contextual sensitivity. These limitations undermine their reliability in analysing the informal and code-switched information typically encountered on sites such as Facebook (Taboada et al., 2011).

2.4. Machine Learning Aproaches

Machine learning (ML) approaches conceptualise sentiment classification as a supervised learning task. Support Vector Machines (SVM), Logistic Regression, Random Forests, and Naïve Bayes are all algorithms that are trained on labelled datasets with known sentiment classifications. These models utilise features like n-grams, TF-IDF scores, or word embeddings to make predictions about new data. When ample labelled data is accessible, machine learning-based sentiment classifiers generally work better than lexicon-based ones (Medhat et al., 2014). However, they are resource-intensive and frequently criticised for their restricted interpretability, as many operate as black-box models in contrast to more open rule-based approaches (Chatterjee & Kumar, 2020).

2.5. Hybrid Approaches

Hybrid sentiment analysis integrates the advantages of both lexicon-based and machine learning approaches. One common strategy involves using lexicon-derived sentiment scores as additional features in machine learning models, thereby enriching the feature space with both statistical and rule-based signals. Prior studies by Medhat et al., (2014) and Septiani et al. (2024) highlight that hybrid models consistently outperform either method alone, particularly in low-resource contexts and when analysing informal language.

This approach is especially relevant for social media analysis in bilingual environments such as Malaysia, where Facebook comments frequently mix Malay and English with casual language. In this study, the hybrid framework improved the accuracy of categorization and provided clearer understanding of sentiment patterns around Technical and Vocational Education and Training (TVET). By combining lexical polarity with statistical learning, the hybrid method effectively addresses challenges such as context ambiguity and domain-specific terminology, offering a practical and scalable solution for monitoring educational sentiment.

3. METHODOLOGY

This study utilised a systematic five-phase method to execute the hybrid sentiment analysis framework illustrated in Fig. 1.

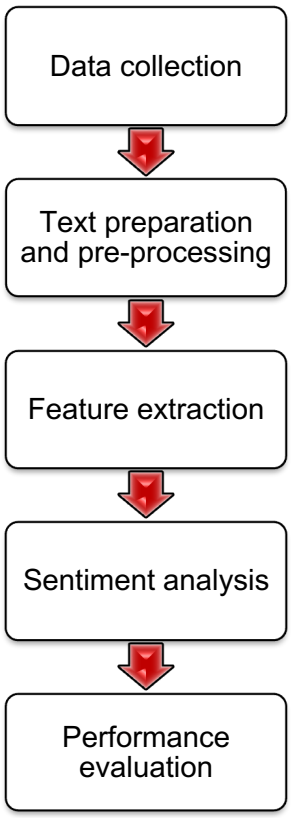

Fig.1.Sentiment analysis phases

3.1. Data Collection

The study employed data from publicly available Facebook groups and media pages. Data were collected from public groups concentrated on TVET-related topics that fostered active discussion. Only postings and comments explicitly pertaining to TVET were included on media pages to maintain dataset relevance. The data collecting process properly complied with Facebook's terms of service, and no private user information or personal identifiers were acquired. Data were collected from April 2021 to March 2023 using Facepager and Apify, both of which are online scraping tools. Apify is an automated scraping platform that extracts and exports unstructured data in .csv format, whereas Facepager, created by Jünger & Keyling (2019) utilises application programming interfaces (APIs) and web scraping methods to obtain publicly accessible data from platforms like YouTube, Facebook, and Twitter.

3.2. Text Preparation and Pre-processing

Before analysis, a thorough pre-processing phase was executed to ensure the quality of the dataset for text mining. This process encompassed cleaning and normalisation procedures, including the elimination of punctuation, rectification of spelling errors, expansion of abbreviations, and correction of informal terms. Due to the nature of the dataset that contains bilingual language Malay and English, all Malay items were translated into English via Google Translate to ensure uniformity in sentiment classification. The translated text was further verified against sentiment lexicons to ensure polarity accuracy and semantic precision.

No resampling was conducted to maintain the natural distribution of attitudes, despite the class imbalance. This decision facilitate a more reliable assessment of classifier efficacy in scenarios that reflect actual sentiment variations. As part of improving data quality in pre-processing phase, a series of data transformation processes were carried out. These include the process of formatting all text into lowercase for consistency and removing special characters and stop words to eliminate noise, and improving semantic clarity. Subsequent to these procedures, a total of 1,304 posts were chosen as appropriate to undergo analysis.

3.3. Feature Extraction

The Term Frequency–Inverse Document Frequency (TF-IDF) technique was utilised to transform unstructured text into a numerical format (Stanley et al., 2023). TF-IDF measures how important a word is by looking at two things. Term Frequency (TF) looks at how often a word appears in a document, and Inverse Document Frequency (IDF determines the scarcity of a word throughout the entire corpus, thus diminishing the influence of prevalent terms (Edalati et al., 2022). This strategy was selected for its proven efficacy in enhancing classification accuracy and its capacity to emphasise relevant terms within the text.

3.4. Sentiment Analysis

A hybrid approach to sentiment analysis was employed, integrating lexicon-based and machine learning approaches. This study utilised the lexicons SentiWordNet, TextBlob, VADER, and AFINN. The classifiers employed for machine learning encompassed Support Vector Machine (SVM), Naïve Bayes (NB), Decision Tree (DT), Random Forest (RF), K-Nearest Neighbours (KNN), and Logistic Regression (LR). This combined approach enhanced the study by using both lexical polarity scores and statistical learning models.

3.5. Performance Evaluation

Accuracy was selected as the primary evaluation criterion to guarantee clarity and consistency in assessing the performance of lexicon-based, machine learning, and hybrid models. Accuracy denotes the ratio of accurately identified occurrences to the total number of predictions made. It is described as follows in Eq. (1):

Where: $$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \quad (1)$$

TP: the number of positive values that were correctly classified;
TN: the number of negative values that were correctly classified;
FP: the number of positive values that were incorrectly classified; and
FN: the number of negative values that were incorrectly classified.

4. RESULTS AND DISCUSSION

The effectiveness of the hybrid sentiment analysis approach is evaluated by comparing the results of lexicon-only, machine learning-only, and hybrid approaches, with an emphasis on determining the most accurate approach for classifying public perceptions of TVET.

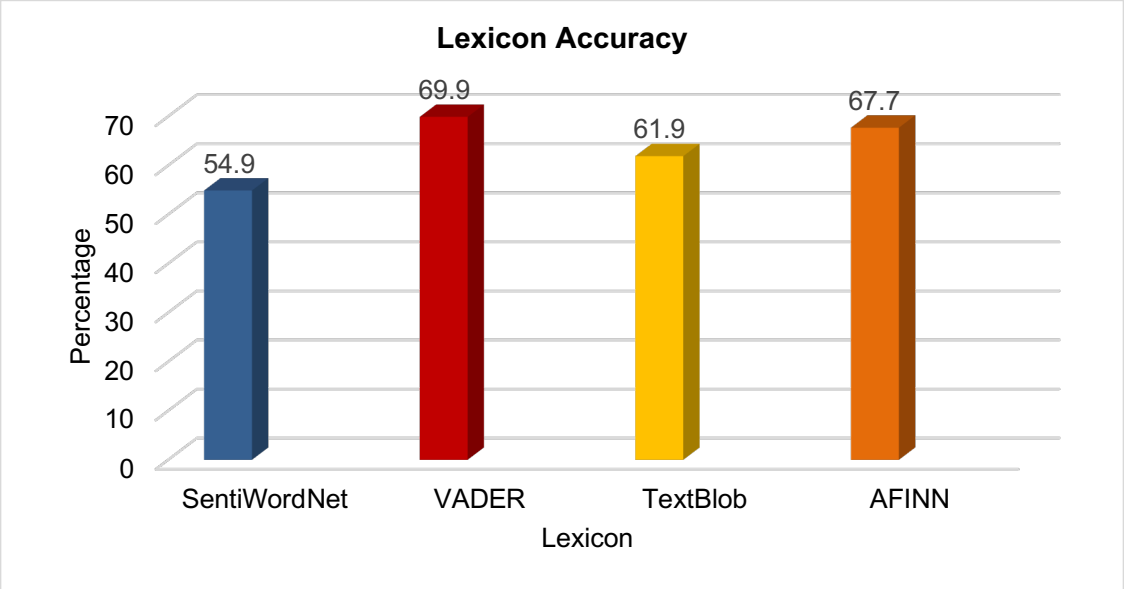

Fig. 1. Lexicon-only accuracy

Fig. 2 shows the accuracy achieved by each lexicon employed independently for sentiment classification. Among the lexicon-based approaches, VADER attained the highest accuracy at 69.9%, succeeded by AFINN at 67.7%, TextBlob at 61.9%, and SentiWordNet at 54.9%. The great performance of VADER is due to its adeptness in managing social media syntax and its sensitivity to punctuation and emoticons.

Additionally, this study utilised a machine learning approach to assess the accuracy of each classifier. Fig. 3 demonstrates the accuracy metrics for the trained classifiers. Among machine learning classifiers, the SVM achieved the highest accuracy at 61.7%, followed by LR at 61.3%, RF at 55.2%, NB at 54.8%, DT at 52.1%, and KNN recorded the lowest performance at 38.3%. These findings recognise SVM and LR are good for classifying text.

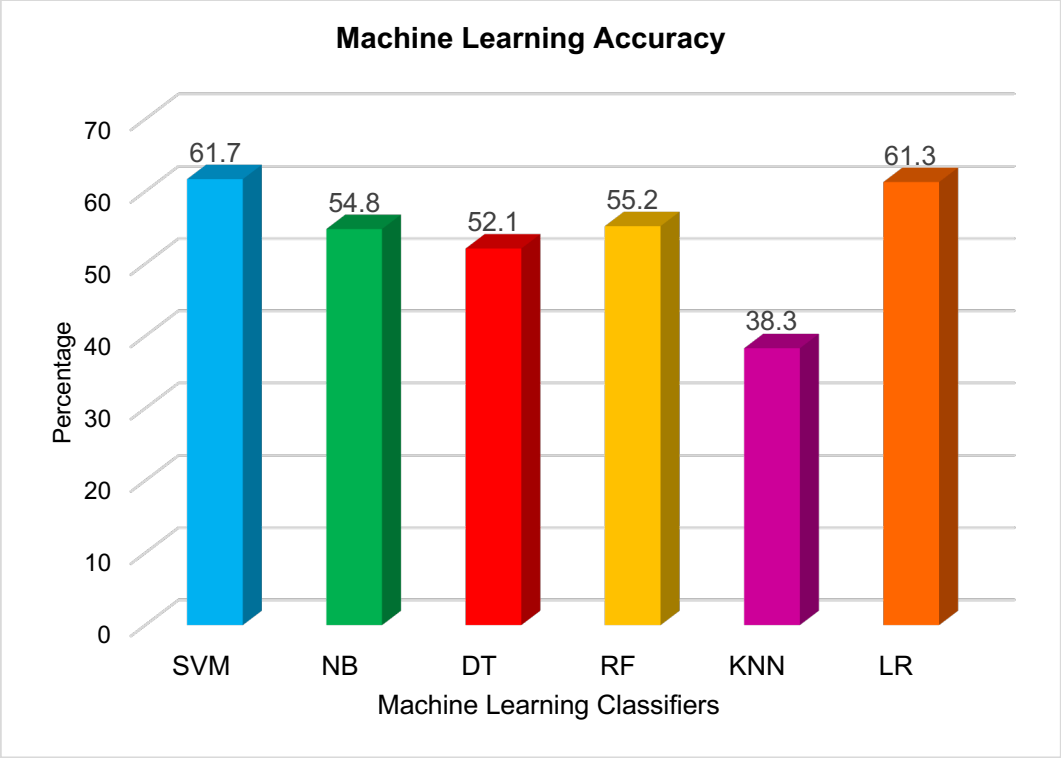

Fig. 2. Machine Learning- only accuracy

To determine the additional benefits integrating lexicon-based and ML approaches, we evaluated hybrid models that utilised sentiment scores from each lexicon were used as supplementary features for ML classifiers. The performance of each hybrid configuration is shown in Table 1.

This comparison clearly illustrates that hybrid models produce performance improvements ranging from 2 to 10 percentage points, depending on the configuration. The integration of lexicon sentiment polarity enriches the feature space for ML classifiers, enabling more effective detection of sentiment patterns in informal, code-switched data commonly present on social media platforms like Facebook.

Table 1: Hybrid accuracy

Classifiers	VADER	TextBlob	SentiWordNet	AFINN
Support Vector Machine (SVM)	0.71	0.72	0.69	0.64
Naïve Bayes (NB)	0.59	0.57	0.57	0.50
Decision Tree (DT)	0.59	0.55	0.59	0.56
Random Forest (RF)	0.70	0.64	0.66	0.62
K-Nearest Neighbors (KNN)	0.48	0.56	0.24	0.50
Logistic Regression (LR)	0.70	0.67	0.68	0.63

The combination of TextBlob + SVM achieved the highest accuracy of 0.72, closely followed by VADER + SVM at 0.71, and VADER + Logistic Regression at 0.70. These findings confirm that the integration of lexicon polarity with machine learning markedly improves classification accuracy in noisy and bilingual content. The TextBlob + VADER emerged as the most effective sentiment tools across all classifiers, owing to their ability to handle informal language and contextual sentiment. Conversely, AFINN and SentiWordNet exhibited inferior performance, especially with classifiers that are sensitive to feature sparsity such as KNN. The SVM consistently outperformed other classifiers, validating its efficacy in high-dimensional text environment. Logistic Regression and Random Forest also showed reliable performance, while KNN yielded the lowest accuracy due to its reliance on distance-based metrics in sparse vector spaces.

These results indicate that hybrid sentiment models can effectively manage the complex nature of informal, bilingual TVET discussions on Facebook. By delivering accurate sentiment classifications, these models enable stakeholders to monitor public perceptions, highlight policy challenges, and refine communication strategies more effectively.

5. CONCLUSION

This study presented a hybrid sentiment analysis approach that integrates lexicon-based scoring with machine learning classifiers to assess public perception towards TVET on Facebook. Among the tested settings, TextBlob + SVM delivered the highest classification accuracy at 0.72, followed closely by VADER + SVM at 0.71. These findings validate the effectiveness of hybrid sentiment analysis for handling informal, multilingual, and real-world data sources, especially within the context of Malaysian TVET discourse.

The results offer several practical implications for stakeholders. Policymakers might leverage sentiment patterns from hybrid models to build targeted communication campaign strategies that address public skepticism or disinformation. Educational institutions may gain advantages by assessing public sentiment to align curricula with social expectations and labor market needs.

Moreover, the hybrid approach offers a scalable tool for continuous sentiment tracking, facilitating prompt actions and enhanced public involvement across digital platforms.

Nonetheless, this study possesses certain limitations. One significant constraint was the absence of manually labelled ground truth data, which may have introduced noise and affected model reliability. The reliance on lexicon sentiment scores also limited the model's ability to capture complex expressions such as sarcasm, idioms, or implicit sentiment. The analysis concentrated solely on Facebook data, potentially omitting to encapsulate sentiment across other social media platforms.

Future studies should focus on integrating deep learning models, such as BERT, with lexicon-informed attention mechanisms to achieve better sentiment representations. Incorporating more platforms such as YouTube, TikTok, or X could provide a more comprehensive perspective on public discourse. Furthermore, engaging human annotators to identify a portion of the data could improve evaluation accuracy and provide richer training signals for sentiment classification.

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FACTORS AFFECTING CYBERSECURITY RISK BEHAVIOUR AMONG MALAYSIAN PAYTECH USERS: THE MODERATING ROLE OF TRUST

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ABSTRACT: The increased uptake of financial technology (FinTech) and digital payment platforms has heightened the importance of investigating the cybersecurity risk behaviour of users. The research focuses on analysing the role of essential constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT) in eliciting cybersecurity risk behaviour among PayTech users in Malaysia, with an emphasis on the moderator of trust. A structured, self-administered survey was employed as a quantitative research design, targeting online payment system users aged 18 to 65 years who actively use this system. Hypothesized relationships were tested using Structural Equation Modeling (SEM). Results show that performance expectancy and effort expectancy have a significant effect on cybersecurity behaviour, but social influence and facilitating conditions are minor predictors of that behaviour. Trust was identified as mediating between several relationships, highlighting its importance in influencing user behaviour. The results provide empirical evidence on the determinants of secure online transaction behavior and will guide policymakers, developers, and financial institutions in improving system usability, user trust building, and the adoption of safer digital financial services.

KEY WORDS: *Paytech, Fintech, Cybersecurity, Behaviour, Risk*

1. INTRODUCTION

In the rapidly evolving digital landscape, financial technology (fintech) has arisen as a revolutionary entity, altering how individuals and enterprises oversee their financial matters. As a center of innovation and economic development, Malaysia has experienced a notable increase in the use and integration of financial technology within its financial ecosystem (Haridan et al., 2020; Shaikh et al., 2020). As “FinTech” refers to using technology platforms and mobile devices to facilitate financial transactions, access banking information, and leverage innovative financing modes such as e-financing and mobile banking (Shaikh et al., 2020). The fintech industry in Malaysia has become the center of the world financial ecosystem, with more than 549 Islamic fintech companies now contributing to a significant portion of the national economy (Santosdiaz, 2024). Meanwhile, mobile banking, digital wallets, and blockchain are rapidly being adopted, which is why it have

become a new wave of payment technology (PayTech) under financial technology, which now serves as a driving force behind financial inclusion (Shaikh et al., 2020; Napis and Daud, 2023). Nevertheless, even the innovations that increase the access present new security dilemmas. The cybercrime issue, such as phishing and malware, as well as the breach of data, has spread to a new level, and an overwhelming majority of cases of cybercrime in the future are likely to be associated with fraud (MyCERT, 2024). The governance measures have been unable to check these tendencies, implying that the scourge is more entrenched in the user behaviours and not necessarily in policy.

Studies indicate that there are a variety of behavioural factors that drive vulnerability: lack of understanding of cybersecurity and overconfidence in technology, peer pressure, and blind use of online resources (Kamalulail et al., 2022; Goddard et al., 2014; Kim et al., 2018). It has been empirically proved that users with limited security literacy or overconfidence are targeted by the cyber threats disproportionately (Parsons et al., 2017; Hadlington, 2018). Since PayTech is experiencing unprecedented growth and the related increase in cyber threats, it is urgent to unravel the factors of risky cybersecurity behaviour and to study the effects of trust on mitigating these relationships. This study can play a vital role in creating targeted recommendations to enhance user awareness, mitigate vulnerabilities, and enhance the integrity of Malaysia's digital financial ecosystem.

This study seeks to:

1. To examine the effect of performance expectancy, effort expectancy, social influence, facilitating conditions, and perceived risk on cybersecurity risk behaviour among Malaysian PayTech users.
2. To examine the direct effect of trust on cybersecurity risk behaviour.
3. To examine the moderating role of trust on the relationships between performance expectancy, effort expectancy, social influence, facilitating conditions, and perceived risk on cybersecurity risk behaviour.

2. PROBLEM STATEMENT

The fintech industry is pivotal in the Malaysian economy, contributing to sustainable economic growth and financial innovation. Despite several steps by the government to address cybercrime issues, the number of cybersecurity incidents in Malaysia keeps increasing due to the revolution that keeps changing (Rahim et al., 2024). Based on the increase in the number of incidents reported in figure 2, it has shown that government strategies and policies cannot efficiently solve the issues.

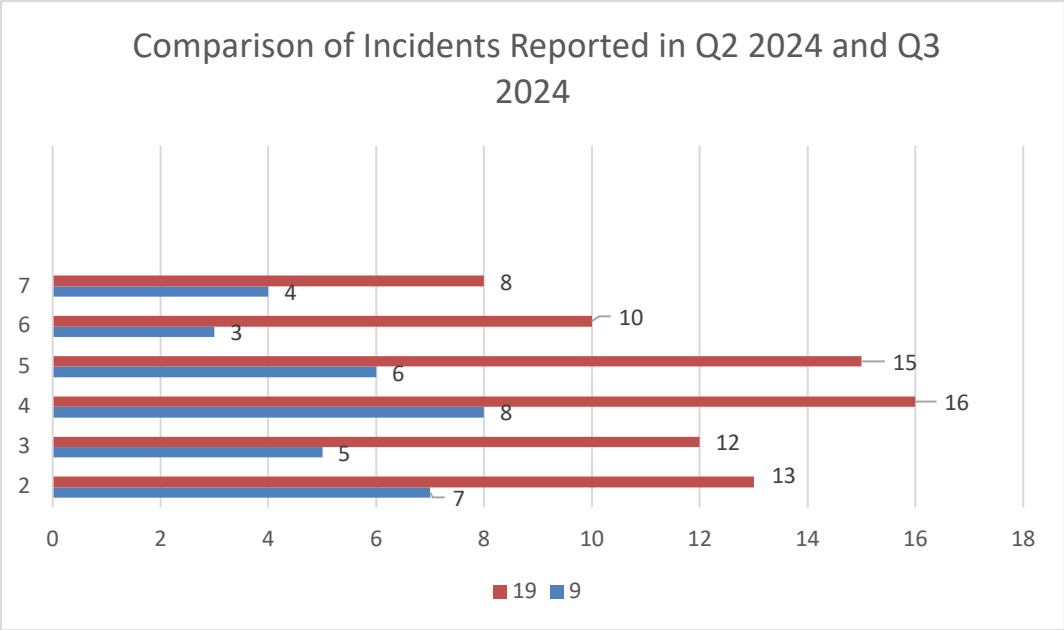

Fig. 1. Cybersecurity Malaysia's comparison of Incidents Reported in Q2 and Q3 2024.

Whereby, according to Figure 1, four categories of events (Denial of Service, Intrusion, Intrusion Attempts, and Spam) were reported to have risen in Q2 2024 relative to Q1 2024, while another four categories (Vulnerabilities et al.) have declined. In the second quarter of 2024, fraud constituted the predominant incident, accounting for 63.94% of all recorded incidents. Subsequently, there are malicious software (11.01%) and data breaches (7.90%). According to prevailing patterns, fraudulent activities will increase in Malaysia in 2024. Simultaneously, for fraud incidents excluding phishing URLs, innovative strategies and methodologies in online scams that amalgamate social engineering and malicious code may persistently proliferate in Malaysian cyberspace (mycert, 2024). Diyana and Shazwani (2018) on phishing threats, provided a real case in Malaysia.

In November 2017, a young woman was scammed by a phisher that forged an e-mail from the Inland Revenue Board of Malaysia (IRBM) asking for her CIMB bank account password, username, and Transaction Authorization Code (TAC), which led to an unauthorised money withdrawal from her account. Phishing is a form of fraud that is used to trick victims into giving their personal information, which includes sensitive passwords and usernames of their accounts. Diyana and Shazwani (2018) revealed that about 97% of users around the globe are unable to identify phishing attacks. Therefore, , the problem statement underscores the need to investigate the various elements influencing cybersecurity risk behaviour, particularly among Malaysian PayTech users, with a specific focus on the mediating role of security knowledge and the moderating impact of trust. This analysis is crucial for developing targeted tactics that enhance user awareness and promote safer cybersecurity practices within the growing PayTech sector.

3. LITERATURE REVIEW

The Unified Technology Acceptance and Use Theory (UTAUT) which were built on the earlier models like the Technology Acceptance Model (Davis, 1989) and later enhanced to UTAUT 2 (Venkatesh et al., 2012), is one of the fundamental theories explaining the process through which people adopt and use technology. As the digital landscape continues to evolve, thorough knowledge of the determinants of cybersecurity risk behaviour has taken on great importance, given that behaviour encapsulates the actions and attitudes of users towards protecting their digital assets. Anchored in the Unified Theory of Acceptance and Use of Technology (UTAUT), a collection of antecedent studies leads to the conclusion that performance expectancy, effort expectancy, social influence, facilitating conditions, perceived risk, and trust interact in a synergistic manner to influence cybersecurity-related decision-making. Performance expectancy is one of the main determinants, as people will show an increased tendency to use cybersecurity measures when they perceive the technological tools to be effective in enhancing performance and protecting information, a phenomenon that has been well-documented in the context of digital finance and new technology areas (Venkatesh et al., 2016; Kaur et al., 2025).The influence of performance expectancy is also enhanced by effort expectancy; the ease by which cybersecurity tools are perceived to be easy to use enhances adoption intentions, thereby reducing psychological and practical obstacles to protective behaviour (Wang et al., 2008; Kumar et al., 2020).

Social influence, in turn, strengthens these relationships, as users often adjust their cybersecurity practices based on the expectations and behaviour of salient others, consequently normalising and promoting secure digital behaviour within socio-professional networks (Alalwan et al., 2017; Chen & Barnes, 2007).Notwithstanding these antecedents, the translation of intention into concrete cybersecurity behaviour is nevertheless highly contingent upon the facilitation of conditions such as adequate technical infrastructure, organisational endorsement, and access to relevant resources that collectively empower users to engage productively with security technologies (Abd-Allawari et al., 2020; Kaur et al., 2025). Despite the existence of enabling conditions, perceived risk remains a key and potentially inhibiting factor, in which high levels of concern about privacy and security breaches and potential losses can undermine the willingness of users to adopt digital solutions.

In this context, trust takes on a pivotal moderating function by reducing the harmful effects of perceived risk by reducing uncertainty and strengthening the confidence of users in cybersecurity technologies. Trust, with its informational elements of reliability, security, and reputation has been shown to empirically foster more favourable attitudes and behavioural intentions in a variety of situations, such as online banking, e-commerce, and telehealth (Casalo et al., 2007; Kumar et al., 2020; AlMojaibel, 2025). Importantly, empirical findings suggest that trust is a crucial bridging agent that helps users reach a position of reconciling their risk perceptions with anticipated benefits from their technology utilisation (Choudhury et al., 2025).

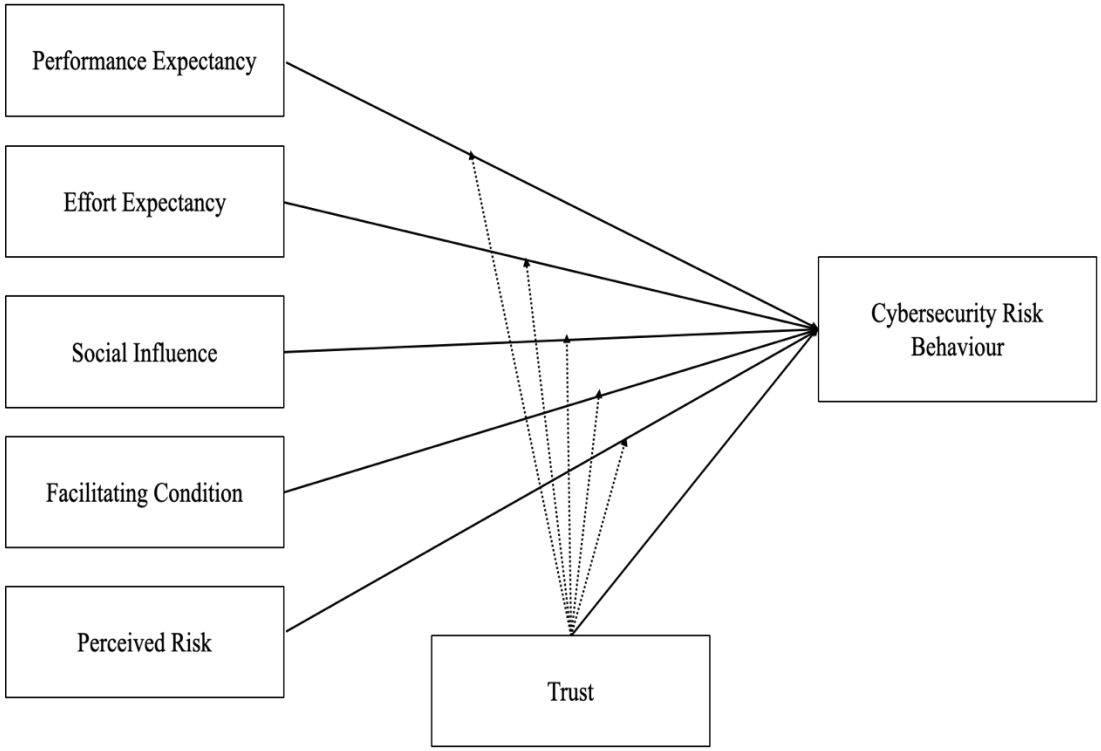

Fig. 2. Theoretical Framework

4. METHODOLOGY

4.1. Research Design

Research design is a comprehensive methodological system by which a study is more or less guided. It specifies the process of data gathering and the methods of analyzing information used to present and prove hypotheses or answer research questions. The strongly designed design is essential in providing the validity and reliability of the empirical studies. This type of design allows studying phenomena in a systematic way, creates critical mental activity, and provides substantive conclusions by using statistical models and analytical procedures to achieve pre-established goals (N. Salkind et al., 2019). A survey instrument to measure self-reported cybersecurity behaviours was created by Kennison and Chan-Tin (2020) and its relationship with personality traits and other personal characteristics was investigated. Similarly, Antunes et al. (2021) have also used two questionnaires to assess cybersecurity risky attitudes and behavior in high-school students. More recently, Tempestini et al. (2023) developed the Cybersecurity Awareness Inventory (CAIN) to measure the cybersecurity knowledge of the users and its relationship with behavioral practices. The current research thus takes a quantitative design, which was considered to be important to examine the determinants of cybersecurity risk behavior among Malaysian PayTech users (Guba & Lincoln, 1994; Sekaran and Bougie, 2016). The cross-sectional design is used in which self-administered questionnaires are used to gather standardized data at one point in time. This model allows studying the correlation between important constructs (Sekaran, 2010; Salkind et al., 2019).

4.2. Population of the study

According to Bryman and Bell (2007), population is the unit over which the samples are taken. It is made up of all the elements that constitute a sample that can be social groupings, organisations, communities, schools, students, states or any other common feature. The target group in the current research is residents of Malaysia who use PayTech, which is a general concept used to define various digital payment tools, including peer-to-peer (P2P) networks, mobile wallets, and other fintech solutions.

Whereas, according to Sekaran (2003), population is defined as a set of all conceivable individuals, objects or measurements of interest of concern. Bank Negara Malaysia (BNM) has indicated that the age at which one may open bank account and online banking account is usually 18 years, in accordance with legal definition of adulthood in Malaysia. As a result, the study focuses on people aged 18-65 that use different FinTech services, which include mobile banking, e-wallets, online investment services and PayTech. According to the statistics provided by the Department of Statistics Malaysia (2023), the number of residents in this age group is estimated at between 23 and 23 million people. Moreover, according to Amanda (2024), there were more than 17 million mobile wallets users in Malaysia in 2022, which is almost one and a half more than in 2021 and a sign that cashless payment technologies are becoming popular in the country.

4.3. Sample size

G*Power was used to calculate the sample size of 103 based on linear regression model with six predictors and an alpha of 0.05 and a statistical power of 0.80 (Erdfelder, Faul, & Buchner, 1996). Data collected using structured questionnaires was used to obtain data of the study variables by ensuring the reliability of data measuremeht, to facilitate testing of the hypothesis.

4.4. Data Collection

This research study involved the use of a structured self-administered questionnaire to gather the data. The questionnaire approach method has been chosen by the researchers to determine necessary information and to define parameters of measurement of the variables of interest as outlined by Sekaran (2010). The strengths associated with the questionnaire method involve ease of establishment of a rapport with the respondents and a sense of a motivational factor to fill in the instrument. In addition, use of questionnaires allows the researcher to interact with the respondents and to clarify any remaining ambiguities concerning the survey questions. This study has embraced a primary data method. Primary data refers to data that is collected at the point of origin in relation to the variable of interest in the case of the particular research (Sekaran, 2010). In this regard, such data are obtained with the help of the questionnaire. The survey will be distributed to the relevant PayTech users in Malaysia.

4.5. Data Analysis

Smart-PLS 4.0 was employed to analyse the collected data using Partial Least Squares Structural Equation Modeling (PLS-SEM), a robust statistical technique suitable for examining complex relationships among multiple variables, including latent constructs measured through observed indicators. Prior to analysis, the survey data were edited, coded, and classified, and descriptive analyses were conducted using IBM SPSS version 30. PLS-SEM was then applied to assess the predictive power of the structural model and the relationships between constructs, as it enables simultaneous evaluation of the measurement and structural models. Consistent with Anderson and Gerbing (1988), integrating both models provides a comprehensive and confirmatory assessment of construct validity and theoretical relationships. Previous studies have demonstrated the effectiveness of SEM and PLS-SEM in examining construct validity and interrelationships among variables (Moon et al., 2011; Jyoti & Dev, 2015), while Sarstedt et al. (2017) highlighted its ability to model structural relationships among latent variables. Additionally, PLS-SEM was deemed appropriate due to its flexibility and suitability for studies with relatively small sample sizes (Amri et al., 2020).

5. FINDING

In this section, the evaluation of the measurement model focuses on assessing both the convergent validity and internal consistency reliability of the study's constructs, ensuring that the measurement instruments are both accurate and dependable. The analysis was based on data collected from 318 successful respondents to the questionnaire. Convergent validity examines the extent to which items intended to measure the same construct are highly correlated, and it is typically assessed using the Average Variance Extracted (AVE), with a value greater than 0.50 considered indicative of satisfactory convergent validity (Hair et al., 2019). Internal consistency reliability, on the other hand, evaluates the degree to which the items within a construct consistently measure the same underlying concept, which is commonly assessed using both Composite Reliability (CR) and Cronbach's Alpha, with values of 0.70 or higher reflecting acceptable reliability (Nunnally, 1994). By examining both convergent validity and internal consistency reliability together, the study ensures that the constructs are not only conceptually coherent but also empirically robust, providing a solid foundation for subsequent structural model analysis.

Table 1: Reflective Measurement Models

Constructs	**Convergent Validity**	**Internal Consistency Reliability**	
	AVE	Composite Reliability	Cronbach's Alpha
	>0.5	>0.70	>0.70
Performance Expectancy	0.603	0.901	0.867
Effort Expectancy	0.603	0.901	0.871
Social Influence	0.703	0.922	0.896
Facilitating Conditions	0.649	0.879	0.837
Perceived Risk	0.731	0.731	0.837

Trust	0.751	0.938	0.917
Cybersecurity Risk Behaviour	0.565	0.833	0.734

These findings suggest that all constructs attained sufficient convergent validity, with the AVE yielding values between 0.565 and 0.751, which is significantly larger than the suggested threshold of 0.50. The threat of internal consistency also proved to be satisfactory, with consistency ranging from 0.833 to 0.938 and Cronbach's Alpha ranging from 0.734 to 0.917, indicating the reliability of the measurement items. Trust (AVE = 0.751; CR = 0.938; α = 0.917) and cybersecurity risk behaviour (AVE = 0.565; CR = 0.833; α = 0.734) demonstrated the greatest validity and reliability, indicating that these constructs could be subjected to structural analysis in the future.

Table 2: Structural Model Assessment

Relationship	Path Coefficients(β)	Standard Error	t-value	p-values	Decision
PE => CRB	0.337	0.052	6.418	0	Supported
EE => CRB	0.199	0.067	2.979	0.001	Supported
SI => CRB	-0.171	0.071	2.402	0.008	Not Supported
FC => CRB	0.065	0.063	1.034	0.151	Not Supported
PR=> CRB	0.125	0.067	1.859	0.032	Supported
TR => CRB	0.234	0.054	4.315	0.000	Supported
TR x PE -> CRB	-0.142	0.052	2.736	0.003	Supported
TR x EE -> CRB	-0.037	0.056	0.667	0.252	Not Supported
TR x SI -> CRB	0.284	0.066	4.319	0	Supported
TR x FC -> CRB	-0.221	0.056	3.923	0	Supported
TR x PR-> CRB	0.021	0.062	0.336	0.368	Not Supported

The results of the structural model illustrate how UTAUT constructs affect Cybersecurity Risk Behaviour (CRB) of PayTech users. The positive influence of Performance Expectancy (PE) on CRB is strong and significant (b = 0.337, p < 0.001), as users who view digital payment systems as useful are more likely to develop secure behaviours. Another positive influence is exerted by Effort Expectancy (EE) (b = 0.199, p = 0.001), which suggests that more convenient system use will encourage safer cybersecurity-related behaviours. Social Influence (SI) and Facilitating Conditions (FC) did not prove to be significant, which implies that peer pressure and support do not significantly affect the cybersecurity behaviour of users. The moderation analysis indicates that trust strengthens the relationship between PE, SI, and FC with CRB, which makes sense given that the UTAUT constructs contribute to either strengthening or weakening these relationships. In general, these results indicate that the perception of usefulness and ease of use are the dominant motivations for cybersecurity behaviour among PayTech users, whereas social and facilitating conditions do not significantly influence perceptions.

The results show that the important drivers of cybersecurity risk behaviour (CRB) among PayTech users are performance expectancy and effort expectancy. When it comes to securing behaviours, users who perceive digital payment systems

as convenient will have a greater likelihood of engaging in secure behaviours (Venkatesh et al., 2003; Davis, 1989). The influence of social influence and facilitating conditions on CRB was negligible, which agrees with past researchers who suggest that external factors are not necessarily of great influence on user behaviour in digital environments (Venkatesh et al., 2003; Venkatesh and Bala, 2008). The moderating role of trust is also important in facilitating interactions between performance expectancy, social influence, and facilitating conditions to CRB (McKnight et al., 2002). In general, the research demonstrates the relevance of the perceived usefulness, ease of use, and trust element in developing secure cybersecurity environments in PayTech systems, which is consistent with the results obtained by previous studies on the power of trust in technology acceptance (Gefen, 2000; Lee, 2009).

6. CONCLUSION

The results of the current study provide substantive knowledge on the major determinants of cybersecurity risk behaviour by PayTech users. By defining the most important drivers that shape the security-related behavior of users, this research adds to the academic knowledge of how users cogently perceive and cope with cyber-risk in digital payment ecosystems. Specifically, the results highlight the overriding importance of trust, alongside technological and behavioural variables, when determining users' propensity to adopt secure practices when using PayTech platforms. Notwithstanding these contributions, the study lays out a number of prospective research trajectories. Longitudinal studies are needed to examine long-term impacts of user trust and frequency of system updates on cybersecurity behaviors, since trust will vary and potentially change as users gain experience with PayTech services or are exposed to security events. Looking into the effect of continuous system improvements, security patches, and platform transparency on sustainable secure behaviour could provide meaningful insights for PayTech providers and policy makers.

Future inquiry should also include the appraisal of the efficacy of cybersecurity education and awareness initiatives in modulating user behaviour. Determining if structured training, digital literacy programmes, or focused awareness programmes lead to demonstrable improvement in cybersecurity practices would be helpful to determine the most efficacious strategies for mitigating user-related security risks in the PayTech ecosystem. Moreover, an exploration of emotional and psychological variables, such as fear, confidence, anxiety, or perceived control, may further enrich extant models of cybersecurity behaviour. These affective dimensions have a powerful influence on the way users value security threats and their response to security measures to protect themselves, but they are underexplored in the PayTech context. Integrating emotional constructs into later research could provide a more holistic understanding of user decision-making processes. Ultimately, by broadening the scope of investigation to include longitudinal effects, educational interventions, and emotional determinants, future research may build on the current research to create more comprehensive frameworks to understand and improve cybersecurity behaviour amongst PayTech users. Such scholarly endeavors would promote the advancement of both theoretical knowledge and the praxis of the design of efficacious security strategies,

user-centric systems, and policy measures in the rapidly evolving digital payment landscape.

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TOWARDS AN ISLAMIC BEHAVIORAL MODEL OF TECHNOLOGY ACCEPTANCE: INTEGRATING QALBUN (HEART) INTO THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

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ABSTRACT: This conceptual paper explores the integration of the Islamic concept of qalbun salim the sound and spiritually purified heart into the Technology Acceptance Model (TAM). While TAM emphasizes perceived usefulness and ease of use as determinants of technology adoption, it overlooks the ethical, spiritual, and moral dimensions that are central to Islamic decision-making. Drawing upon Qur'anic verses and classical Islamic scholarship, this paper presents qalbun salim as a reflective, evaluative faculty that filters technological choices through the lens of divine guidance and maqasid al-shariah (objectives of Islamic law). Rather than altering TAM's empirical structure, this study offers an interpretive integration that repositions the heart as a locus of moral cognition in the technology acceptance process. This framework aims to enrich the discourse on ethical digital behavior from an Islamic epistemological standpoint. It also lays the foundation for interdisciplinary engagement between Islamic thought, behavioral science, and digital ethics.

KEY WORDS: *Technology Acceptance Model, Qalbun, Theory, Integration of model*

1. INTRODUCTION

The intersection between Islamic value and technology remains a terrain ripe for exploration in the contemporary landscape of technological evolution. The Technology Acceptance Model (TAM) is a widely recognized framework in the realm of technology, where it has been a central framework model to analyse technology acceptance in society. However, its synergy with Islamic thought has yet to be comprehensively explored. Integrating Islamic principles into contemporary frameworks offers a unique lens through which we can delve into this refined interaction. This study delves into the dynamic relationship between the Islamic concept of Qalbu a term encompassing the heart, spirit, and mind and the established Technology Acceptance Model (TAM). Rooted in the rich tapestry of Islamic principles, this study seeks to decipher the nuanced dimensions that shape individuals' technology acceptance and utilization from the Islamic perspective.

As technology continues to shape our daily lives, exploring how intrinsic beliefs, guided by Islamic teachings, play a role in acceptance and interaction with modern

innovations is imperative. The Technology Acceptance Model, a framework that explicates user behaviour and technology acceptance, will provide a structured foundation for this exploration. Therefore, this article will explore a scholarly endeavour to bridge the gap between traditional Islamic wisdom and contemporary technological frameworks. By intertwining Qalbun, which acts as an analysing tool with the well-established TAM, we aim to unravel the unique insights that emerge where qalbunplays its role in technological acceptance convergence.

Accordingly, this article will contribute to the rowing discourse on the human-technology interface from a distinctly Islamic standpoint. Besides, this exploration will shed some light on how qalbun as a mind from the Islamic perspective will influence perceptions of technology and offer a platform for cross-fertilizing ideas between religious studies and technology adoption research. Consequently, it will enrich our understanding of the complex interplay between Islamic values and technology, fostering a more holistic comprehension of the ever-evolving digital landscape within the context of Islamic perspectives.

This paper will be structured as follows. Section 2 will explain a literature review of TAM and Qalbu. Subsequently, the results and discussions will be presented in Section 3. The final section of this paper, Section 4, will show the conclusion of this research.

2. LITERATURE REVIEW

2.1. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was originally proposed by Davis (1989), and since its introduction, most studies analyzing the level of IT acceptance have used this theory. In essence, this theory has been adapted from the Theory of Reasoned Action (TRA) pioneered by Ajzen and Fishbein (1980), which emphasizes beliefs in influencing an individual's attitude and intention, ultimately leading to the individual's behavior. The theory was further developed until the Theory of Planned Behavior (TPB) became an extension of TRA (Azjen, 1985). In addition, this theory introduced perceived behavior control (PBC) as a new factor to influence individual behavior, encompassing perceptions of skills, resources, and opportunities to achieve desired outcomes (Kriponant, 2007). Therefore, this model has three crucial factors influencing intention and individual behavior: attitude, subjective norm, and perceived behavior control (PBC).

TAM is a model developed from TRA that prioritizes two important elements to measure technology acceptance: perceived usefulness (PU) and perceived ease of use (PEOU). Although TAM is an evolution of TRA, the subjective norm is not included in TAM because it was developed after information systems were introduced in an organization. Moreover, TRA is a model introduced by psychology to study users' actual behavior in various sectors, while TAM is a model specializing in user acceptance of technology or information systems. Therefore, Davis (1985) considered only attitude as the main construct without including the subjective norm, and the two crucial variables related to attitude formed are PU and PEOU. Thus, Figure 1 below illustrates the evolution of the emergence of the TAM model concisely.

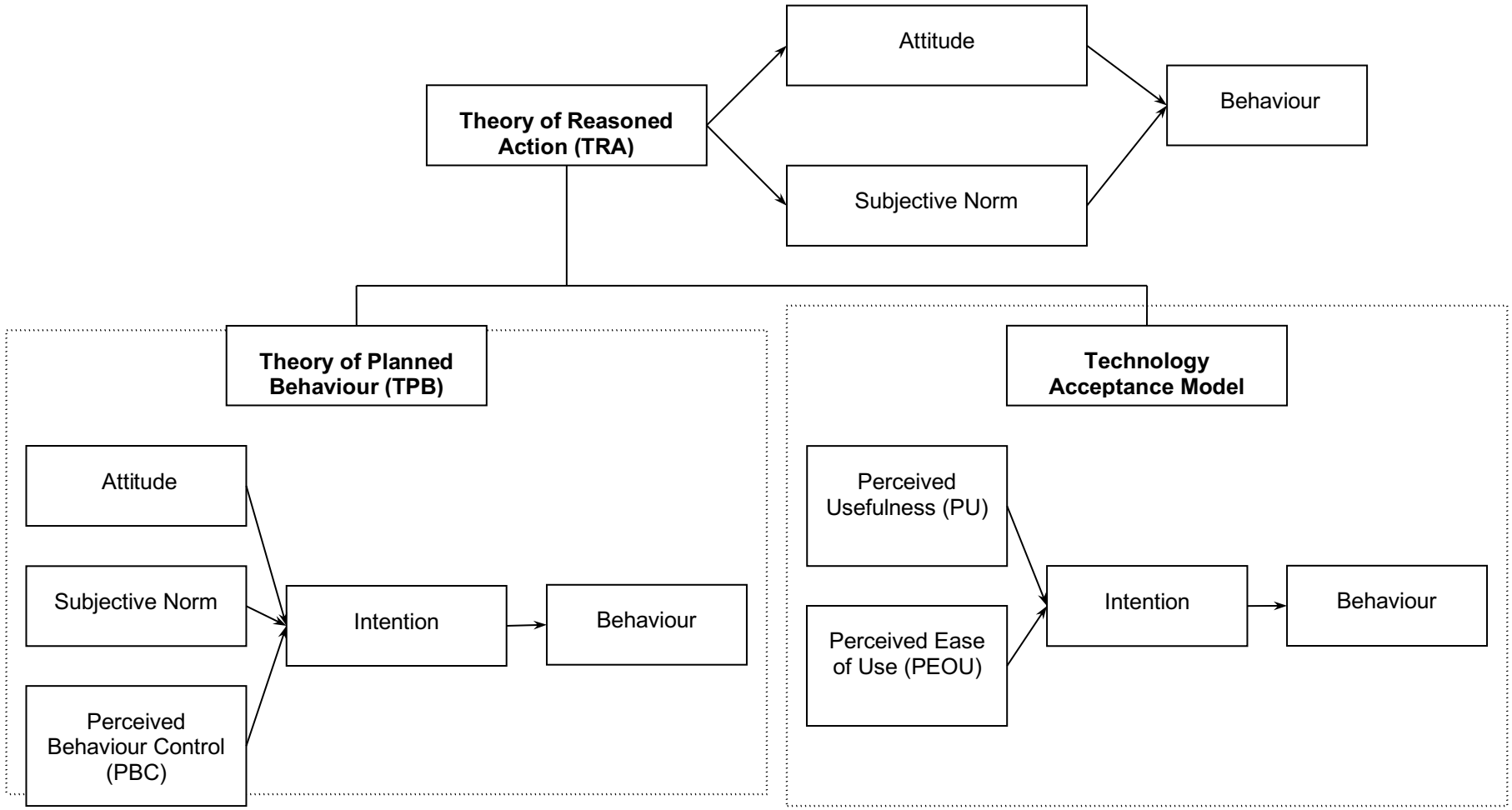

Fig. 1. Evolution from TRA model to TPB and TAM

Source: Adapted by authors from previous studies (Davis 1989; Ajzen and Fishbein, 1980)

Generally, PU is the perceived usefulness of technology, indicating that users believe the technology will enhance their work performance, while PEOU is defined as an individual user's perception that the technology will be easy to use. External variables can also mediate PEOU and PU to predict technology acceptance behavior. It can be seen that various empirical studies support the use of this model in investigating technology acceptance behavior (Adams et al., 1992; Venkatesh & Morris, 2000; Karahanna et al., 2006; Venkatesh et al., 2003, 2007). Therefore, Figure 2 below illustrates the TAM model and the variables contributing to user acceptance in this model.

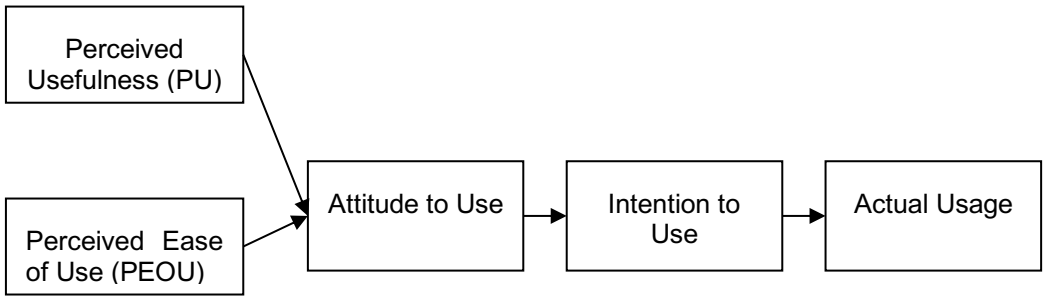

Fig. 2. Technology Acceptance Model (TAM)

Source: Adapted by the author based on previous studies (Davis 1989; Adams et al., 1992; Venkatesh & Morris, 2000)

2.2. Qalbu: A Conceptual Perspective

As demonstrated, the TAM model analyses how the intention to use and actual usage of technology will be influenced by PU (Perceived Usefulness) and PEOU (Perceived Ease of Use). At the same time, an essential aspect of identifying how a decision or intention to use such technology emerges from an Islamic perspective. It cannot be denied that the variables within that technology (its benefits) influence the use of any technology, but the element that influences the decision needs to be clarified. In this discussion, the essence of acceptance or the intention of usage from an Islamic perspective originates from the qalbun or heart. Every decision an individual makes depends on the insight and intellect that determine the goodness or badness of that particular matter. Hence, this makes it crucial, especially for the acceptance among society of new technologies they have never used.

Qalbun has been discussed for centuries and mentioned many times in the Al-Quran. Some studies stated that “qalbu” has been mentioned 168 times, while others claim it to be 158 times in the Al-Quran (al-Baqi’, 1981; Arafat, 2015). The term “qalbu” has various meanings, including referring to the heart (Fuad al-Baqi’, 1364H). Simultaneously, it also conveys meanings related to the ability to influence cognitive ability, feelings of fear, sadness, joy, and belief in faith (Mahrus, 2009). Evidently, “qalbu” is often associated with the core of an individual's actions in daily activities. This has been mentioned by Ibn Taymiyah (1998), who emphasizes the

role of the heart that will influence and shape an individual's behaviour, where an unhealthy heart will destroy the true essence and image of the heart.

2.3. Discourse on the Concept of Qalbun Among Scholars

The discussion regarding qalbun has also been extensively explored by scholars, especially Al-Ghazali, who stressed the concept of qalbun within human beings. According to Al-Ghazali (1997), qalbun can be defined into two: a physical organ in humans is a piece of flesh shaped like the صنوبر (pine) fruit (circular, elongated form) on the left side of the chest. Within it is a space that serves as a channel for flowing blood, acting as the central source of the soul. This definition can be found in the organ of the heart in every creature of Allah.

There is also another definition, namely the spiritual heart, which is something that is gentle (lathifah), possesses a divine nature (rabbaniyyah), and is spiritual (ruhaniyyah), aiding humans in having a sense of perception, recognizing, and understanding certain matters or knowledge (Al-Ghazali 1997). In essence, both types of hearts explained by Al-Ghazali are closely related, even though not elaborated in depth. Upon examination, both definitions align well with the function of recognizing, loving, and experiencing Allah SWT. This can be observed through the words of Allah:

إِنَّ فِي ذَٰلِكَ لَذِكْرَىٰ لِمَن كَانَ لَهُۥ قَلْبٌ أَوْ أَلْقَى ٱلسَّمْعَ وَهُوَ شَهِيدٌ ٣٧

Translation: (Surah Al-Qaaf: 37)

> *Verily in this is a Message for any that has a heart and understanding or who gives an ear and earnestly witnesses (the truth).*

It can be observed that the qalbu, referred to by Al-Ghazali, is a delicate channel which are devine and high spiritual to perceive everything with the heart, understand things, and analyze matters carefully and profoundly. The function of the qalbun can be examined through the verses of Allah on how it becomes the vital pulse of an individual. This is because its function is to observe, hear, and carefully contemplate the lessons of things, as the qalbun can be interpreted as the spiritual eye of a person that needs to be nurtured to perform righteous deeds (Hilmi Jalil et al., 2016). This can be seen in Al-Quran when Allah mentioned the function of qalbun for the human being

وَلَقَدْ ذَرَأْنَا لِجَهَنَّمَ كَثِيرًا مِّنَ ٱلْجِنِّ وَٱلْإِنسِ ۖ لَهُمْ قُلُوبٌ لَّا يَفْقَهُونَ بِهَا وَلَهُمْ أَعْيُنٌ لَّا يُبْصِرُونَ بِهَا وَلَهُمْ ءَاذَانٌ لَّا يَسْمَعُونَ بِهَآ ۚ أُو۟لَٰٓئِكَ كَٱلْأَنْعَٰمِ بَلْ هُمْ أَضَلُّ ۚ أُو۟لَٰٓئِكَ هُمُ ٱلْغَٰفِلُونَ ١٧٩

Translation: (Surah Al-A’raf: 179)

> Indeed, we have destined many jinn and humans for Hell. They have hearts they do not understand with, eyes they do not see with, and ears they do not hear with. They are like cattle. In fact, they are even less guided! Such ˹people˺ are ˹entirely˺ heedless.

A human comprises many elements, such as the body, soul, heart (qalbu), intellect, and desires (Al-Ghazali, 1997). The heart or qalbun within a person is the most crucial aspect because the heart determines an individual's personality and is

a significant factor in deciding something. This highlights the importance of the heart to humans and the need always to cultivate the heart to ensure it is virtuous and draws closer to Allah. Moreover, the qalbun is one of the elements within a human being that, when observed, is related to the human intellect. This is because, while the intellect functions to think about the goodness or badness of something, the heart will come into function to analyze that matter carefully, subsequently shaping the individual to be virtuous. This can be understood through Al-Ghazali (1997), who mentions that desires, anger, and intellect influence the heart. As an instrument for thinking, the mind will affect the heart, resulting in a positive and virtuous individual. Conversely, when the power of thought is undesirable, it leads to a diseased heart and, eventually, to become a negative personality. This is evident in Ibn Taymiyah's statement that the heart will die if not illuminated by the light of knowledge rendered through intellectual capacity (Ibn Taymiyyah, 2006).

It can be observed that the qalbun is the central instrument that ensures all human activities run smoothly through the functioning of the soul, desires, and intellect for either benefit or harm (Abu Dardaa et al., 2014). Therefore, every Quranic verse about the qalbun explains the heart's function in controlling human perceptions to have faith, believe, and be grateful for the blessings of Allah SWT. In addition, Nasir Makarim al-Shirazi also defines the "qalbu" as an emotional center on the left side of the human chest, responsible for generating human emotions. According to Abu al-Hasan Ali bin Muhammad bin Ali al-Husaini al-Jurjaniy (1413M), the "qalbu" can be defined as a gentle element within a human being through which one can impartially examine matters. According to Robert Frager (2014), the "qalbu" is considered heart-shaped or classified as the center of compassion, which is similar to what had been stated by Al-Ghazali. Through the awareness of a deep-seated heart, an individual can seek a path to encounter Allah, the eternal source of compassion (Jalaluddin Rumi, 2001). This is supported by al-Sharqawi (2001), who mentions that the nature of the heart constantly vacillates, and Allah is the owner of the heart who will transform the human heart according to His will. Through the definitions provided by these scholars, it is clear that the "qalbu" can be understood as a divine element within the human being, influenced by reason, desires, and anger, serving to examine every matter, whether good or bad and shaping an individual's personality and actions for various purposes.

2.4. Jurisprudential Basis for Ethical Technology Use

In aligning technology adoption with Islamic jurisprudence, it is essential to consider the guiding principles of maqasid al-shariah (objectives of Islamic law), which aim to preserve religion (din), life (nafs), intellect (‘aql), lineage (nasl), and wealth (mal). The qalbun salim, as a spiritually refined faculty, aids Muslims in evaluating whether a given technology promotes or undermines these objectives.

From a fiqh perspective, adopting technology is permissible (mubah) as long as it does not contravene any Shariah prohibitions. When mediated by qalbun salim, technology use transforms from a neutral act into one that upholds maslahah (public good) and avoids mafsadah (harm), in line with the legal maxim:

“Al-darar yuzal”:Harm must be eliminated.

“Al-mashaqah tajlib al-taysir”: Hardship begets ease.

These maxims guide the assessment of new technological tools, particularly in fintech, education, and healthcare, where ethical concerns are prevalent. A purified heart (*qalbun salim*) does not merely make technical evaluations but conducts moral scrutiny rooted in divine consciousness (*taqwa*), ensuring decisions align with both utility and virtue. Moreover, Islamic jurists accept the evolving nature of technology through the principle of *istislah* (public interest) and *istihsan* (juristic preference), allowing flexibility in rulings where outcomes align with *maqasid*. Thus, by integrating *qalbun salim* as a filter within TAM, the decision to adopt a technology is not only behavioral but also jurisprudentially sanctioned.

2.5. Diversity of Terms for Qalb in the Al-Quran

Al-Quran mentioned various words that convey equivalent meanings to the heart. For instance, "fuaad" (فؤاد), "sadr" (صدر), "nafs" (نفس), "hawaa" (هوى), and "lubb" (لب). The term "fuaad" and all its derivatives were mentioned in the Quran 16 times, and some specifically refer to the heart (Baqi, 1981). Generally, these elements are closely related to the sensory organs, functioning to gather and analyze information about a particular matter (Duriana & Lihi, 2015). The heart will examine this information honestly and focus on the truth without embellishments. The information gathered and analyzed will be absorbed and eventually become knowledge within the heart of an individual.

On the other hand, "sadr" occupies the outermost layer, playing a role in evoking the emotions of a human being, such as feelings of love, affection, sadness, and anger (Duriana & Lihi, 2015). This term has been mentioned 44 times in the Al-Quran verses, referring to the heart (Fuad, 1981).

The third term is "nafs" and refers to an individual's soul (Al-Asfahani, 1997). This soul serves as the channel for various emotions reflected in the individual's behavior. Therefore, the nafs are highly significant in interpreting the nature of an individual, whether it is good or not, as a sick soul will exhibit "ammarotun bi al-suu" (engaging in evil deeds). According to Al-Ghazali (1997), the term "nafs" is defined in two ways: firstly, as the feelings of anger and desires that lead to bad behavior, and secondly, as the soul of an individual. The importance of the nafs can be seen through a high intellectual capacity that encourages human beings to become al-nafs al-muthmain (the tranquil soul). In contrast, when the soul is unstable, it leads to al-nafs al-lawwamah (the blaming soul), and a soul that continuously indulges in sin due to low intellectual capacity leads to al-nafs al-ammarah (the commanding soul). The term "nafs" was mentioned 286 times in the Al-Quran, whether through the words *al-nafs, anfus, or nufus* (Baqi, 1981).

Besides that, the term "hawaa" also shares a similar meaning with "qalbu," where it is defined as the human desire to achieve something, whether it is to attain power, influence, or wealth. Hawaa, often associated with nafs, is dangerous when it tempts humans to disobey. As a result, the qalbu, originally a means to draw closer to Allah SWT, goes astray due to the influence of hawaa. Therefore, humans should control their desires to remain pure from temptations. Finally, another term that partly conveys the meaning of qalbun is the word "lubb." It is defined as the intellect capacity, but there are also instances where it does not refer to reason (Al-Asfahani, 1997; Al-Jazari, 1987). Hamka (1999) presents "lubb" as the main essence that reflects the relationship between lubb and the intellect capability of

humans. Indeed, upon examination, the reason is related to the qalbu, which supports Abdul Aziz et al.'s study (2021) to consider lubb synonymous with qalbu.

2.6. Type of Qalbu

It can be observed that the term qalbu, or other synonymous expressions pointing to the same meaning, underscores the importance of the heart in human beings, and Allah frequently mentions it. Therefore, the various types of hearts within an individual are examined, and according to Ibn Qayyim, they can be classified into three types: a dead heart (qalbun mayyit), a sick heart (qalbun maridh), and a healthy heart (qalbun salim) (Fadhli Bahri, 2002). Al-Ghazali also divides the heart into three states, beginning with the sound or healthy state, namely qalbun salim, followed by a hardened heart known as the dead heart, caused by sins and disobedience, and there is also the sick heart. The sick or maridh heart is a heart that fluctuates between faith and disobedience, where it can subsequently only be saved through self-purification and deep repentance.

Meanwhile, the dead heart is damaged, devoid of remembrance of Allah SWT. Those with such a dead heart no longer worship Allah SWT and are influenced by desires, leading to their spiritual illness and eventual death. Indeed, this dead heart will not find the path of truth and Allah's guidance, causing harm to the earth without guilt (Daulay, 2015). In contrast, the sick heart is still alive within an individual, but it fluctuates between goodness and disobedience. As a result, this heart is afflicted with illness and tends towards desires and nafs, showing signs of arrogance while also harboring love for Allah SWT on the other side. This can be seen in Allah SWT's verse describing the characteristics of a sick heart:

لِّيَجْعَلَ مَا يُلْقِى ٱلشَّيْطَٰنُ فِتْنَةً لِّلَّذِينَ فِى قُلُوبِهِم مَّرَضٌ وَٱلْقَاسِيَةِ قُلُوبُهُمْ ۗ وَإِنَّ ٱلظَّٰلِمِينَ لَفِى شِقَاقٍۭ بَعِيدٍ ٥٣

Translation: (Al-Hajj: 53)

> *All that so He may make Satan’s influence a trial for those ˹hypocrites˺ whose hearts are sick and those ˹disbelievers˺ whose hearts are hardened. Surely the wrongdoers are totally engrossed in opposition.*

Meanwhile, the heart that should be the goal of every Muslim individual, namely a sound heart, which is safe and clean from the diseases of the heart, ultimately focuses on its worship for the sake of Allah SWT. Ibn Qayyim also interprets qalbun salim as a healthy and pure heart free from submission to desires and following lust. Such a heart is dedicated to obeying Islamic teachings (Ibn Qayyim, 2007). Therefore, qalbun salim is a pure heart, not diseased, always drawing closer to Allah, and the owner of such a heart will strive to perform good deeds on Earth. The term qalbun salim has been mentioned in the Quran, where it can be seen in the verse of Prophet Ibrahim, who turns to Allah with a healthy heart, hoping that his supplication is accepted.

إِذْ جَآءَ رَبَّهُۥ بِقَلْبٍ سَلِيمٍ ٨٤ وَإِنَّ مِن شِيعَتِهِۦ لَإِبْرَٰهِيمَ ٨٣

Translation: (As- Shaffat: 83-84)

Remember˹ when he came to his Lord with a pure heart, and said to his father and his people, "What are you worshipping?

Furthermore, the sign of a pure and healthy heart is also conveyed by Allah SWT as one that is always softened when hearing the verses of Allah SWT and subsequently obeys the commands of Allah SWT with full submission and obedience. This can be seen in verses 58 of surah Maryam

أُوْلَٰٓئِكَ ٱلَّذِينَ أَنْعَمَ ٱللَّهُ عَلَيْهِم مِّنَ ٱلنَّبِيِّـۧنَ مِن ذُرِّيَّةِ ءَادَمَ وَمِمَّنْ حَمَلْنَا مَعَ نُوحٍ وَمِن ذُرِّيَّةِ إِبْرَٰهِيمَ وَإِسْرَٰٓءِيلَ وَمِمَّنْ هَدَيْنَا وَٱجْتَبَيْنَآ ۚ إِذَا تُتْلَىٰ عَلَيْهِمْ ءَايَٰتُ ٱلرَّحْمَٰنِ خَرُّواْ سُجَّدًا وَبُكِيًّا ۩ ٥٨

Translation: (Maryam: 58)

Those were some of the prophets whom Allah has blessed from among the descendants of Adam, and of those We carried with Noah ˹in the Ark˺, and of the descendants of Abraham and Israel,[1] and of those We ˹rightly˺ guided and chose. Whenever the revelations of the Most Compassionate were recited to them, they fell down, prostrating and weeping.

Similarly, Abdul Qadir al-Jailani explains a healthy heart as one that is safe from falsehood and the world's harm (Irawati, 2018). Every action of a human depends on the condition of their heart, whether it is pure or afflicted by disease. When the heart is pure and safe, individuals will aim to glorify Allah and align their behavior to seek closeness to Allah. Therefore, Irawati (2018) explains the term qalbun salim as a heart free from any impurities and constantly striving to attain happiness in both the world and the Hereafter. Dewi Asri (2010) also explains the principle of qalbun salim, associating the heart's function with an individual's faculty of thought. Through the task of the qalbun as reason, an individual can fulfill their duty as a representative of Allah SWT.

3. THE RELATIONSHIP BETWEEN QALBUN AND INDIVIDUAL BEHAVIOUR

As the qalbun is closely linked to an individual's intellect, it can be observed that the qalbun plays a role in contributing to their actions. The decisions made by every individual are not solely dependent on their intellect, especially for Muslim individuals. They need to prioritize the qalbu, which acts to comprehend, investigate, and analyze the good and wrong of a matter. This can be reflected in the saying of the Prophet Muhammad (peace be upon him), which indicates the significance of the qalbun in shaping an individual's perceptions, emotions, and ultimately, their decisions and actions:

عن عامر قال سمعت النعمان بن بشير يقول سَمِعْتُ رَسولَ اللهِ صَلَّى اللَّهُ عليه وسلَّمَ يقولُ: وأَهْوَى النُّعْمانُ بإصْبَعَيْهِ إلى أُذُنَيْهِ، وإنَّ في الجَسَدِ مُضْغَةً، إذا صَلَحَتْ، صَلَحَ الجَسَدُ كُلُّهُ، وإذا فَسَدَتْ، فَسَدَ الجَسَدُ كُلُّهُ، ألا وهي القَلْبُ

Translation: (Muslim: 1599; Bukhari: 52)

From 'Amir, he said: I heard Nu'man bin Bashir say: I heard the Messenger of Allah (SAW) saying: 'Indeed, in the body, there is a lump of flesh. When sound,

the whole body is good; when it is corrupt, the entire body is evil. Verily, it is the heart.

Additionally, Ibn Sirin also affirms the function of the qalbun as an instrument for acquiring knowledge (Tafsir Ibn Kathir):

"A sound heart (qalbun salim) is a heart that knows the reality of Allah, the reality of the inevitable Day of Judgment, and that Allah will resurrect every living creature."

Consequently, it can be seen that every decision or intention to do something is associated with the qalbun salim, where this sound or healthy heart will mirror decisions that will be scrutinized for the good and bad of the matter. Making decisions based on such considerations aims to be closer to Allah. Furthermore, Jalaluddin Rumi also mentions the nature of the human qalbu, which can act 700 times faster than the human brain. He even likens an individual who uses the qalb to decide to have a quicker pace than when they think using reason (Amin Syukur & Masharudin, 2002). Al-Ghazali, who defines qalbun as the center of human behavior, explains that knowledge can be acquired through a purified and improved heart (tazkiyah al-nafs and ishlāh), indicating that the qalbun is the center of knowledge for an individual. Furthermore, some studies highlight the efficiency of the qalbun in grasping a particular field of knowledge. According to Chittick (2001), the qalbun is even more powerful than other senses. True wisdom can be explored through thinking, unveiling, and understanding by combining reason and qalbu. While reasoning and logical thinking are limited to one perspective, the nwill analyse that knowledge comprehensively. Therefore, the source of any decision is based on the qalbu, and it turns out that the king of the body for an individual lies within the qalbu, whether it is healthy, sick, or dead (salim, maridh, mayyit).

4. QALBUN SALIM AS A SPIRITUAL FILTER IN TAM

The Technology Acceptance Model (TAM) is a well-established cognitive-behavioral framework grounded in rationalist assumptions. It posits that perceived usefulness (PU) and perceived ease of use (PEOU) influence user attitudes and behavioral intentions toward technology usage. While TAM provides critical insights into the factors driving technology acceptance, it primarily reflects secular, utility-driven decision-making. From an Islamic epistemological perspective, however, human behavior is not purely rational or utilitarian; it is also profoundly shaped by spiritual consciousness (*taqwa*) and the moral orientation of the heart (*qalbun*).

In this context, *qalbun salim* a heart purified of spiritual disease and aligned with divine guidance serves as a central evaluative filter that interprets both external information and internal intentions. It does not merely respond to technological functionality (e.g., usefulness or ease), but evaluates whether the technology aligns with moral, ethical, and Shariah-based values. This means that while TAM identifies *what* influences behavior, *qalbun salim* explains *how and why* those factors are embraced, resisted, or reinterpreted by a spiritually guided Muslim.

The *qalbun* plays a cognitive role in thinking, analyzing, and reflecting on technology from a comprehensive worldview that includes the Hereafter. This integration is not meant to redefine TAM's empirical structure by inserting new

constructs, but to offer a conceptual bridge between Islamic metaphysical psychology and modern behavioral theory. In this sense, the *qalbun* is not only a locus of emotion but also a center of ethical intelligence (*fiṭrah*) and divine accountability.

Accordingly, a person with a *qalbun salim* will not uncritically accept technology based solely on convenience or benefit. Instead, they will weigh its implications against the higher objectives of the Shariah (*maqasid al-shariah*), such as the preservation of faith, life, intellect, lineage, and property. This ensures that any act of technology adoption is consistent with the pursuit of divine pleasure (riḍā' Allah) and not merely worldly utility.

In the context of TAM, this means that the *qalbun salim* plays a significant role in shaping the intention to use the key predictive variable in the model. For Muslims, intention is deeply tied to the heart. Therefore, the decision to use a technology is filtered through the *qalbun*, which evaluates whether it brings one closer to Allah or risks moral harm. Especially in the adoption of new or disruptive technologies, the heart examines both virtues and vices, guiding choices through a spiritually grounded rationale.

This conceptual synthesis offers a richer and more holistic understanding of technology acceptance among Muslims. It invites scholars to revisit behavioral models through the lens of Islamic epistemology, recognizing that the heart is not only metaphysical but also a practical center of judgment. Thus, the *qalbun* expands the interpretive scope of TAM without altering its foundational structure illustrating that decisions informed by faith are not irrational, but spiritually enlightened.

This theoretical relationship between *qalbun salim* and TAM is illustrated in Figure 3, where the heart acts as a spiritual-intellectual filter influencing the pathway from PU and PEOU to intention and behavior.

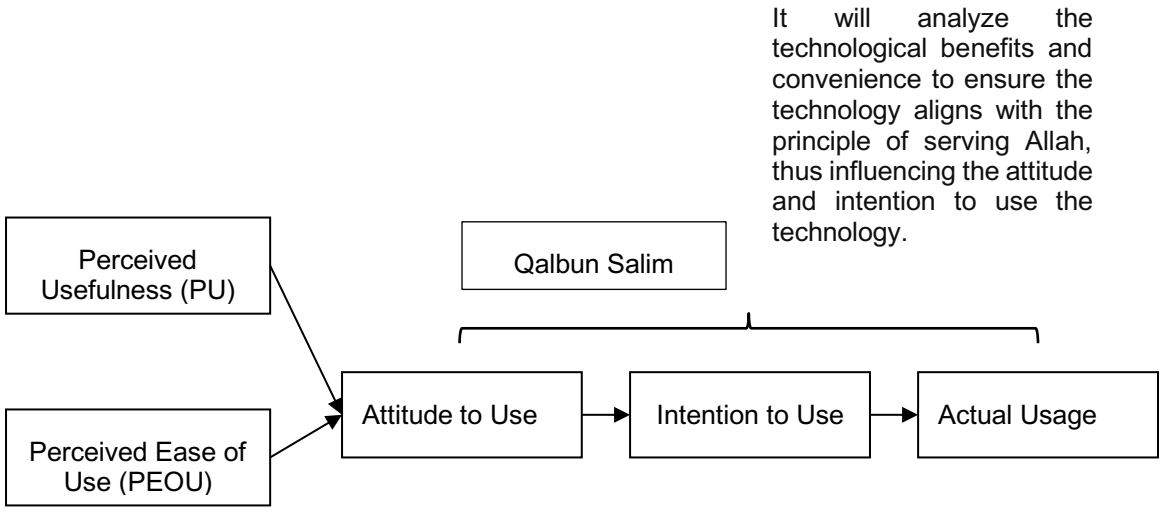

Fig. 3. Technology Acceptance Model (TAM) with Qalbun Salim

Source: Author's Own

5. RESEARCH IMPLICATIONS AND FUTURE DIRECTIONS

This paper presents a conceptual integration of qalbun salim into the Technology Acceptance Model (TAM), drawing from Islamic metaphysical psychology and classical scholarship to offer a spiritually grounded understanding of technology acceptance. As a conceptual article, it does not propose or test an empirical model. However, this theoretical framework opens several avenues for empirical research within the fields of Islamic behavioral science, technology studies, and spiritual psychology.

5.1. Addressing the Empirical Gap

Future studies may build on this framework by developing instruments that operationalize qalbun salim within TAM. This could include designing a Qalbun-TAM scale using Islamic psychometric constructs such as spiritual intelligence, ethical sensitivity, or religiosity indices based on Qur'anic worldview. Experimental or survey-based studies could test the moderating or mediating role of qalbun on PU, PEOU, and intention, particularly among Muslim populations. Longitudinal studies may also explore how sustained spiritual development influences user engagement with digital technologies.

Such empirical extensions would not only validate the conceptual model but also help establish a uniquely Islamic contribution to technology adoption literature, grounded in taqwa (God-consciousness) and maqasid al-shariah.

5.2. Theoretical Contributions and Interdisciplinary Expansion

While this study focuses on conceptual grounding, it engages in a critical interdisciplinary conversation between Islamic epistemology and cognitive-behavioral theory. Recognizing qalbun salim as a locus of moral reasoning and spiritual judgment enriches existing behavioral models and creates space for developing Islamic behavioral science frameworks.

Moreover, this integration speaks beyond the Muslim context. Future research can examine comparative spiritual ethics in technology use, drawing parallels between qalbun and universal constructs like conscience, virtue ethics, or emotional intelligence. This would expand the framework's relevance to a broader audience and promote interfaith and intercultural dialogue in the digital ethics discourse.

5.3. Reframing Limitations as Research Opportunities

Rather than viewing the conceptual nature of this study as a limitation, it should be seen as a foundation for future empirical and methodological innovation. The inclusion of qalbun salim offers a new lens for researchers to explore value-based decision-making in the digital age an area increasingly important amid debates on AI ethics, fintech, surveillance, and digital well-being. By rethinking technology acceptance through the lens of Islamic metaphysics, this paper contributes to a growing body of literature seeking to harmonize traditional religious wisdom with modern behavioral science.

6. CONCLUSION

This study has explored the integral role of *qalbun* (the heart), particularly *qalbun salim* within the Technology Acceptance Model (TAM) from an Islamic perspective. The heart functions as a reflective, analytical faculty that shapes decision-making by integrating both rational assessment and spiritual consciousness (*taqwa*). As such, it serves as an essential filter through which Muslims evaluate the acceptance and intention to use technology, ensuring alignment with Shariah principles and ethical standards. Viewed through the lens of *qalbun*, TAM is enriched beyond its conventional cognitive-behavioral framework to encompass moral and spiritual dimensions. The *qalbun salim* guides Muslims to adopt technology not only based on perceived usefulness and ease but also on whether the technology promotes righteousness, benefits society, and draws individuals closer to Allah. This fusion highlights the importance of embedding Islamic ethical values and *maqasid al-shariah* (objectives of Islamic law) within behavioral models of technology acceptance.

At this intersection of Islamic thought and contemporary technology studies lies a fertile intellectual space where tradition and innovation converge. Recognizing the influence of *qalbun* offers a more holistic understanding of Muslim users' technology behaviors and opens new pathways for developing frameworks that integrate faith-based values with digital innovation. This conceptual integration is a foundational step in a broader, evolving discourse. Future empirical research should focus on operationalizing *qalbun salim* using Islamic psychometric tools such as spiritual intelligence scales, ethical sensitivity measures, and religiosity indices and investigate how it moderates the relationships between perceived usefulness, ease of use, and technology adoption intentions. Additionally, cross-cultural studies could explore how spiritually guided decision-making differs across Islamic and secular contexts, thereby expanding TAM's applicability and enriching the field of Islamic behavioral science.

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DATA SHARING ACT 2025 AND THE CONSTITUTIONAL SAFEGUARDS ON INFORMATIONAL AUTONOMY IN MALAYSIA

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ABSTRACT: Malaysia's rapid digitalisation of public administration has significantly expanded the scale and intensity of personal data processing within government digital services. Platforms such as MySejahtera, PADU, MyIdentity, MyDigital ID and one stop centre MyGov apps have become central to service delivery, policy implementation, and data-driven governance. The new Data Sharing Act 2025 (DSA 2025) is a significant piece of legislation designed to facilitate inter-agency data sharing and enhance administrative efficiency. However, the centralisation and dissemination of personal data within the public-sector raise important constitutional and governance questions concerning informational autonomy and state accountability. Although the Federal Constitution does not expressly recognise a right to privacy, Malaysian courts have interpreted Article 5 (1) on life and personal liberty, together with Article 8(1) on equality before the law, as comprising elements of autonomy, dignity, and protection against arbitrary state action. This paper adopts a doctrinal legal methodology to examine whether the institutional design and operational mechanisms of the DSA 2025 adequately align with these constitutional principles. It analyses the Act's data-sharing architecture, executive discretion, and oversight arrangements, and evaluates the extent to which existing constitutional safeguards constrain state power over the processing of citizens' personal data. Drawing on comparative insights from Germany, the European Union, the United Kingdom, and Canada, the paper argues that effective public-sector data governance requires principles constraints that extend beyond administrative efficiency. It proposes the development of a Malaysian Doctrine of Informational Autonomy, grounded in Articles 5(1), 8(1), and constitutional supremacy, to provide a coherent framework for assessing the constitutional and governance-based analytical framework, this paper contributes to ongoing debates on digital governance, trust, accountability, sovereignty and the protection of individual informational liberty in Malaysia's evolving data-driven services.

KEYWORDS: *Governance, Digital Services, Constitutionalism, Personal Data*

1. INTRODUCTION

Malaysia's rapid transition towards a data-driven public administration has significantly expanded the scale and complexity of personal data processing within government digital services (Nisar et al, 2025). Public sector platforms such as

MySejahtera, PADU, MyDigital ID, and *MyIdentity* have become central infrastructures for delivering services, managing entitlements, and facilitating data-driven policy changes. In an increasingly interconnected governance ecosystem, these approaches increase administrative efficiency but also raise questions about state accountability, autonomy, and informational privacy. In light of this, the Data Sharing Act 2025 (DSA 2025), which aims to support national digitalisation goals while streamlining cross-agency data access, represents a significant regulatory development. However, the significant concerns about sovereignty, constitutional protections and the boundaries of state authority over personal data are raised by the centralisation and sharing of personal data among public-sector government agencies (Harun, 2025).

The Federal Constitution does not explicitly recognise a right to privacy. However, as demonstrated most notably in Sivarasa Rasiah v Badan Peguam Malaysia [2010] 2 MLJ 333, Malaysian courts have construed Article 5(1), which protects the right to life and personal liberty, as containing aspects of autonomy, dignity, and personal privacy (Hashim, 2020). A purposive interpretation of fundamental liberties has been upheld by later case law, such as Maria Chin Abdullah v Ketua Pengarah Imigresen & Anor [2021] MLJU 12 and CTEB & Anor v Ketua Pengarah Pendaftaran Negara, Malaysia & Ors [2020] 3 MLJ 634, which highlights a wider evolution of the constitution. However, the courts have not established a unified standard governing informational privacy or constitutional bounds of state data operations, and these legal developments continue to be scattered. The implementation of DSA 2025, which permits significant interagency data exchange without commensurate constitutional standards of need, proportionality, or non-arbitrariness, shows this doctrinal gap.

The inherent power imbalance between the State and the citizen is worsened by the growth of government data infrastructure, posing structural issues that cannot be resolved by administrative or legal means alone (Oskar.JG, 2023). Strong data governance frameworks must be based on constitutional principles that limit the discretionary use of public power, as shown by comparative jurisdictions such as Canada's constitutionalised oversight of government data handling, the United Kingdom's public-sector data protection regime, and Germany's Informational Self-Determination doctrine. According to these models, constitutional protections that guarantee openness, accountability, and the preservation of individual right must be balanced with statutory efficiency.

Therefore, this paper suggests that DSA 2025 lacks the constitutional protections required to control the State's increased authority over personal data, even as it fosters digital governance (Daud. M, 2025). Due to the Act's focus on administrative effectiveness and interoperability, constitutional standards that are often applied to protect individual right are not clearly included. Malaysia needs a coherent constitutional doctrine in the absence of an explicit right to privacy in order to provide assurance that public-sector actions involving personal data adhere to the rule of law, refrain from arbitrary intrusion, and respect individual liberty.

Thus, based on Article 5(1) and Article 8(1) of the Federal Constitution as well as the idea of constitutional supremacy, this paper recommends Malaysia to develop a stand-alone Malaysian doctrine of informational autonomy (Hongqiang.Z et al, 2025). Such concept would guide judicial interpretation, harmonise statutory instruments with fundamental liberties, and offer a clear analytical framework for

assessing the constitutionality of government data actions. Malaysia may better integrate its digital transformation strategy with the protection of civil liberties and the long-term validity of the constitutional order by establishing data governance on constitutional principles rather than emphasising chiefly on administrative expediency.

2. MALAYSIA'S CONSTITUTIONAL FRAMEWORK ON STATE POWER AND PERSONAL DATA

Malaysia's Federal Constitution does not expressly recognise a right to privacy. This absence is textual and can be confirmed by examining the Constitution's provision, which do not include "privacy" as a fundamental liberty. Article 5 (1) guarantees that "No person shall be deprived of his life or personal liberty save in accordance with law", Scholars and courts have interpreted "personal liberty" as extending beyond physical restraint to include facets of autonomy and dignity. The precise doctrinal scope of autonomy under Article 5 (1) has not been definitely settled by the courts.

In Sivarasa Rasiah v Badan Peguam Malaysia [2010] 2 MLJ 333 the Federal Court held that Article 5 (1) encompasses rights implicit in "life" and "personal liberty", provided that they are consistent with the Constitution. This case is commonly read to imply that informational or decisional autonomy may fall within the ambit of Article 5 (1), although the Court did not explicitly address digital privacy. In Maria Chin Abdullah v Ketua Pengarah Imigresen & Anor [2021] MLJU 12, the High Court applied a purposive reading of Article 5 (1), emphasizing evolving societal contexts. Thus, this demonstrates judicial willingness to interpret fundamental liberties dynamically, though not specifically in the context of government data practices. In CTEB & Anor v Ketua Pengarah Pendaftaran Negara, Malaysia & Ors [2020] 3 MLJ 634, the court adopted a more flexible constitutional approach, departing from strict literalism. Therefore, despite the lack of a clear privacy concept, this provides validity to the idea that Malaysian constitutional jurisprudence may adjust to new technological realities.

The Federal Court's broad interpretation of the right to personal liberty had been referred to in some other cases, all giving more favour and support to the acceptability of right to privacy as a constitutional right in Malaysia (See, for example, Toh See Wei v Teddric Jon Mohr & Anor [2017] 4 AMR 903; Pendakwa Raya lwn Nor Hanizam bin Mohd Noor [2019] MLJU 638, HC and Genting Malaysia Bhd v Pesuruhjaya Perlindungan Data Peribadi & Ors [2022] 11 MLJ 898, HC). But despite this decision, the right to receive a civil remedy on the basis of invasion of privacy may still be far from settled.

2.1. State Power and Absence of Explicit Data Protection Duties

Government agencies are exempted from the Personal Data Protection Act 2010 (PDPA) [Act 709] under Section 3 (1). As a result, rather than extensive statutory obligations, the State's handling of personal data is generally governed by administrative policy and sector-specific legislation. As of right now, Malaysia lacks a comprehensive constitutional or statutory concept that establishes restrictions on the gathering, use, and dissemination of government data. Meanwhile, interagency

data exchange procedures are introduced by the DSA 2025. Although the Act increases executive power over data flows, it does not include clear constitutional requirements for minimal impairment, necessity, or proportionality.

Article 8(1) of the Federal Constitution guarantees that “all persons are equal before the law and entitled to the equal protection of the law.” This principle of non-arbitrariness is commonly derived from Article 8 (1), and courts have applied this principle to strike down arbitrary state action. In the context of government data practices, arbitrary or disproportionate data collection or sharing may implicate Article 8 (1), although no case yet addressed this directly.

2.2. Constitutional Supremacy and Digital Governance

Article 4(1) establishes that the Federal Constitution is the supreme law of the Federation. Any statute including the DSA 2025 must therefore comply with constitutional standards governing personal liberty and equality. Constitutional supremacy is upheld by Malaysian courts, although previously untested, they usually require a definite disagreement between statute and constitution before declaring legislation unconstitutional (Hamid. N, 2019).

The Data Sharing Act 2025 (DSA 2025) [Act 864] of the Parliament of Malaysia. The Act was gazetted on 20 February 2025 and came into force on 28 April 2025. The long title of the Act states that it provides for the sharing of data under the control of a public sector agency with other public-sector agencies, the establishment of the National Sharing Committee, the functions and powers of the Director General of the National Digital Department in relation to data sharing, and related matters.

Official explanatory materials and FAQs issued by the National Digital Department describe three main objectives of the DSA 2025:

(i) To provide clear legal authority to regulate and enforce laws related to data sharing;

(ii) To improve the effectiveness of data sharing implementation and management among agencies; and

(iii) To establish a more systematic and focused governance structure within the data sharing ecosystem.

Section 2 of the Act states that it binds the Federal Government. The official FAQ clarifies that the Act applies to data under the control of federal public sector agencies and federal statutory bodies, and that its scope is confined to the federal government machinery. Consequently, state governments and state-level entities fall outside the direct scope of the Act unless separately brought within its regime.

The Act defines, in Section 3 “public-sector agency” to include the public services under Article 132 (1) of the Federal Constitution (with specified exclusions) and statutory authorities exercising powers vested by federal law. This definition positions the DSA 2025 as an internal federal data-sharing framework, rather than a law directly directed at private-sector actors. In addition, the Act defines “data” broadly as any facts, statistics, instructions, concepts or other information capable of being communicated, analysed or processed by individuals, computers or other means. This definition clearly extends beyond “personal data” as understood in the

Personal Data Protection Act 2010 (PDPA), thereby covering both personal and non-personal information within the public-sector.

Commentaries note that the DSA 2025 framework may indirectly affect private entities where they are engaged by public agencies to perform data migration, data integration or data analytics work, and in such cases those entities must comply with the Act's security and handling requirements. Although the Act does not directly reconfigure private-sector obligations under the PDPA, it creates a secondary layer of compliance for private contractors working with pubic-sector data.

2.3. Institutional Structure: National Data Sharing Committee and the Role of Director General

Part II of the Act establishes a National Data Sharing Committee (the Committee). The Committee is chaired by the Minister responsible for digital affairs and includes, among others, representatives from each ministry, the Prime Minister's Department, the Chief Government Security Officer, the National Cyber Security Agency (NACSA), and the Personal Data Protection Department. Section 6 (1) sets out the Committee's functions, which include: formulating policies and strategies on data sharing; overseeing implementation of the Act; resolving administrative difficulties; formulating policies relating to databases for data sharing; and performing necessary consequential functions. The Committee is therefore designed as a central policy and coordination body with substantial influence over the architecture of public-sector data governance.

Section 11 of the Act confers specific duties and powers on the Director General of the National Digital Department, including: implementing Committee policies; coordinating and facilitating data sharing; advising the Committee; requiring information or documents; issuing circulars or guidelines; and carrying out other duties as directed. This places the Director General in a pivotal operational role, effectively functioning as the executive authority for the day-to-day administration of federal data sharing.

Part IV of the DSA 2025 regulates the process by which a public sector agency may request data from another public sector agency. Section 12 provides that a requesting agency must specify, among others, (a) the data requested; (b) the purpose for which the data is requested; (c) the public sector agencies that will act as data provider and data recipient; and (d) the manner in which the data will be handled. Commentaries describe that the receiving agency must evaluate the request against statutory criteria, including relevance to the stated purpose, consistency with Section 13 of the Act, and risks to health, safety, welfare or other protected interests. This indicates an internal administrative gatekeeping process that purports to structure inter-agency data flows.

The Act states that it is to be read together with other written laws that allow data sharing and that its provisions are "in addition to, and not in derogation of," the relevant written laws. This "pillar" clause, prescribed in Section 4, suggests that the DSA 2025 is intended to overlay existing sectoral frameworks rather than displace them. The Act expressly provides that data of public sector agencies must be dealt with in accordance with the Official Secrets Act 1972 and other specified laws listed in the Schedule, and that disclosures under the DSA 2025 are deemed to be disclosures under those laws. This provision is significant because it normalises

internal data disclosures by situating them within existing secrecy and confidentiality regimes.

2.4. Constitutional Risks Posed by the Data Sharing Act 2025

The DSA 2025's institutional structure, which places operational authority in the Director General of the National Digital Department and policy-making in the National Data Sharing Committee, tend to concentrate decision-making power within the executive branch. The main control over data flows is administrative rather than constitutional or judicial since requests and authorisation for data sharing are managed internally amongst public-sector entities, with appraisal carried out by other executive actors (Harun, 2025). From the perspective of Article 5(1) of the Federal Constitution, such concentration of discretion over citizens' data raises the risk that interagency sharing may affect aspects of personal liberty without being subjected to an explicit necessity or proportionality test.

As discussed earlier, the Personal Data Protection Act 2010 (PDPA 2010) does not extend to the Federal Government or State Governments pursuant to section 3(1). By contrast, the Data Sharing Act 2025 (DSA 2025) is designed to operate within the public-sector context, including federal entities that are not subject to any comprehensive personal data protection regime. As a result, the data-sharing mechanisms established under the DSA 2025 may operate within a less stringent regulatory framework than that applicable to personal data processing in the private sector. This structural divergence raises legitimate concerns regarding the adequacy of data privacy safeguards for citizens.

Nevertheless, this risk may be mitigated, at least in part, by the statutory duty imposed under the DSA 2025 on all parties involved in data sharing in which both data providers and data recipients to take the necessary measures to safeguard the security and privacy of shared data (Section 16(b) DSA 2025). This duty encompasses, inter alia, the protection of data from loss, misuse, unauthorised or accidental modification, access or disclosure, alteration, or destruction in language that closely mirrors the security principle under the PDPA 2010, as well as the preservation of individuals' rights relating to personal data protection. However, in the absence of further statutory elaboration or interpretive guidance on the scope and content of these "rights," it remains uncertain how this obligation will operate in practice, particularly in relation to the protection of citizens' data privacy and informational autonomy.

3. INFORMATIONAL AUTONOMY AND LOSS OF INDIVIDUAL CONTROL

The concepts of dignity and personal liberty that Malaysian courts have linked to Article 5 (1) are intimately linked to informational autonomy, which is defined as an individual's ability to govern the disclosure and use of personal data. Under the DSA 2025 framework, individuals whose data are collected by one public sector agency typically have no direct procedural role in authorising or refusing subsequent inter-agency sharing.

Article 8(1) guarantees equality before the law and equal protection of the law. When large volumes of data are pooled and analysed across agencies, there is a

heightened possibility that algorithmic profiling, risk scoring, or categorization may be used to shaped how services, enforcement, or benefits are distributed. In the absence of explicit statutory duties to conduct equality or non-discrimination assessments before deploying data-driven decision systems, there is a constitutional risk that data sharing may indirectly lead to practices that conflict with Article 8(1).

3.1. Transparency, Accountability, and Rule of Law Concerns

Article 4(1) declares the Federal Constitution to be the supreme law of the Federation. Constitutional supremacy presupposes that exercises of public power are sufficiently transparent and reviewable so that courts, Parliament, and the public can assess their legality and compatibility with fundamental liberties (Widiarto et al., 2025). It is unclear to what extent data-sharing agreements, internal policies, or risk assessments made under the Act are published or systematically tabled before Parliament. Limited transparency regarding the exact scope, frequency, and purposes of inter-agency data exchanges makes it difficult for individuals to know when their information has been shared and on what legal basis. This lack of visibility can weaken the practical operation of the rule of law, because individuals may be unable to identify specific decisions or practices to challenge in court under Article 5(1) or 8(1). When considered collectively, these characteristics point to a structural conflict between the DSA's efficiency-driven reasoning and the constitutional need that state power exercises that impact equality and individual liberty be subject to clear, debatable, and moral restraints.

The foregoing analysis indicates that the constitutional risks posed by the DSA 2025 are systemic rather than episodic: they arise from the overall architecture of data sharing rather than from isolated breaches or misuse. At the level of Article 5(1), the main risk is that broad administrative discretion over personal data could compromise liberty and autonomy without being held to the unambiguous constitutional requirements of proportionality and necessity. At the level of Article 8(1), the risk lies in opaque, data-driven decision-making that may result in unequal treatment or hidden forms of discrimination that are difficult to trace and contest. At the level of Article 4(1) and the rule of law, concerns focus on the limited transparency and external oversight mechanisms governing how public sector agencies design, authorize, and implement cross-agency data flows. These combined risks support the central claim of this paper, that Malaysia would benefit from a structured Doctrine of Informational Autonomy to guide legislative design and judicial review of public sector data sharing, ensuring that digital governance remains anchored in constitutional principle rather than administrative expediency (Sukerta et al, 2024).

4. COMPARATIVE DOCTRINES: TOWARDS INFORMATIONAL AUTONOMY

4.1. Germany: Information Self-Determination

The German Federal Constitutional Court, in its 1983 Census decision, recognized a fundamental right to informational self-determination under the

German Basic Law. The Court grounded this right in Article 2 (1) (general freedom of action) read with Article 1(1) (human dignity) of the Basic Law. Informational self-determination has been described as granting individuals the authority to decide, in principle, when and within what limits personal data may be disclosed and used (Vladimirovna, 2022).

This doctrinal move constitutionalised control over personal data as a dimension of personal freedom and dignity rather than treating it merely as a statutory or administrative concern. Commentators note that the 1983 Census judgment laid the foundations of both constitutional and sub-constitutional German data protection law. The decision established several requirements for legislation that restricts informational self-determination, including clear legal basis, specific purposes, necessity, and proportionality (Roßnagel et al, 2025).

In practical terms, this means that German public authorities must justify large-scale data collection and linkage by reference to constitutionally acceptable aims and must ensure that risks of profiling, misuse or chilling effects are mitigated.

For Malaysia, the German experience illustrates how a court-developed doctrine can supply a coherent constitutional framework for evaluating state data practices, even in the absence of explicit textual reference to “privacy” or “data protection”.

4.2. European Union: Fundamental Right to Data Protection

The EU Charter of Fundamental Rights recognises a distinct right to the protection of personal data in Article 8, separate from the right to respect for private and family life in Article 7. Article 8(1) states that “Everyone has the right to the protection of personal data concerning him or her.” Article 8(2) further requires that such data be processed fairly for specified purposes and on the basis of consent or another legitimate legal basis, and that individuals have rights of access and rectification. Article 8(3) stipulates that compliance with these rules shall be subject to control by an independent authority. The General Data Protection Regulation (GDPR) is widely described as the key legislative instrument that operationalises this fundamental right to data protection in EU law. The EU model therefore combines an explicit constitutional right, detailed legislative standards, and independent supervisory authorities as core pillars of its data-protection architecture. For public-sector data processing, including inter-agency sharing, the GDPR’s requirements, such as purpose limitation, data minimisation, legal basis, and data subject right, serve as enforceable constraints on state power (Legido-Quigley et al, 2025).

Compared with Malaysia, where constitutional privacy is implied and public-sector data protection duties are scattered, the EU framework represents a more explicit and vertically structured regime in which constitutional, legislative and institutional safeguards mutually reinforce each other.

4.3. United Kingdom: Public-Sector Data Protection Under UK GDPR and The Data Protection Act 2018

In the United Kingdom, data protection is governed primarily by the UK General Data Protection Regulation (UK GDPR) and the Data Protection Act 2018 (DPA 2018) Government guidance states that the UK’s data protection legislation controls

how personal information is used by organisations, including government departments. The DPA 2018 is described as the UK's national data protection law that supplements UK GDPR and applies to organisations processing personal data in the UK, including the public-sector (Lim, 2025).

The Information Commissioner's Office (ICO) is identified as the independent authority responsible for regulating and enforcing UK GDPR and the DPA 2018, including in relation to government bodies. This institutional design ensures that public-sector data practices are subject to an external regulator with investigative and enforcement powers, including the ability to issue guidance, conduct audits, and impose sanctions.

UK GDPR and the DPA 2018 collectively impose legal duties on public authorities, such as lawfulness, fairness, transparency, purpose limitation, accuracy, storage limitation, and integrity and confidentiality, which constrain inter-agency data sharing. Although the UK does not have a written constitution comparable to Malaysia's the statutory regime operates as a functional equivalent to a constitutional safeguard in the specific domain of data protection, particularly when combined with judicial review and human rights instruments.

For Malaysia, the UK example highlights how even without an entrenched constitutional right to data protection, robust public-sector data governance can be achieved through comprehensive legislation and an empowered independent regulator, elements currently missing from Malaysia's treatment of government-held personal data.

4.4. Canada: Privacy Act and Federal Public-Sector Data Governance

At the federal level in Canada, the Privacy Act (R.S.C, 1985, c.P-21) governs the collection, use and disclosure of personal information by federal government institutions. Section 2 of the Privacy Act states that its purpose is to extend the laws of Canada that protect the privacy of individuals with respect to personal information about themselves held by a government institution and that provide individuals with a right of access to that information (Desrochers, 2024).

Official explanations emphasise that the Privacy Act applies to how the federal government collects, uses and discloses personal information, and that it gives individuals the right to access and request correction of their personal information held by government institutions. The Act is administered by the Privacy Commissioner of Canada, who has oversight functions including investigating complaints and reporting to Parliament. As a result, Canadian federal public-sector data practices are structured by a rights-based statute that both limits government handling of personal information and provides individuals with enforceable procedural mechanisms. The combination of statutory privacy rights, access and correction mechanisms, and independent oversight enables individuals to challenge or scrutinise federal inter-agency data sharing, even where there is no explicit constitutional text equivalent to Article 8 of the EU Charter.

For Malaysia, the Canadian model underscores the importance of having a dedicated public-sector privacy statute that sits alongside, and complements, any private-sector data protection framework, something currently absent given the PDPA's exemption for government.

4.5. Lessons for Doctrine of Informational Autonomy in Malaysia

Across Germany, the EU, the UK and Canada, a common pattern is observable: public-sector data practices are constrained by a combination of (i) rights or rights-like principles, (ii) comprehensive legislative frameworks, and (iii) independent oversight institutions.

Germany exemplifies a court-created constitutional doctrine (informational self-determination), which then shapes legislation and administrative practice. The EU model embeds data protection as a constitutional fundamental right, operationalised through the GDPR and supervised by independent authorities in each Member State.

The UK and Canada illustrate statutory-rights models in which detailed legislative obligations and independent regulators perform a function analogous to constitutional safeguards in the specific area of data protection. In contrast, Malaysia's framework for public-sector data governance currently lacks all three elements in a fully developed form: there is no explicit constitutional right to data protection, no comprehensive public-sector data protection statute, and no independent authority with a clear mandate over government data practices.

The comparative experience therefore supports the central claim of this paper that Malaysia would benefit from articulating a Doctrine of Informational Autonomy, grounded in the existing text and structure of the Federal Constitution but informed by foreign models (Abdul Hadi et al, 2024).

Such a doctrine would not need to replicate any particular foreign system wholesale; rather, it could adapt the core ideas of autonomy, proportionality, transparency, and independent oversight into a framework compatible with Malaysia's constitutional arrangements and institutional context.

5. TOWARDS A MALAYSIAN DOCTRINE OF INFORMATIONAL AUTONOMY

5.1. Constitutional Foundations

Article 4(1) of the Federal Constitution declares the Constitution to be the supreme law of the Federation. Article 5 (1) guarantees that no person shall be deprived of life or personal liberty save in accordance with law. Article 8 (1) provides that all persons are equal before the law and entitled to the equal protection of the law. Read together, these provisions establish that any statutory framework which authorises the State to collect, process, and share personal data must remain subject to constitutional limits on arbitrariness and unjustified interferences with liberty and equality.

Existing Malaysian case law, including Sivarasa Rasiah, Maria Chin Abdullah and CTEB, indicates that the courts are willing, at least in principle, to interpret fundamental liberties purposively and in light of contemporary conditions. The courts have not yet explicitly framed informational privacy or data protection as a distinct constitutional right. However, the recognition that "life" and: "personal liberty" encompass more than mere physical restraint suggests a conceptual space

within which a doctrine of informational autonomy could be developed without constitutional amendment.

A Malaysian Doctrine of Informational Autonomy would therefore operate as an interpretive framework derived from Article 5(1), 8(1) and 4(1), guiding both judicial reasoning and legislative design in matters involving State control over personal data.

5.2. Core Elements of the Proposed Doctrine

The proposed Malaysian Doctrine of Informational Autonomy can be structured around five core elements: autonomy, justification, proportionality, transparency, and accountability and redress (Abdul Halim et al, 2018) (Ong, 2020), (Sweet & Mathews, 2017) & (Abdul Hadi, 2024).

i. **Autonomy** - First, the doctrine should recognise that personal data not merely administrative resources but are closely linked to individual autonomy, dignity, and self-development. Informational autonomy, in this sense, refers to the individual's interest in controlling, within reasonable limits, the disclosure, use, and onward circulation of personal data held by public authorities. his recognition does not require an absolute veto for individuals over all forms of public-sector data processing but does require that State decisions affecting personal data be treated as interferences with liberty that demand principled justification (Abdul Hadi, 2024).

ii. **Justification and Necessity** -Second, the doctrine should require that any significant collection, aggregation, or sharing of personal data by the State be supported by a clear and legitimate purpose grounded in law. For public-sector data sharing under the Data Sharing Act 2025, this would mean that agencies must be able to show that the requested data are genuinely necessary to achieve a specified statutory of policy objective, rather than merely convenient. The doctrine would encourage courts, when reviewing such measures, to ask whether less data-intensive means was reasonably available to achieve the same ends (Abdul Halim et al, 2018).

iii. **Proportionality and Minimal Impairment**- Third, the doctrine should incorporate a proportionality requirement, under which the scope and intensity of data sharing must be proportionate to the importance of the objective pursued. This entails consideration of the breadth of data categories shared, the number of agencies involved, the duration of retention, and the potential downstream uses of the data. A minimal impairment principle would require that inter-agency data flows be designed to minimise unnecessary exposure of sensitive attributes and to limit secondary uses unrelated to the original purpose (Harun, 2025).

iv. **Transparency**- Fourth, the doctrine should emphasise transparency as a constitutional expectation in the design and operation of public-sector data systems. As a matter of principle, individuals should be able to know, at least in general terms, which categories of their data are shared, between which agencies, for what purposes, and under what legal authority. Current practice under the Data Sharing Act 2025 does not clearly guarantee systematic public reporting on the scale, frequency, and types of inter-

agency data exchanges. Under a doctrine of informational autonomy, opacity would be treated as a factor that counts against the constitutionality of extensive data-sharing arrangements, especially where they significantly affect liberty or equality interests (Abdul Hadi, 2024).

v. **Accountability and Redress** - Fifth, the doctrine should require that individuals have accessible avenues to challenge unlawful or disproportionate State data practices, this does not necessarily require a new constitutional remedy, but it does require that existing mechanisms, such as judicial review, constitutional litigation, or complaints to oversight bodies, be meaningfully available in data-related cases. The presence or absence of independent oversight, whether judicial or institutional. Would be a key consideration in assessing whether public-sector data governance is compatible with Article 5(1) and 8(1) of Federal Constitution (Che Yussoff, 2021).

5.3. Application to the Data Sharing Act 2025

Applying this proposed doctrine to the Data Sharing Act 2025 highlights specific areas where constitutional alignment appears fragile. From the perspective of autonomy and justification, the Act's broad definition of "data" and the absence of an explicit distinction between personal and non-personal data mean that very wide categories of personal information can be brought within inter-agency sharing regimes without tailored safeguards. Under a doctrine of informational autonomy, courts could interpret Article 5 (1) as requiring that data-sharing decisions affecting intimate or highly sensitive information be subjected to closer scrutiny than decisions involving aggregated or anonymised data (Daud. M, 2025).

Proportionality concerns arise where inter-agency access is granted on a wide, ongoing basis, with limited temporal or categorical constraints, especially if the same policy outcomes could be achieved with more targeted or pseudonymised datasets. Transparency is implicated by the largely internal nature of the DSA 2025 mechanisms, which make it difficult for individuals to trace how their personal data move through the public sector.

A doctrine of informational autonomy would support interpretations of the Act that favour publication of general data-sharing frameworks, regular reporting, and, where feasible, mechanisms enabling individuals to obtain information about significant uses of their data. In the absence of constitutional litigation on the Act, it remains uncertain how Malaysian courts would respond to a challenge framed explicitly in terms of informational autonomy. Nonetheless, the doctrine provides a structured lens through which courts could evaluate whether specific applications of the DSA 2025 unduly impair personal liberty or equality.

6. CONCLUSION

The proposed doctrine of informational autonomy could be developed in Malaysia through at least three complementary pathways: judicial interpretation, legislative reform, and institutional design. First, courts could, in appropriate cases, explicitly recognise that certain dimensions of personal data control fall within the

protective scope of Article 5(1), drawing analogies from existing liberty and dignity jurisprudence.

Such recognition could be incremental, starting with cases involving particularly intrusive or wide-ranging public-sector data practices, rather than attempting to define a comprehensive right in a single judgment. Secondly, the Parliament could revise or supplement the Data Sharing Act 2025 and related statutes to incorporate explicit references to constitutional principles of autonomy, proportionality, and non-arbitrariness, thereby operationalising the doctrine in positive law. This might include introducing public-sector data protection provisions, mandating privacy impact assessments, and imposing heightened safeguards for sensitive categories of data.

Thirdly, institutional reforms, such as strengthening existing bodies or creating a specialised oversight mechanism for government data practices which could give practical effect to accountability and redress dimensions of informational autonomy. These pathways are not mutually exclusive; together, they would help embed informational autonomy as a living constitutional principle guiding Malaysia's digital transformation, rather than as a purely theoretical construct.

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FROM E-GOVERNMENT TO DIGITAL GOVERNMENT: RECENT ADVANCES AND LESSONS LEARNED FROM THE KOREAN EXPERIENCE

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ABSTRACT: Despite significant progress in e-government initiatives across many developing countries, as reflected in the UN e-Government Development Index (EGDI), several nations—particularly in Sub-Saharan Africa—continue to face substantial challenges. These include inadequate IT infrastructure, low digital literacy, severe budget constraints, bureaucratic resistance to change, among others. Sharing lessons from successful countries in building digital government can provide valuable guidance to these nations. This can help them to consolidate best practices and overcome common pitfalls. To this end, this study highlights the key success factors, experiences, and lessons learned from the development of Korea's digital government. Beginning with the computerization and informatization eras and progressing to the current digital transformation era, Korea has pursued advancements over the past 40 years that have laid the foundation for its emergence as one of the leading countries in e-government and the digital revolution. This workr explores and emphasizes the socio-technical development pillars and elaborates on the key services provided. It also summarizes the challenges encountered and lessons learned. The paper employs qualitative methods to examine how the core policies of Korean e-government were formulated and implemented. It includes document analysis and reviews of key stakeholder websites.

KEY WORDS: *Digital government, e-government, Digital Platform, AI and Data, Korean Experience, SDGs*

1. INTRODUCTION

Based on the UN e-government survey, South Korea is among the leading countries in the E-government Development Index (EGDI). It has achieved this position due to its continuous development starting in the early 1970s (Chung, 2015; joon, 2009). As shown in Figure 1, beginning with the introduction of computers in the departments of statistics and planning in the 1960s, and extending to the current era of digital government characterized by the use of advanced ICT and the adoption of AI technologies, the country has leveraged these advancements to achieve significant socio-technical and technical progress. Today, e-government is a cornerstone of all advanced economies. It plays a crucial role in modernizing public administration by leveraging Information and Communication Technologies (ICT) to enhance service efficiency, transparency, and citizen engagement. E-government also reduces operational costs, provides better and more convenient access to services, and fosters trust by creating more transparent, accountable, and

responsive interactions between governments and citizens(Khanova, Matyushenko, Shtal, Rudych, & Grygorova-Berenda, 2025).

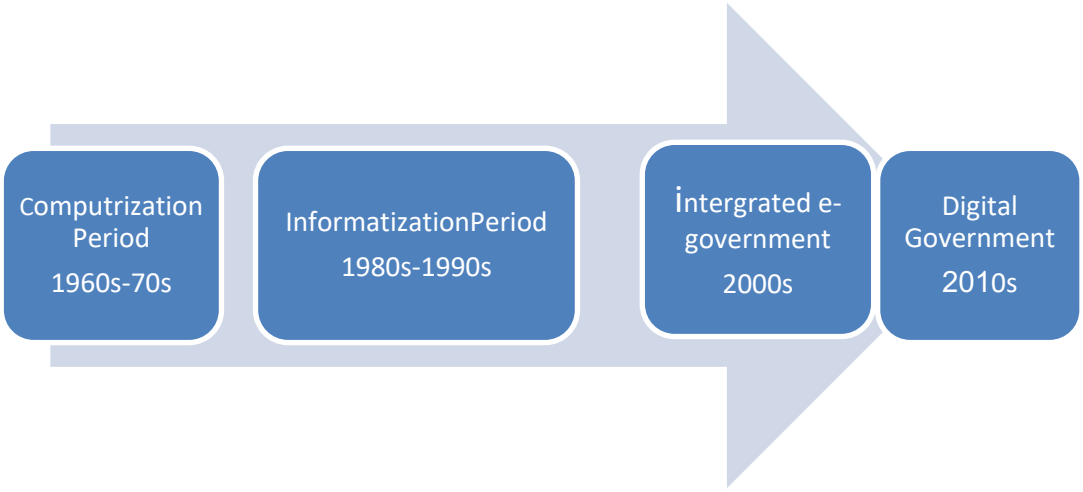

Fig.1. Historical development of the digital government in Korea

In addition to supporting overall economic development, today's e-government services constitute a crucial catalyst for achieving the 2030 Sustainable Development Goals (SDGs)(Durkiewicz & Janowski, 2021; Solomon & Van Klyton, 2020). They accelerates progress on goals related to poverty reduction, quality education, gender equality, and sustainable cities. Additionally, they enhance service delivery, boost accountability, and increase citizen engagement(Islam, Ya, & Sultana, 2025; Lim, 2015). To this end, many researchers believe that the implementation and effective utilization of the surplus benefits of e-government are crucial for developing countries and Sub-Saharan African nations to reduce administrative bureaucracy, increase transparency, enhance public accountability, foster trust in government institutions, reduce corruption, and facilitate economic growth by streamlining interactions among citizens, businesses, and government(Rarhoui, 2024a; Twizeyimana & Andersson, 2019).

E-government project implementation in developing countries and Sub-Saharan African nations faces critical challenges, primarily due to inadequate ICT infrastructure, limited financial resources, and a significant digital divide. Additional key obstacles include a shortage of qualified personnel, resistance to change within bureaucracies, and heavy reliance on external technology vendors, among others(Nkohkwo & Islam, 2013; Pramuditha, Muhafidin, Sumaryana, & Susanti, 2025; Rarhoui, 2024b; Saeid, 2025; Saikia, 2024; Thorpe & Pokhrel, 2024). The purpose of this work is to highlight several key lessons for policymakers and practitioners derived from the successful global implementation, design, and execution of e-government, with a particular focus on the Korean experience and its e-government development journey. To this end, the remainder of the work is organized as follows: Section 2 rigorously highlights and explains the key socio-technical and technological success factors of Korea's e-government development project; Section 3 describes the main services provided by the project; and Section 4 summarizes the key challenges and recommendations.

2. RESEARCH METHODOLOGY

This research employs qualitative methods to examine how the core policies of Korean e-government development were formulated and implemented. It includes document analysis and reviews of key stakeholder websites. Additionally, policy evaluations are conducted to gather data on both intended and actual practices. Reports from the United Nations e-Government Development Index (EGDI) and the Organisation for Economic Co-operation and Development (OECD) on e-government development in Korea are also utilized.

3. KEY SOCIO-TECHNICAL SUCCESS FACTORS OF THE E-GOVERNMENT DEVELOPMENT OF KOREA

Over the last three decades, Korea has made significant progress in e-government thanks to the development of 'joint optimization', which is a complex interdependent system of social and technological elements (socio-technical). This socio-technical advancement results in an excellent e-government technological design that meets social needs for better performance. The main socio-technical success factors of Korea's e-government development journey can be identified from the Korean e-government policy framework, which consists of five pillars, as shown in Figure 2. These include strong political leadership, excellent governance and a robust legal framework, sustainable advancement in project funding (financial resources), systems operation, technical support, and innovation(Karippacheril, Kim, Beschel Jr, & Choi, 2016).

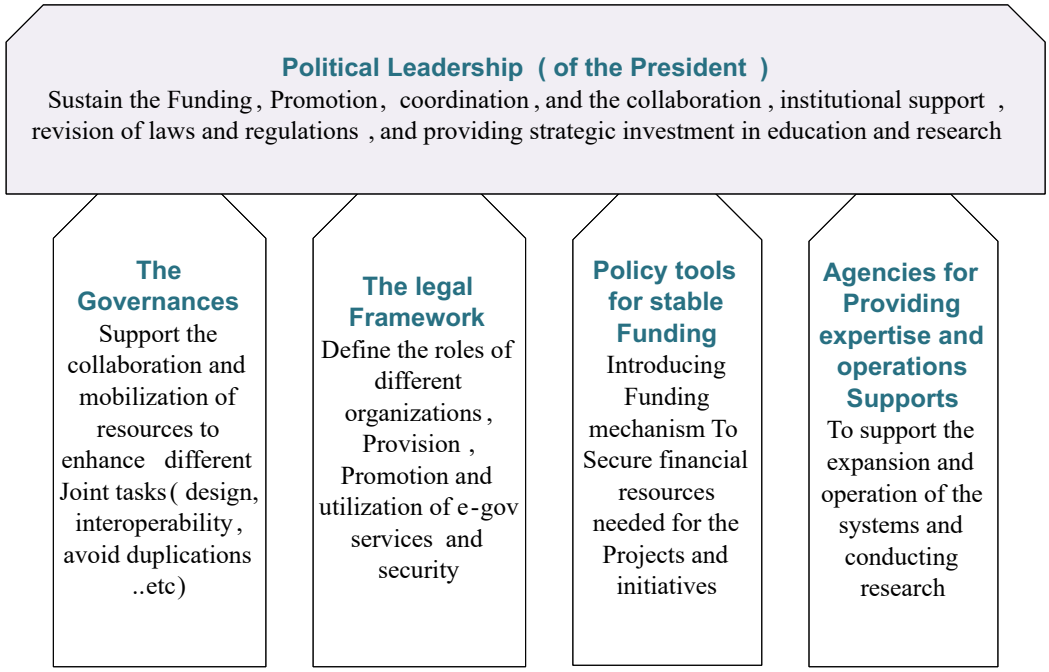

Fig. 2. Key social-technical success Factors of the e-government development of Korea

4. POLITICAL LEADERSHIP AND GOOD GOVERNANCE PILLARS

First of all, the strong political leadership demonstrated by the President of Korea, regardless of the regime/period, for the e-government project not only supports coordination and collaboration among different entities but also promotes and sustains a commitment to continuously energize innovation and development in all aspects of the project and its initiatives throughout the entire process(joon, 2009). For example, over the past 30 years, digital government innovation issues has been promoted as a national agenda regardless of changes in the political regime (Chung, Choi, & Cho, 2022). Another important aspect related to leadership is its role and position in the top of the overall governance of e-government projects, which involves the institutional arrangements that support mission, collaboration and the mobilization of resources and initiatives to enhance different tasks.

Excellent e-government governance is critical for the successful implementation of e-government projects because it provides the strategic framework, policy alignment, coordination, sustainability, and oversight the projects to ensure efficiency, transparency, accountability, and risk management. In fact, in the Korean case, its proper governance successfully manages complex stakeholder interactions, reduces the digital divide, and ensures that technology adoption aligns with public service goals(Chung et al., 2022). The detailed structure of the current Presidential Committee on Digital Platform Government (DPG) and the corresponding governance framework for Korea's digital government are illustrated in Figures 3 and 4, respectively. This innovative governance framework is responsible for executing the current mission and key initiatives to advance the digital government to the new Digital Platform Government, which will be powered by AI and data and characterized to be a people-centric, a one-team government, a growth platform for public-private collaboration, and a foundation of trustworthiness(Bang et al., 2024; Moon, 2024; Myeong, 2025). Furthermore, a careful examination of the historical records of various institutional arrangements used as governing bodies during the different development phases of e-government projects of Korea listed in table 1, along with the current Digital Platform Government governance summarized in Figures 3 and 4, highlights the significant role of effective governance in the development of e-government(J.-S. Hwang, 2023; the Presidential Committee on Digital Platform Government 2023).

Table 1: Presents the major governance bodies responsible for the successful implementation of the e-government development strategy throughout its journey. Source (J.-S. Hwang, 2023)

Period	Key Objectives	Key Organizations	Characteristics
1987-1995	• Computerization of National Basic Data	• National Computerization Board under President • National Computerization Agency	• Computerization of 5 key areas such as public administration, finance, education, national defense, security • Lay the foundation for e-government and data era
1995-2000	• Information Superhighway (Broadband Internet)	• National Informatization Committee chaired by the Prime Minister	• Enact of Framework Law on National Informatization • Integrated approach to digital government

	• Digital & Online Service	• establish of Ministry of ICT (MIC)	• World first nationwide roll-out of broadband Internet
2001-2007	• e-Government Development (Integration) • Ubiquitous computing	• special committees on e-Government **under President** • National Informatization Committee	• Strong leadership from the President • Upgrade to integrated e-Government and services • Two separate governances for e-Gov and national ICT
2008-2012	• e-Government (governance)	• dismantle of MIC and distributed governance • National Informatization Strategy Committee	• Weakening of ICT governance with distributed organizations • Introduction of new ICT management such as CIO position and enterprise architecture
2013-2016	• Smart Government (Gov3.0)	• Government 3.0 Committee • establish of Ministry of Science and ICT	• Focus on government innovation based on emerging technologies such as data analytics • Two separate governances for e-Gov and national ICT
2017-2022	• The Fourth Industrial Revolution (FIR)	• **Presidentia**l Committee on the Fourth Industrial Revolution • National Data Policy Committee	• Focus on national ICT for FIR • Development institutions and organization for data and AI
2022-Present	• Digital Platform Government	• **Presidential** Committee on Digital Platform Government	• New government innovation model based on data infrastructure and close collaboration between the public and the private sectors

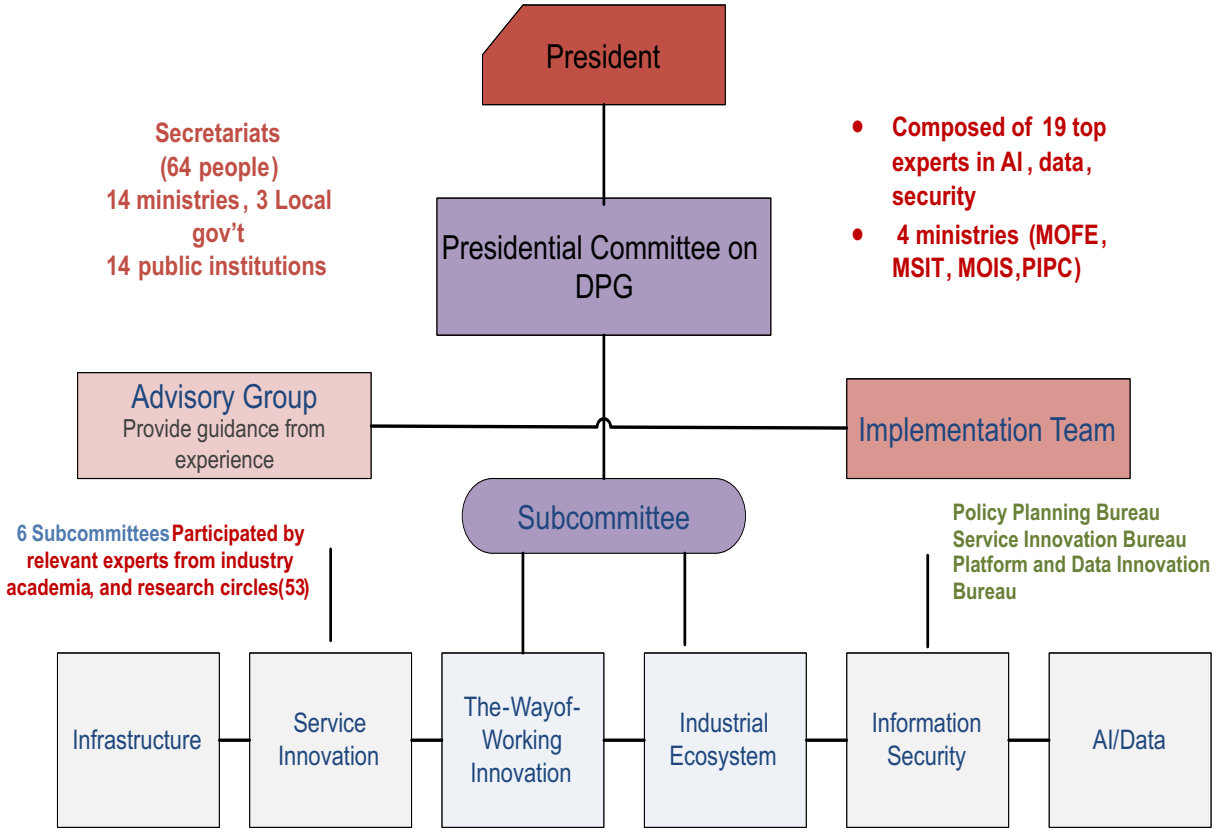

Fig. 3. the Presidential Committee on Digital Platform Government Information Source (DPG) (J.-S. Hwang, 2023)

As shown in figures 3 and 4, the current Korean Digital Government Governance structure is composed of a set of ministries, government entities, research institutes, and technical and innovation creation agencies led by the Presidential Committee on Digital Platform Government at its core. Furtheremore, the Presidential Committee on Digital Platform Government in turn gathered a group of technical experts commitees and Subcommettees who were based in industries, academia, and research(such as ETRI, K-data, TTA, and NIPA). The strength of his Governance structure is driven by a combination of high-level political commitment that transcends administration changes, and the centralized and coordinated institutional model led by the Ministry of the Interior and Safety (MOIS) as explicitly shown in figure 4. In fact, the success of the Korean e-government Project during its journey can be attributed to its strong governance(Chung et al., 2022; OECD, 2025).

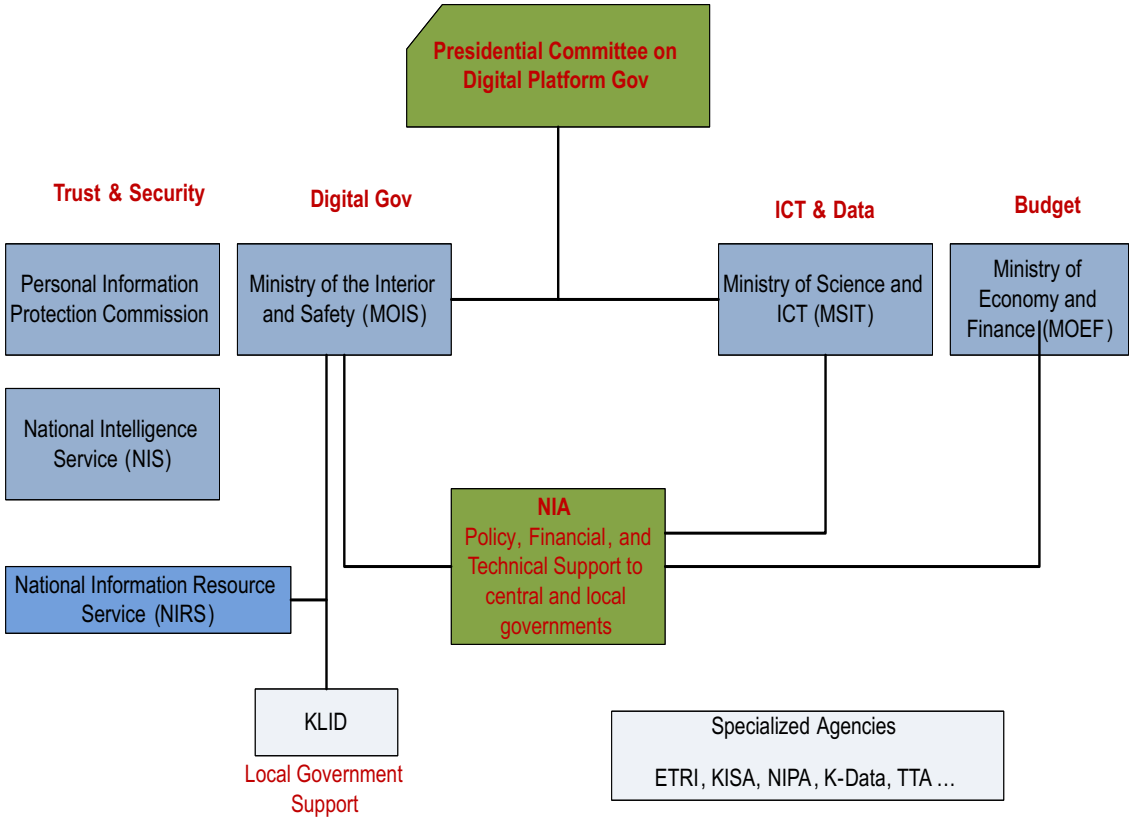

Fig.4. Korean Digital Government Governance structure
Information Source (J.-S. Hwang, 2023)

5. THE LEGAL FRAMEWORK OF THE E-GOVERNMENT OF KOREA

In 2001, Korea established its first e-Government Act to reduce paper documents and provide electronic administrative services to the public. (Chung & Kim, 2019). The major laws and regulations that contribute to the advancement of e-government development in Korea are listed in Table 2. These ground-breaking laws are aimed at improving administrative productivity, transparency, and democracy by digitizing government operations, establishing online service delivery, and enabling electronic processes. In fact, Korea's current global leadership in digital government can be traced back to the 2001 e-government Act and its amendments in subsequent years and periods. It mandates the digitization of administrative procedures (innovation, governance, planning, implementations, and operations), as well as establishing and enforcing fundamental principles such as efficiency, transparency, and convenience of services to citizens. The following amendment deals with the introduction of cloud services, Open Data/Government 3.0, Intelligent Government, and Digital Platform Government, which are the major milestones in Korean e-government advancement (Chung & Kim, 2019)

Table 2: Major Laws and Regulations Enacted for the Development of E-Government

Name of the Law	Main Purpose
e-government act 2001(continuously amended to emphasizing the use of e-government services by developing and providing administrative services demanded by the public)(Chung & Kim, 2019)	Provision and utilization of e-government services and data
Set of ICT Laws for internet promotion and information industry (such as Information and Communications Industry Promotion Act 2009)	Related to Promotion of internet, enhancement of internet industry, cybersecurity and personal data protection
Personal Information Protection Act (PIPA amended in 2023.)D. H. Kim & Park, 2024(	Comprehensive data privacy law regulating both online and offline data processing
The Korean Open Data Act, 2013(Seo, Kim, & Kwon, 2021)	Established a legal framework for public institutions to proactively provide data, aiming to enhance transparency, improve public services, and boost the economy.
Korean Basic Act on Intelligent Informatization (2020)	Contribute to realizing an intelligent information society
AI Basic Act 2025 (South Korea AISI, 2025)	Establishing a new framework for artificial intelligence (AI) by laying the fundamental matters necessary to support the sound development of AI and to establish a foundation for trustworthiness in AI society, thereby protecting the rights and interests of the people and their dignity, contributing to improving the quality of life of the people, and enhancing national competitiveness.

6. TECHNICAL AND FINANCIAL SUPPORTS AND INNOVATION

The Korean e-government story has been successful by institutionalizing e-government and placing key institutions at the core of e-government governance to provide technical support and innovation. To this end, both the Korean National Information Society Agency (NIA) and the Korean Local Information Research & Development Institute (KLID) are introduced as core institutions in the development of Korean e-government. Their past role was to promote and establish the foundation for e-government projects. Currently, their focus has shifted to the development of e-government support projects, system operation and management, as well as research and innovation. In addition, Table 3 lists the main agencies contributing to the advancement of e-government. On the other hand, to sustain financial support for the continuous development of e-government, the Korean government has introduced the use of settlement after investment, information promotion fund, and general accounting budget funding mechanisms. In addition to service engineering, another fundamental component of Korea's e-government project is the telecommunications infrastructure developed through the Korea Information Infrastructure (KII) Project and the Three Government Data Centers Projects. These initiatives are essential, significant, and financially demanding projects.

Table 3: lists the main agencies contributing to the advancement of e-government. Source (NIA and MOIS. 2025)

Agency	Main Function
National Information Society Agency (NIA)	Korea's leading government agency driving the development of an inclusive, innovative, and resilient digital society.
Korea Internet & Security Agency · (KISA)	Leads a Secure and. Reliable Digital Future Society
Korean National Central Intelligence Agency	Contribute to the Innovations in security and cybersecurity
National IT Industry Promotion Agency. NIPA	Reinforcing the competitiveness of the ICT industry and contributes to the economic growth through the efficient support and laying the groundwork for the industrial technology promotion
Electronics and Telecommunications Research Institute(ETRI)	Makes contribution to the nation's economic and social development through research, development and distribution of industrial core technologies in the field of Information, Communications, Electronics, Broadcasting and Convergence technologies

7. MAJOR AND IMPORTANT E -GOVERNMENT SERVICES

Table 4 highlights the most important e-government services in Korea, even though almost everything is digital. These services facilitate digital interactions between the government and citizens (G4C), the government and businesses (G4B), and the government to government (G4G). These services leverage the surplus generated by digital government technology for the benefit of Korean citizens and the nation as a whole (Panayiotou & Stavrou, 2021). More details on the full list of the services provided by the digital government of korea is available at(Ministry of Interior and safety, 2023). As shown in Figure 5, these e-government services are running on top and supported by a robust telecommunications infrastructure, which comprises the Korean information infrastructure and 5G broadband networks; a data infrastructure comprising three government data centers; and a cloud infrastructure consisting of G-Cloud and a public-private hybrid cloud. Notably, these infrastructures have been incrementally developed and built during different and successive planning periods.

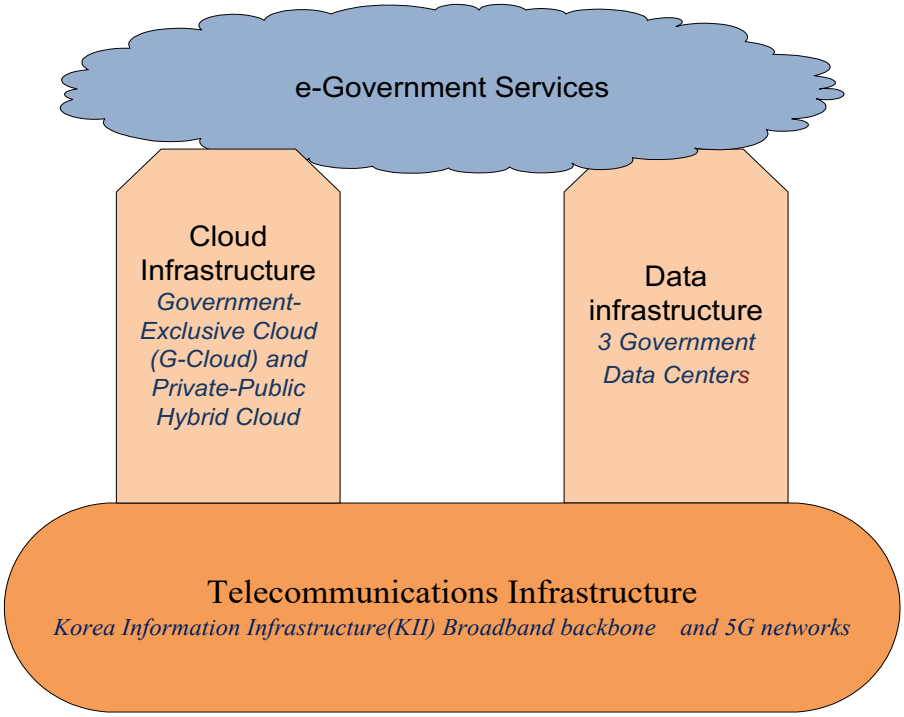

Fig. 5. Shows the main infrastructure components supported the Korean e-government services

Table 4: Major and important e-government services provided by the Korean e-government

Name of the Services	Type of the Services	Main Functions
One-stop Government service Portal (government 24 at Gov.kr)	G4C	This is an Integrated platform for all public government services
Korean Online E-Procurement System (KONEP)	G2B	Facilitate the processes of E-Procurement From registration to Payment
UNI-PASS	G4B	Electronic Custom clearance system
National Electronics Tax system (HomeTax)	G4C	Facilitate Tax Services payment and filing online
Digital budget and Accounting system (dBrain)	G2G	Integrated financial management information system
Online petition and discussion portal (e-people)	G4C	Facilitate citizen participation in all kind of civil petition
Open data portal (www.data.go.kr)	G4B and G4C	Create value from free use of public data. This is very important for innovation and innovative systems development (for more details see the experience of the K-response for Covid-19)

8. KOREAN PROGRESS FROM E-GOVERNMENT TO DIGITAL PLATFORM GOVERNMENT

Although the terms e-government and digital government are used interchangeably in this article, this may be because the concept of digital government has only recently been established and remains in the research stage. In fact the practice of digital government tends to be developed based on e-government, and the concept of digital government is not yet firmly established

outside Korea. In fact Korea, several large-scale projects underway to transform it is e-government into digital government and what is called Digital Platform Government (DPG) . In today's world, the development and implementation of digital government services and applications are very important for economic growth. Many consider it one of the very important pillars of the overall country's digital transformation process. The digital government concept grew from the traditional e-government concept to incorporate a more comprehensive digital transformation of the public sector, embracing data as a strategic asset, adopting emerging technologies and ensuring government innovations to keep pace with industrial and societal change. The OECD defines digital government as using digital technologies to modernize and create public value. It depends on a digital ecosystem that includes government actors, NGOs, businesses, citizen groups, and individuals. This ecosystem supports access to data, services, and content through interaction with the government." On the other hand, the OECD's definition of e-government is basic: "the use of the governments of information and communication technologies (ICTs), and particularly the Internet, as a tool to achieve better government". According to the OECD definition, we can conclude that Korea is currently in the era of digital government.

9. KEY CHALLENGES RECOMMENDATIONS

Based on Korea's experience in implementing and developing e-government, several key lessons have emerged for policymakers and practitioners in designing, executing, and sustaining innovations in the development of digital government, as demonstrated in the previous sections. Our focus in this section is to highlight the main challenges and open-ended problems that must be addressed for greater innovations, and the key recommendations that can be learned from past experiences.

9.1. Key Challenges

The Korean government is facing several challenges as it tries to incorporate and use AI, big data, blockchain, and increased citizen inputs into service design and provisioning. Privacy concerns, scalability issues, ethical regulations, and change management issues are all part of this. Bridging the digital divide for vulnerable groups and addressing skills gaps are additional challenges that need to be addressed.

9.2. Key Rekommandation

- Have strong political will and Strategic vision are Paramount: This is justified because successful e-government projects require strong commitment from top management to drive coordination and implement the necessary structural, organizational, and cultural changes(Elmatsani, Widianingsih, Nurasa, Munajat, & Suwanda, 2024).
- Institutionalize (establish good governance legal framework) and adopt an incremental approach to develop the digital government: Rather than implementing massive systems all at once, it is often better to begin with

phased and targeted outcomes. This agile approach supports preserving interoperability, making open sources, reusability, standardization, and the use of e-GovFrame and common Enterprise Architecture (EA) (Ahmad, Drus, & Kasim, 2020; Lee, 2016; Lucia Kim & Teo, 2013).

- Focus on User-Centric Design: E-government should be designed around the needs of citizens rather than the bureaucratic structure of departments. This approach is supported by recent advances in e-government research, as reported by(Bokayev et al., 2021; Durmuş, 2012; H. Hwang & Kim, 2025)
- Bridge the Digital Divide , Literacy and skills Gap: Inadequate infrastructure, limited digital literacy, and insufficient digital skills are reported as major barriers. Therefore, policymakers must invest in public education reform at both basic and higher education levels, as well as provide training for employees by developing sharing and collaboration strategies at national and international levels. Additionally, they should strive to ensure minimum accessibility and connectivity for all(Ishak, Khalid, Jenal, Rizal, & Abd Rashid, 2024; Myeong, Kwon, & Seo, 2014).
- Prioritize Data Security and Privacy: Concerns about data breaches are a major barrier to adoption. Therefore, robust cybersecurity measures—including strategies, laws, and regulations—should be developed or enacted, and clear privacy policies are essential to foster public trust(Feigenbaum & Nelson, 2021; D. K. KIM, 2019; Paz, Tejerina, & Kang, 2024).
- Sustainable Financial Planning: E-government is a long-term strategic project that requires sustained investment—not only for initial setup (to buildcommunications, data and cloud infrastructure), but also for ongoing maintenance, upgrades, and capacity building. Classical funding techniques are insufficient; innovative funding approaches are necessary. This can include the use of centralized revolving funds, public-private partnerships, results-based financing, among others(Chima & Kasim, 2018; Owusu, 2015).
- Leverage the making use of the Public-Private Partnerships (PPPs): In addition to funding, partnering with the private sector can enhance capacity building, address the digital divide, and bridge gaps in technical expertise and infrastructure. This is justified by the practice reported by (Kaliannan, Awang, & Raman, 2010; Palaco, Park, Kim, & Rho, 2019; Sarker, 2025; Sharma, 2007).
- Focus on Change Management and modernization: Resistance to transitioning from manual to digital processes is a significant traditional challenge. A robust change management strategy is essential to address resistance within the civil service departments(La Bella & Santoro, 2025).

10. CONCLUSIONS

This article highlights and deeply researches and explains the key policy socio-technical pillars contributing to the success of the Korean e-government project. Additionally, it lists and elaborates on the major categories of services. Finally, the article summarizes the key recommendations and challenges. Our aim is to provide

policy guidance to developing and Sub-Saharan African countries on how to implement e-government and maximize the benefits of ICT technology. The aim is to encourage their economic growth and contribute to the global Sustainable Development Goals (SDGs).

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THE COMPUTATIONAL CONVERGENCE OF AI AND ISLAMIC DIGITAL HUMANITIES: A CRITICAL ANALYSIS OF NLP APPLIED TO THE ARABIC LANGUAGE, QURAN, HADITH, AND ISLAMIC LITERATURE

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ABSTRACT: This study investigates the accelerating paradigm shift driven by Artificial Intelligence (AI) and Deep Learning architectures within Arabic computational linguistics and Islamic scriptural hermeneutics. Contemporary literature indicates that Natural Language Processing (NLP) provides robust frameworks for parsing complex Arabic morpho-syntactic structures and semantic layers, alongside automating translation and manuscript digitization. Specialized deep learning architectures—specifically domain-adapted Arabic BERT variants—have significantly mitigated systemic grammatical and semantic ambiguities. Conversely, deploying these systems introduces profound ethical, ontological, and theological vulnerabilities, including data-driven algorithmic biases and epistemic hallucinations within sacred text interpretations. To secure a resilient and doctrinally sound implementation, this paper proposes a governance matrix derived from the teleological objectives of Islamic jurisprudence (Maqasid al-Shariah). Through comprehensive case studies, empirical benchmarks, and comparative cross-lingual analyses, this research demonstrates that maximizing AI's utility for Islamic cultural heritage requires a strictly regulated equilibrium balancing technical automation with expert human oversight and foundational Islamic principles.

KEY WORDS: *Artificial Intelligence, Arabic NLP, Scriptural Hermeneutics, Quranic Analytics, Hadith Verification, Maqasid al-Shariah, Computational Ethics.*

1. INTRODUCTION

The field of computational linguistics has recently experienced profound paradigm shifts driven by deep learning and Transformer-based Large Language Models (LLMs). These technological breakthroughs have expanded the horizons of AI applications into highly complex linguistic and theological domains. Among world languages, Arabic occupies a unique position; as the liturgical vehicle of the Holy Quran, Prophetic traditions (Hadith), and classical Islamic literature, it possesses an intricate, multi-layered morphological, syntactic, and semantic architecture.

This structural complexity presents exceptional challenges for standard computational models. The tri-literal and quadri-literal root-and-pattern system,

extensive derivational morphology, and rich context-dependent semantic variations make mapping Arabic text via automated systems technically challenging. However, the advent of domain-adapted LLMs and advanced NLP pipelines has unlocked unprecedented capabilities for deep structural and semantic parsing of sacred texts.

This study establishes a rigorous framework to:

- Deconstruct the mechanics of AI integration within Arabic syntax, morphology, and semantics through empirical benchmarks.
- Evaluate live case studies and algorithmic performance within Quranic text mining, Hadith verification, and classical literature retrieval.
- Formulate a robust ethical and jurisprudential governance model anchored in Maqasid al-Shariah to align algorithmic outputs with Islamic values.
- Execute a cross-lingual performance comparison contrasting Arabic AI pipelines against Anglocentric models to isolate systemic digital divides.
- Outline practical applications transforming digital pedagogy, machine translation, and manuscript digitization across the global Islamic ecosystem.

2. THEORETICAL FRAMEWORK AND LIERATURE REVIEW

2.1. Morpho-Syntactic Intricacies and Computational Barriers

The Arabic language relies on a non-concatenative root-and-pattern morphological system that challenges standard Western NLP parsing designs. A singular token can represent a complex semantic proposition through agglutination. For example, the Quranic token "فأسقيناكموه" ("and We have given it to you to drink"—Surah al-Hijr) morphologically compresses a conjunction, a particle, a perfect verb, an agent pronoun, an indirect object pronoun, and a direct object pronoun into a single orthographic unit.

Furthermore, historical and classical Arabic texts frequently lack short vowel diacritics (Tashkeel), inducing intense semantic homography. A non-diacritized word like "عقد" can be phonologically and semantically decoded into vastly different lexical categories based on syntax, such as a verb meaning he tied/contracted, or nouns representing decades or contracts. This deep structural ambiguity historically caused Arabic computational development to lag behind its English counterparts by approximately a decade.

2.2. Syntactic Parsing (Al-Nahw)

Computational models must accurately capture syntactic configurations—including case markers (I'rab), explicit or latent agents (Fa'il), and aspectual verbal shifts—to ensure high-fidelity semantic extraction. While modern neural models utilize syntactic dependency parsing to map subject-verb-object dynamics, several core challenges persist:

- Lack of Capitalization: Arabic lacks capitalization markers, severely complicating Named Entity Recognition (NER) for identifying proper nouns, titles, and geographic locations.

- Diacritic Absence: The absence of explicit case endings distorts structural parsing, necessitating automated diacritized text synthesis and data augmentation algorithms to reduce syntactic entropy before text execution.

2.3. Morpho-Syntactic Intricacies and Computational Barriers

Computational models must accurately capture syntactic configurations—including case markers (I'rab), explicit or latent agents (Fa'il), and aspectual verbal shifts—to ensure high-fidelity semantic extraction. While modern neural models utilize syntactic dependency parsing to map subject-verb-object dynamics, several core challenges persist:

To understand the mathematical optimization driving modern neural tokenizers during the morphological decomposition of an agglutinated Arabic word string W the process can be modeled as finding the optimal sequence of morphemic segments $\widehat{M} = (m_1, m_2, \dots, m_T)$ that maximizes the conditional log-likelihood parameterized by network weights θ:

$$\widehat{M} = \arg M^{max} \sum_{t=1}^{T} \log P(m_t | m_{<t}, W; \theta) \quad (1)$$

When resolving homographic tokens resulting from the absence of diacritics, soft-attention layers compute alignment scores e_{ij} and normalized attention weights α_{ij} to dynamically weigh the contextual significance of surrounding tokens:

$$\alpha_{ij} = \frac{\exp(e_{ij})}{\sum_{k=1}^{U} \exp(e_{ik})} \quad (2)$$

$$e_{ij} = v_a^T tanh(W_a s_{i-1} + U_a h_j) \quad (3)$$

where h_j represents the hidden representation vector of the target Arabic sub-word element, s_{i-1} denotes the decoder state, and W_a, U_a, v_a^T constitute learnable weight tensors optimized during domain adaptation training.

2.4. Semantic Vectorization and Lexical Networks

Capturing context within the highly elevated rhetoric of sacred text requires dense semantic vector spaces capable of handling intricate allegories, historical idioms, and complex metaphors. Unsupervised models frequently fall victim to semantic drift when analyzing sacred corpora. To preserve the accurate meaning of sacred concepts, AI frameworks utilize multi-layered semantic networks that establish explicit ontological relationships between verses (Ayat), and correlate Quranic passages directly with prophetic traditions (Hadith) and classical commentaries (Tafsir). Without these context-aware restrictions, generative architectures frequently suffer from severe epistemic hallucinations—producing highly persuasive, grammatically flawless text that is completely inaccurate regarding Islamic theology and law.

Formally, the token transitions within these high-dimensional vector spaces rely on Scaled Dot-Product Attention structures. Given an input matrix containing embedded tokens of classical commentaries, the attention weights are computed

using Query (Q), Key (K), and Value (V) transformations scaled by the dimensionality hidden parameter d_k:

$$Attention(Q, K, V) = softmax\left(\frac{QK^T}{\sqrt{d_k}}\right)V \quad (4)$$

By optimizing this mechanism, domain-adapted transformers can mathematically isolate cross-textual semantic parallelisms across disparate centuries of classical scholarly production.

2.5. Evolution of Digital Lexicons and Corpora

The transition from static lexicons to dynamic, machine-readable knowledge bases represents a foundational shift in Arabic NLP. Initiatives like Arabic WordNet, alongside digital text databases such as the Tanzil Project, serve as vital benchmarks for training and validating state-of-the-art models. The lexical diversity of sacred text is exceptionally dense; the Quranic corpus contains 5,277 unique lexical stems across a total running word count of 157,935 tokens, demanding high-capacity representations to avoid overfitting or vocabulary gaps.

3. SPECIALIZED AI ARCHITECTURES IN QURANIC AND HADITH HERMENEUUTICS

Recent literature highlights specialized NLP applications designed for sacred text corpora. A landmark systematic review by Bashir et al. (2023) demonstrated a sharp rise in Quranic NLP engineering since 2010, covering focus areas from automated morphological tagging to audio-based automatic speech recognition (ASR) for acoustic verification of recitation (Tajweed). Crucially, the review notes that the Quranic text requires specialized handling due to its adherence to the preservation of the Uthmanic orthography (Al-Rasm al-Uthmani), which breaks modern standard Arabic spelling conventions. Furthermore, researchers emphasize that computational systems cannot parse the Quran in isolation; ignoring the Prophetic Sunnah and classical jurisprudential texts (Fiqh) leads to flawed semantic outputs and erroneous theological deductions.

In the domain of Hadith hermeneutics, models must evaluate both the textual content (Matn) and the complex genealogical chain of transmitters (Isnad). To address this, specialized models like ArabianGPT (offered in 0.1B and 0.3B parameter scales) provide native deep learning capabilities tailored for classical Islamic literature. Empirical evaluations demonstrate that ArabianGPT-0.1B achieves an accuracy rate of 95% in targeted sentiment analysis and classification tasks on religious texts, while its larger 0.3B counterpart excels at advanced text summarization and complex question-answering tasks.

4. APPLIED PARADGMS AND CASE STUDIES

4.1. Advanced Theological Question-Answering (QA) Systems

Recent engineering initiatives have led to the creation of highly specialized, annotated datasets designed to evaluate deep learning performance on sacred texts. Key developments include the QUQA Dataset (a Quranic Question-Answering repository featuring 3,369 curated query entries containing over 301,000 words) and the HAQA Dataset (a Hadith Question-Answering benchmark consisting of 1,598 structural entries tracking over 290,000 words).

When evaluating models across these benchmarks, hybrid implementations combining large and small AraBERT models produced top-tier accuracy for Quranic text retrieval, whereas CAMeL-BERT demonstrated superior performance when navigating the specialized biographical terminology used within Hadith databases. Notably, baseline commercial Large Language Models like raw GPT-4 produced subpar results on these datasets due to severe theological hallucinations. Resolving these errors required deploying Retrieval-Augmented Generation (RAG) pipelines, which anchor the model's generation stage within verified, authoritative Islamic texts and commentaries.

4.2. Neural Machine Translation (NMT) and Inter-Lingual Access

Deploying advanced neural translation frameworks (such as Google Translate alongside regionally developed engines like Qalam.ai) has dramatically accelerated global access to Islamic scholarship. However, preserving semantic precision across complex theological concepts remains a key challenge. Recent research within specialized linguistics journals confirms that standard translation engines frequently drop the fine-grained rhetorical nuances inherent to classical Arabic, highlighting the critical need for expert human-in-the-loop validation and fine-tuning.

4.3. Digital Preservation and Manuscript Digitization

AI is transforming the curation of historical Islamic heritage through advanced computer vision and specialized NLP pipelines. For example, the automated transcription of rare multi-lingual manuscripts—such as the Garshuni-Arabic manuscript project (which processes Arabic texts written in the Syriac script)—relies heavily on advanced Optical Character Recognition (OCR) systems integrated with custom language models. These deep learning pipelines correct orthographic anomalies and transcribe delicate materials into fully searchable digital databases, opening new doors for researching classical poetry, historical records, and early Islamic literature.

4.4. Personalized Educational Technology (EdTech)

Islamic educational platforms are increasingly adopting generative models and natural language interfaces to personalize language learning. Industrial metrics show that integration within systems like ArabicTutorAI drove a 30% increase in student engagement by dynamically tailoring lesson difficulties to individual user competencies. Similarly, institutions like the EdTech Academy in the United Arab Emirates utilize custom conversational agents and automated assessment metrics to deliver highly responsive, context-aware learning environments.

5. COMPUTATIONAL GOVERNANCE MATRIX: THE MAQASID AL-SHARIAH FRAMEWORK

The rapid expansion of AI architectures within theological domains demands a rigorous ethical framework. Scholars have demonstrated that the core tenets of Maqasid al-Shariah—the preservation of Religion (Din), Life (Nafs), Intellect (Aql), Lineage (Nasl), and Wealth (Mal)—provide a robust structure for technological governance. Applying these teleological goals to AI engineering isolates key operational rules: the preservation of intellect and life directly maps to ensuring data privacy, algorithmic equity, and individual liberty, while the principle of harm mitigation ("La darar wa la dirar") forms the foundational jurisprudential maxim governing software deployment.

Table 1: Ethical framework

Maqasid Domain	Algorithmic Vulnerability	Risk Assessment	Mitigation Strategy
Preservation of Religion (Hifz al-Din)	Epistemic Hallucinations & Unverified Fatwas	Critical: Risks corrupting theological truth and spreading doctrinal distortions.	Implement rigid RAG pipelines tied exclusively to verified classical text repositories; mandate human scholastic sign-off.
Preservation of Intellect (Hifz al-Aql)	Algorithmic Bias & Sectarian Prejudices	High: Can lead to cognitive echo chambers and systemic misinterpretations of religious texts.	Enforce radical transparency in training data distribution; diversify corpus sources to prevent localized bias.
Preservation of Privacy/Life (Hifz al-Nafs)	Unauthorized Data Mining & Surveillance	High: Leads to ethical violations and compromises personal safety.	Deploy decentralized, local privacy-preserving architectures with robust encryption layers.

To satisfy these requirements, computer scientists must work directly with traditional theologians, integrating formal frameworks of Islamic legal deduction (Usul al-Fiqh) directly into AI architecture designs to help prevent logical errors and keep model outputs aligned with Islamic ethical values.

6. CROSS-LINGUAL PERFORMANCE DISPARITIES: ARABIC VS ANGLOCENTRIC MODELS

Despite a global community of 422 million Arabic speakers spanning 27 countries, Arabic AI development faces major resource constraints compared to English-centric models. The vast majority of mainstream LLM research focuses on high-resource, Latin-script languages, creating a digital divide. This imbalance stems from a lack of diverse, high-quality training datasets and the structural challenges of parsing the unique morpho-syntactic features of the Arabic language.

From a performance standpoint, benchmark evaluations reveal that while mainstream models like GPT-4 show high proficiency in English, their performance drops significantly when handling complex Arabic tasks. For example, in dialectal

sentiment analysis tasks focusing on regional dialects, GPT-4 outpaced older models like Bard AI but struggled to match specialized, domain-specific models like AraBERT or CAMeL-BERT. This performance gap confirms that base generative architectures cannot replace highly tailored, manually curated data training pipelines. Furthermore, given that 73% of the global Muslim population does not speak Arabic natively, building high-performance, cross-lingual localization networks remains essential for global digital equity.

7. METHODOLOGY

This research adopts a critical multi-method analytic pipeline to evaluate the intersection of AI engineering and Islamic text analysis:

- Systematic Literature Review: Collection and critical evaluation of approximately 20 peer-reviewed academic papers (2020-2025) from specialized computational linguistics and theology journals.
- Empirical Data Architecture Analysis: Evaluation of open-source datasets and performance outputs, isolating benchmarks from the QUQA, HAQA, and ArabianGPT (0.1B/0.3B) systems.
- Semi-Structured Expert Interviews: Collaborative sessions held between computer science researchers and Islamic legal scholars to establish ethical baselines grounded in Maqasid al-Shariah.
- Indirect Comparative Case Study Analysis: Strategic review of active implementations (e.g., the Niyyah application, Alfanous search engine, and Garshuni-OCR translation tools) to extract systemic operational risks and strengths.

8. RESULTS AND DISCUSSION

8.1. Expanded Opportunities

- Advanced Syntactic and Semantic Comprehension: Implementing platforms like QuranGPT enables highly accurate structural mapping of sacred texts, automating parts of classical grammar analysis and allowing researchers to isolate parts of speech and structural assignments.
- Personalized Spiritual and Linguistic Pedagogy: Real-world educational data shows that tailored AI tutoring platforms generate higher student engagement; for instance, the platform Niyyah—active across 70 countries since 2023—leverages interactive text interfaces to help tens of thousands of users improve text memorization and linguistic understanding.
- Preservation of Cultural Heritage: Deep learning OCR systems allow institutions to digitize massive archives of delicate historical manuscripts at scale, which can then be paired with specialized open-source search tools like Alfanous to enable precise linguistic querying across ancient texts.

8.2. Persistent Challenges and Risks

Epistemic Hallucinations: Generative systems remain prone to fabricating unverified text, such as inventing completely false prophetic traditions (Hadith) or issuing flawed legal opinions, which highlights why autonomous generative AI cannot be granted independent authority over religious jurisprudence.

Resource Inequities and the Digital Divide: Developing and training massive language models requires massive computing infrastructure. These resource constraints threaten to centralize advanced Arabic NLP development within a few wealthy research hubs, potentially marginalizing academic institutions in developing nations—a gap that requires a concerted push from international bodies like UNESCO to fund open-source models, improve digital literacy, and expand access to shared computing infrastructure.

9. CONCLUSION

This research demonstrates that artificial intelligence provides highly powerful analytical frameworks for Arabic computational linguistics and Islamic digital humanities, provided these technologies remain guided by strict human expertise and clear ethical boundaries. Maximizing the value of these technological tools requires executing a coordinated, cross-disciplinary strategy:

- Mandate Ethical Oversight: Integrate the teleological goals of Maqasid al-Shariah directly into model development cycles to ensure data authenticity and prevent the spread of algorithmic bias.
- Develop Multi-Disciplinary Cooperation Pipelines: Build joint research networks that bring together software engineers, classical linguists, and Islamic legal scholars to systematically review training data and validate model outputs.
- Expand Open-Source Resources: Invest in building large, high-fidelity, open-source datasets that feature full grammatical diacritics and span diverse regional dialects.
- Reject Raw Autonomous Deployment: Require strict human-in-the-loop verification for any public-facing systems handling religious law, scriptural translation, or manuscript interpretation to protect the epistemic integrity of the tradition.

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APPENDIX A: COMPREHENSIVE DATA APPENDIX

This appendix details the quantitative profiles and dataset configurations of the core text repositories and specialized models examined within this study.

Table 2: Comprehensive data

Dataset Name	Text Focus / Domain	Total Word Count	Document / Query Entries	Unique Lexical Parameters
Quranic Corpus Baseline	Classical Arabic / Uthmanic Script	157,935 tokens	114 Chapters (*Surahs*)	5,277 unique stems
QUQA Dataset	Quranic Question-Answering	Over 301,000 words	3,369 curated queries	Domain-specific annotation
HAQA Dataset	Hadith Question-Answering	Over 290,000 words	1,598 annotated entries	Biographical transmitter chain mapping

Table 3: Specialized Neural Architecture and Performance Profiles

Architecture Model	Parameter Scale	Optimization Target	Benchmarked Target Domain	Top Accuracy Metric
ArabianGPT-0.1B	100 Million Parameters	Sentiment Classification	Classical Liturgical Text	95% (Sentiment Parsing Tasks)
ArabianGPT-0.3B	300 Million Parameters	Summary & Text Extraction	Complex Islamic Jurisprudence	High Generative Synthesis Capacity
AraBERT (Hybrid)	Variable Scale Models	Context-Aware Vectorization	Quranic Structural Extraction	Top Rank (Quran Retrieval Tasks)
CAMeL-BERT	Domain-Adapted BERT	Morphological Disambiguation	Hadith Narrator (*Isnad*) Queries	Top Rank (Hadith Analysis Tasks)

A CONCEPTUAL BUSINESS MODEL FOR SAFESPHERE: ADVANCING SMART HOME SECURITY SYSTEMS

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ABSTRACT: The goal of this paper is to present a conceptual SafeSphere Smart Home Security System business model embedded within a digital platform aligned with the United Nations Sustainable Development Goals (SDG). Although smart home technologies are expanding, adoption remains limited due to ecosystem fragmentation and multiple device communication protocols that complicate integration for users. To address this, the SafeSphere model proposes a smart home gateway that acts as a unified hub to manage diverse protocols, enhancing device interoperability and simplifying user experience. The value proposition centres on safety, convenience and compatibility through features such as AI-powered intrusion detection, PDPA-compliant local data storage and centralized control of cameras and locks via a single mobile application. Guided by the principle of Rahmatan lil 'Alamin, SafeSphere aims to promote universal well-being by offering accessible security solutions for all communities. The business model includes affordable and scalable packages for B40 and M40 households to encourage wider adoption and reduce digital inequality. The gateway approach also provides a standardized communication layer that benefits both users and hardware providers. The purpose of this paper is to develop an initial business model and platform that address the key challenges, pains and desired gains of four main customer segments: homeowners, small businesses operators, schools institutions and hardware providers. The initiative aligned with SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 16 (Peace, Justice and Strong Institutions), by promoting secure digital innovation and strengthening digital trust. The paper adopts the Design Thinking (DT) methodology to understand user pain points and generate innovative solutions. Business modelling tools such as the Business Model Canvas (BMC), Value Proposition Design Canvas (VPC) and Environmental Map (EM) are used to conceptualize and evaluate the proposed business model.

KEY WORDS: *Smart home security, Internet of Things (IoT), Data sovereignty, Business Model Canvas (BMC), B40 and M40*

1. INTRODUCTION

In the age of digital transformation, where cities aim to become "smart" and every device communicates through data, the twenty-first century is witnessing a blend between technology and daily life that is reshaping how people live, work and

protect their homes. The Fourth Industrial Revolution (4IR) has introduced technologies such as the IoT and AI that have revolutionized how individuals interact with their environments. In Malaysia, the increasing crime index from 50,813 cases in 2022 to 52,444 in 2023, with 41,991 property crimes reported has been one of the key factors driving the adoption of smart home technologies (Department of Statistics Malaysia, 2024). As Ab-Rahman and Razaly (2012, as cited in Mokhtar & Ismail, 2018) stated “home surveillance systems can be used to keep up with the increasing rate of crime” (p. 9).

Globally, the smart home security market was estimated at approximately USD 33.94 billion in 2024 and is projected to reach around USD 82.07 billion by 2030, growing at about 15.2% (Grand View Research, 2025). However, while these technologies promise convenience, they also expose vulnerabilities particularly in terms of data privacy and interoperability. The growing adoption of smart devices has led to diverse and uncoordinated ecosystems, forcing users to manage multiple applications and hubs that often fail to integrate seamlessly (Kam et al., 2023).

In Malaysia, security and interoperability remain fundamental challenges. The market is still dominated by imported smart home solutions that are costly and poorly adapted to local needs. These challenges highlight the need for a unified smart home platform that prioritizes safety and data sovereignty. The national agenda supports this direction under the 13th Malaysia Plan (2026-2030) that emphasises digital infrastructure, data governance and ICT-enabled growth (Ministry of Economy, 2025). Moreover, the recently tabled Malaysia Budget 2026 reinforced the government’s commitment by allocating resources to digital infrastructure, sovereign AI cloud services and 5G expansion (AmInvestment Bank Berhad, 2025). These figures highlight not only the urgent need for property protection but also the need for a centralized smart security hub that can unify multiple devices and protocols under one reliable platform.

To address this gap, the SafeSphere Smart Home Security Ecosystem is conceptualized as a next-generation hub that bridges compatibility across diverse smart home devices. SafeSphere serves as a central gateway capable of handling protocols such as ZigBee, Wi-Fi and Bluetooth allowing cameras, sensors, alarms and smart locks to operate through a single platform. This approach reduces complexity for users by replacing multiple apps with a single interface. Built with AI-driven motion recognition, IoT connectivity and locally hosted cloud services, SafeSphere ensures both technological efficiency and compliance with Malaysia’s Personal Data Protection Act (PDPA). In the spirit of rahmatan lil’ alamin, SafeSphere is designed not only as a commercial venture but as a contributor to safer, more inclusive communities, ensuring that B40 and M40 households also have equitable access to smart security technology. SafeSphere promotes trust and digital responsibility, reflecting the ethical vision of serving humanity and safeguarding communities in a sustainable way.

The MyMukim2Cloud initiative illustrates how integrated platforms can improve service delivery by consolidating data, improving security and streamlining processes across multiple stakeholders through a Whole-of-Government (WoG) approach (Saleh et al., 2013). This demonstrates that Malaysia benefits greatly from centralized systems built on shared databases, coordinated infrastructure and

interoperability which are the principles that similarly guide the development of SafeSphere.

The key customer segments include homeowners, small businesses, schools and hardware providers. For homeowners, the central job-to-do involves protecting family members and property through real-time monitoring but face challenges such as complex installation, high costs and privacy concerns. Furthermore, small business owners need reliable monitoring and access control for safety. Lastly, hardware providers aim to expand their market reach by integrating compatible smart devices through SafeSphere's ecosystem that can reduce distribution costs and enhance brand credibility.

Current solutions in the marketplace such as Eufy and Hive offer remote access, smart doorbells and motion sensors but rely heavily on international cloud servers, which raises concerns regarding the Personal Data Protection Act (PDPA) compliance and limits consumer control over their own data. Furthermore, they exhibit limitations in terms of affordability, local data hosting and system interoperability, thereby creating a gap in the Malaysian market (Kam et al., 2023). SafeSphere aims to address these gaps by providing a unified gateway architecture that improves reliable smart living.

Ultimately, SafeSphere is introduced as a practical response to current security and integration challenges, offering a reliable system that supports safer and more connected living environments across Malaysia. This platform reflects Malaysia's aspiration for a secure and digitally empowered society in line with the National 4IR Policy and MyDigital Blueprint 2030.

2. PROBLEM STATEMENT/OBJECTIVES

Growing concerns over safety in Malaysia underscore a critical demand for an integrated, secure, and locally optimized smart security ecosystem across several key customer segments. Homeowners increasingly struggle with fragmented smart home systems that lack interoperability, leading to unreliable surveillance, complex management, and privacy risks due to dependence on foreign cloud servers (Kam et al., 2023). Concurrently, small business operators face challenges related to affordability and scalability when adopting smart security systems needed to protect assets and ensure workplace safety, particularly as property crimes rose to 41,991 cases in 2023 (Department of Statistics Malaysia, 2024). Meanwhile, schools institutions are under immense pressure to significantly strengthen student and staff safety following several tragic incidents that exposed weaknesses in surveillance, supervision, and emergency response within educational institutions including the fatal stabbing of a 16-year-old student in Bandar Utama and the death of a 10-year-old student in a school toilet (The Straits Times, 2025). Furthermore, hardware providers encounter barriers in integrating their diverse devices into unified ecosystems, which limits their market reach and compatibility with emerging smart security platforms. Collectively, these pain points highlight a significant gap in the national security technology landscape, a lack of trusted, interoperable, and locally governed solutions that ensure safety, privacy and seamless user experience across all segments (Smart Home Security Market (2025-2030), n.d.). These challenges reflect a nationwide demand for technology-driven yet accessible

security infrastructure that aligns with Malaysia's Personal Data Protection Act (PDPA) and national digitalization agenda (Ministry of Economy, 2025).

The objective of this paper is to develop a conceptual business model for SafeSphere, a unified smart security ecosystem and mobile application designed to address Malaysia's urgent need for safer and smarter environments. SafeSphere seeks to integrate IoT-enabled devices such as cameras, alarms, and smart locks into a single, user-friendly interface that provides real-time monitoring, AI-assisted anomaly detection, and locally hosted cloud storage to ensure PDPA compliance. The platform aims to deliver tailored value to each customer segment: empowering homeowners with simple, privacy-conscious home protection; supporting rental property owners and SMEs with affordable, scalable security; enhancing schools' ability to monitor large areas and respond quickly to emergencies; and enabling hardware providers to integrate and market compatible devices within an interoperable ecosystem. Ultimately, SafeSphere aspires to create a sustainable and inclusive smart security solution that reinforces trust, digital responsibility, and national resilience in line with Malaysia's 4IR and MyDigital Blueprint 2030 goals (Economic Planning Unit, Prime Minister's Department, 2021).

3. METHODOLOGY

This paper adopts the Design Thinking (DT) methodology to construct a validated conceptual business model for the SafeSphere project, a digital platform offering smart and affordable home security solutions. Recent research emphasizes that Design Thinking functions not only as a methodology but also as a strategic mindset for business model innovation (You, 2022). The process began with a literature review and benchmarking of similar smart security companies using the Business Model Canvas (BMC) framework to identify innovation gaps and best practices. Design Thinking integrates effectively with tools like the Business Model Canvas (BMC) and value-focused ideation techniques reinforcing its role in shaping user-centred and socially grounded business models (You, 2022). Surveys and interviews were then conducted with different customer segments with homeowners, rental property owners, small businesses and hardware providers to understand their jobs-to-do, extreme pains and essential gains. Insights from this stage guided the development of the initial business model and a digital app prototype, designed using business modeling tools such as the Ecosystem Map (EM), Business Model Canvas (BMC) and Value Proposition Canvas (VPC). The initial model was then tested and validated through stakeholder feedback to refine its value propositions, channels and revenue streams. The findings were analyzed and discussed to ensure user alignment and practicality. Finally, a Strategy Canvas was created to evaluate SafeSphere's relevance and sustainability compared to existing smart security solutions from the perspectives of various customer segments resulting in a user-centered and market-relevant conceptual business model.

4. LITERATURE REVIEW

It evaluates relevant information that are pertinent to the study and may back up the research topic.

4.1. Smart Home Security Market

Rapid advancement of the Internet of Things (IoT) has transformed how people interact with technology, especially in residential settings. Smart Home is considered as a part of IoT. Smart home security is a subset of smart home technologies that aim to enhance the comfort, safety, and energy efficiency of residences. The idea was to use a suite of high technology tools that allow for remote home control through the use of ambient intelligence to keep an eye on the house. This concept has brought a large impact on the smart home market where Mintel (2025) mentioned over 50% consumers in the United States claim security as their leading reasons for purchasing smart home technology. Furthermore, a report from Statistica (n.d.) highlighting Malaysian consumers are increasingly seeking smart home devices as energy efficiency and home security become their priority. This emphasis on security and privacy is a key motivation of businesses in the smart home industry to constantly promote the consumer benefits of smart home technologies, such as ease, cost savings, and home security (Cannizzaro et al., 2020). It is a massive sum, showing how popular the smart home security industry is growing.

4.2. Interoperability

The current integration in the smart home security system has effectively handled common security threats. But there are problems with interoperability since these systems frequently employ distinct standards, protocols, and technology. This lack of standardization could lead to user frustration, dissatisfaction, and wasteful energy usage in conducting smart home ecosystems. Elmi (2023) says that this problem can be lessened by allowing devices to communicate seamlessly to improve user experience, energy efficiency, and security. It improves overall functionality and usability while reducing system complexity and costs within a unified environment. High compatibility could enhance performance, reduce user frustration, and increase perceived reliability, aligning with the Technology Acceptance Model's emphasis on ease of use and usefulness (Phan & Kim, 2020).

4.3. Attitude toward Technical Performance

The consumer's attitude toward technical performance may be defined as their level of satisfaction with the smart home technology's functional and operational aspects. Li et al. (2025) emphasised that the clear value propositions of smart home technologies are control and convenience. Thus, it was an important factor influencing the adoption of smart home technology as consumers' willingness to utilize a smart appliance would depend on their view of mature technology. Studies show that Malaysians’ willingness to adopt home automation is influenced by how effectively the system performs its core tasks as Lau et al. (2022) report merely 4.34 mean respondents were likely to incorporate smart technology features into their homes due to this factor.

4.4. Data Sovereignty in Cloud Computing

Data sovereignty in cloud computing refers to the principle that data must adhere to the rules and regulations of the nation. The involvement of cloud computing in storing and processing data on distant servers in numerous places could raise worries about regulatory compliance and management. Therefore, it is vital for Malaysian enterprises who depend on cloud solutions to understand the idea. This requirement is based on Malaysia's Personal Data Protection Act (PDPA) 2010, which specifies how personal data acquired for commercial purposes must be maintained and secured. Lim (2024) mentioned any businesses failure to comply with the PDPA 2010 is not negotiable and can lead to significant disruptions in operations, including penalties up to RM500,000 and three years imprisonment. So, data sovereignty is not only a legal need but it is also a business necessity that helps achieve national goals like the MyDigital Economy Blueprint by regulating where data is stored, which enhances security and encourages transparency, which in turn builds trust and confidence among consumers. Along with this, enterprises must prioritize data residency by having suppliers, such as Telekom Malaysia or other local vendors, that guarantee local data storage, implement strong security protocols such as encryption, and ensure legal measures that satisfy Malaysian sovereignty needs (Aegis, 2025). Finally, as Malaysia's digital landscape evolves, adopting data sovereignty is vital to safeguarding companies legally and increasing their competitiveness.

4.5. Benchmark of Smart Home Security Business Models

Benchmarking is the practice of comparing your business's performance against a rival in the same market (Business Victoria, 2022). The objective is to learn from the best and figure out how to improve.

4.5.1. Apple Homekit

Homekit is the Apple's underlying software platform/framework for controlling and connecting smart home devices providing dependability and ease of use for tech-savvy consumers and homeowners. Homekit lets the user control smart home products using apps on Apple devices such as iPhone, iPad, or Mac. They offer their items directly to consumers, selling their products through their website, Apple, and other retail partners. Revenue is generated from Smart Home Hub sales and IoT collaborations, while main investments include software development, marketing, and support. Apple fosters long-term client ties through AppleCare and online forums as depicted in Fig. 1.

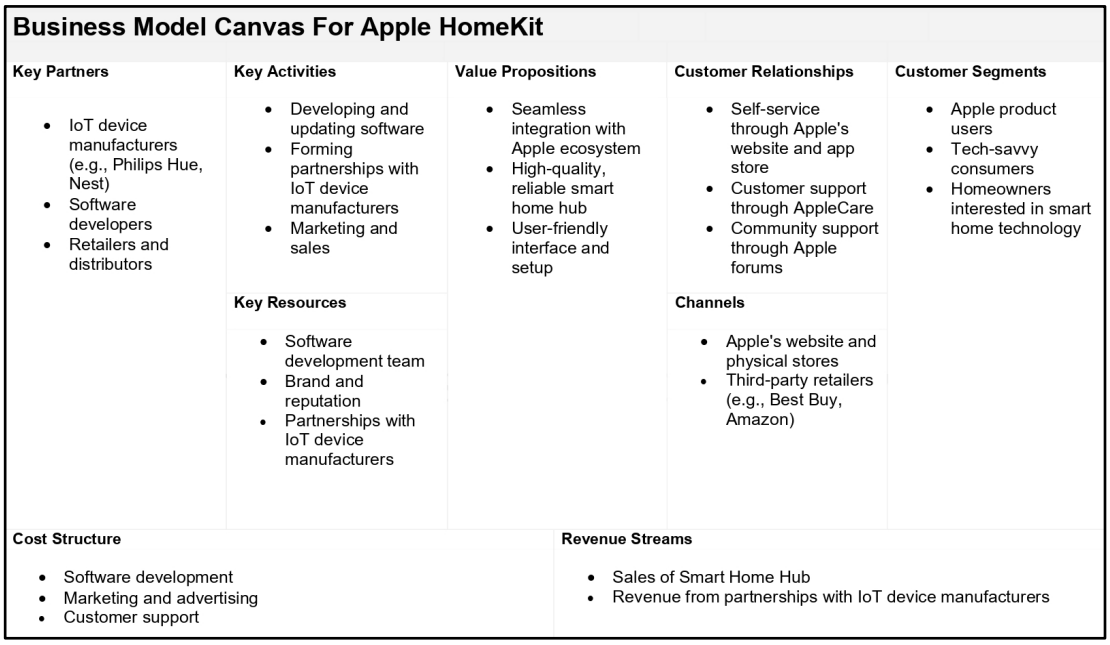

Fig. 1. Business Model Canvas (BMC) for Apple HomeKit

4.5.2. Samsung SmartThings

SmartThings is recognized as one of the most comprehensive and versatile home automation systems developed by Samsung. It offers compatibility with over 5,000 devices, including lights, thermostats, and security cameras through the partnerships with third-party service providers. With the SmartThings app, users can easily set up and manage their homes. The app allows for custom routines and scenes, automating daily tasks such as adjusting lighting brightness or controlling thermostat. The business model of its service is shown on Fig. 2.

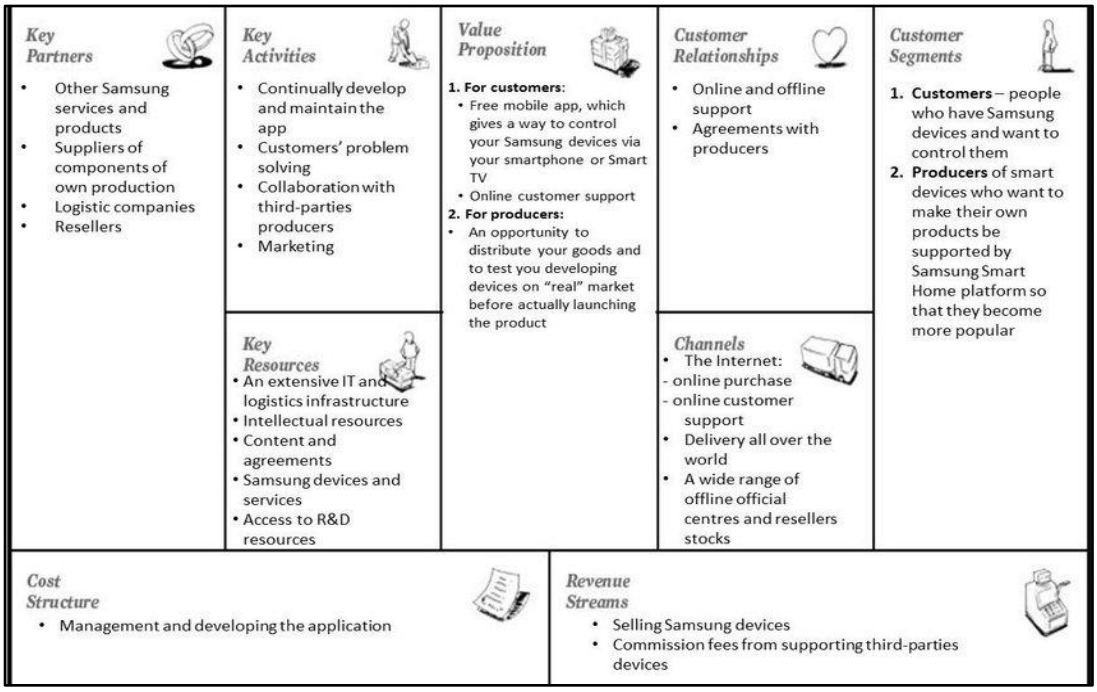

Fig. 2. Business Model Canvas (BMC) for Samsung SmartThings

4.5.3. Wink Hub

Wink operates as a smart home platform primarily targeting homeowners in the United States and Canada. It provides unified control by using the Wink Hub/Hub 2 to translate diverse device protocols like Z-Wave, ZigBee and Wi-Fi into one language. It enables advanced automations like Robots, Schedules, and Shortcuts for security and energy efficiency. including the free Wink App available in iOS and Android. This value is distributed through e-commerce partners like The Home Depot and Amazon.com. Over 50 leading device manufacturers like GE, Nest, Schlage, voice integration services, like Amazon Alexa and many more manufacturer partners alongside. Mandatory monthly subscription for full service access including cloud control and remote monitoring which forms the main revenue stream alongside the sale of Hub hardware. Crucial activities involve delivering the key value which is continuous platform development, security auditing, and partner certification, which contribute to a cost structure that emphasizes the high expense of maintaining and developing the platform. The business model of its service is shown on Fig. 3.

Business Model Canvas For Wink Hub

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
• IoT device manufacturers (e.g., GE, Nest, and Schlage) • Retailers and distributors	• Developing and updating software • Forming partnerships certification • Marketing and sales • Security auditing	• Universal multi-protocol connectivity • Unified Control Platform • User-friendly interface and setup	• Customer support via Webform, Twitter or Facebook during working hour • Community support through Wink Hub forums	• Homeowners (in the United States and Canada) • Device manufacturers and technology partners
	Key Resources		**Channels**	
	• Software development team • Brand and reputation • Partnerships with IoT device manufacturers		• Direct sales at Wink.com • Third-party retailers (e.g. Amazon.com, The Home Depot, and The Home Depot Canada)	

Cost Structure	Revenue Streams
• Software development • Marketing and advertising • Security auditing • Partner Certification	• Sales of Hub hardware • Revenue from partnerships with IoT device manufacturers • Monthly subscription

Fig. 3. Business Model Canvas (BMC) for Wink Hub

5. INITIAL BUSINESS MODEL (BM) – USING BMC & VPC

The Business Model Canvas is a tool that maps out the nine building blocks of a business model including customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. It helps SafeSphere Smart Home Security businesses understand and communicate how we can create, deliver, and capture value which makes it useful for developing the idea of new business models. Fig. 4 depicts the initial BMC crafted for SafeSphere's Smart Home Security Ecosystem, drawing insights from the above literature review.

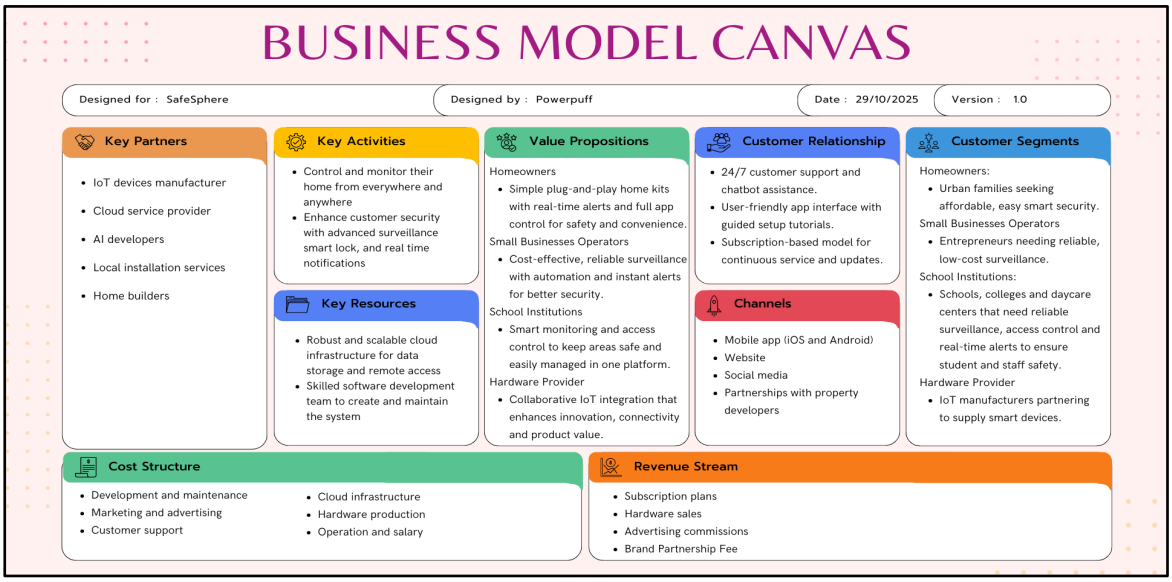

Fig.4. SafeSphere Initial Business Model

The Value Proposition Canvas (VPC) further refines how SafeSphere creates and delivers value to its diverse customer segments by aligning the company's products and services with customer's specific needs, pains and desired gains. It provides a clear view of how the SafeSphere Smart Home Security Platform addresses the widespread challenges of fragmentation, incompatibility and data security in the smart home ecosystem. By mapping customer expectations against SafeSphere's unique offerings such as its centralized gateway hub, AI-driven monitoring and locally hosted cloud services, the VPC demonstrates how the platform delivers meaningful solutions that are both technologically efficient and socially inclusive. Through this framework, SafeSphere ensures that each customer segment including homeowners, small business operators, schools institutions and hardware providers receives targeted value, whether in the form of improved safety, device integration, operational scalability or new business opportunities within a trusted ecosystem.

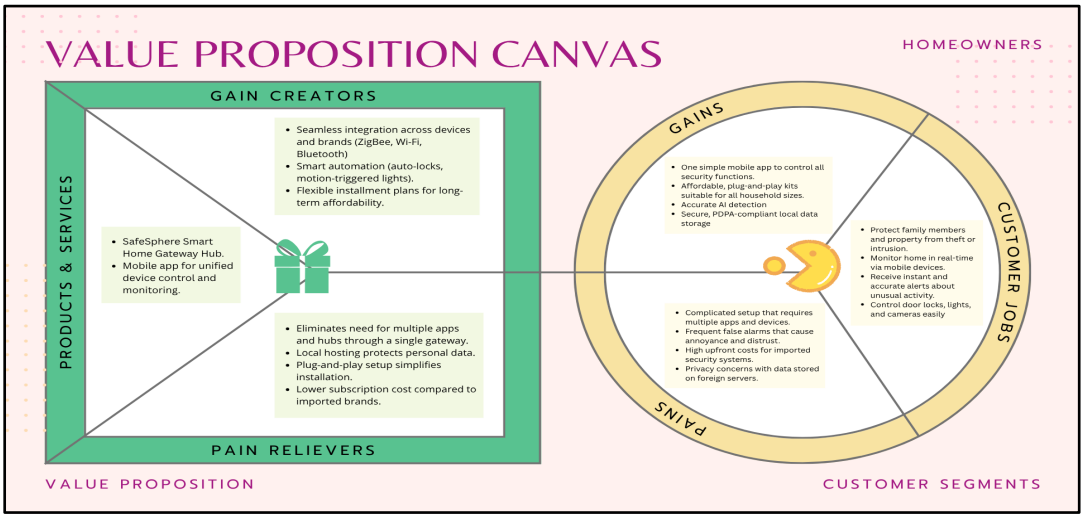

Fig.5. Value Proposition Canvas for Homeowners

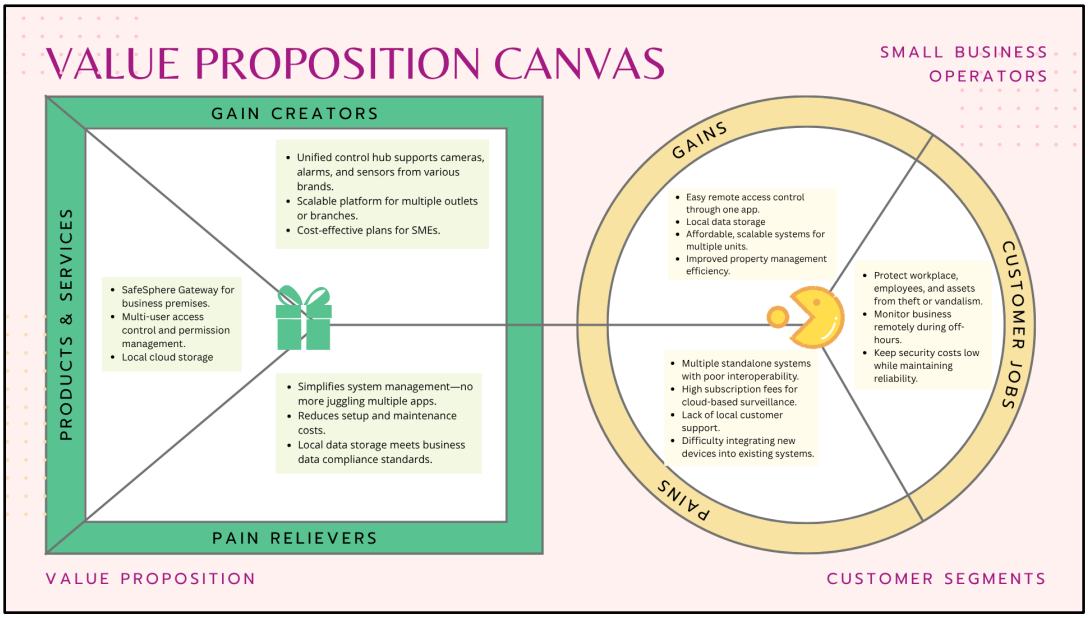

Fig.6. Value Proposition Canvas for Small Business Operators

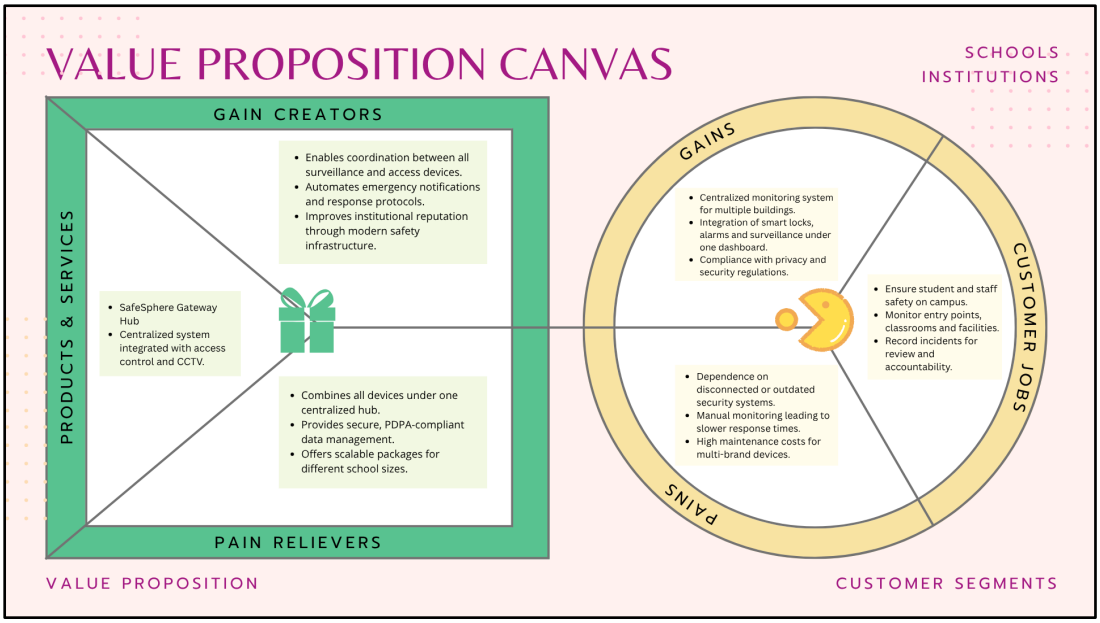

Fig.7. Value Proposition Canvas for Schools Institutions

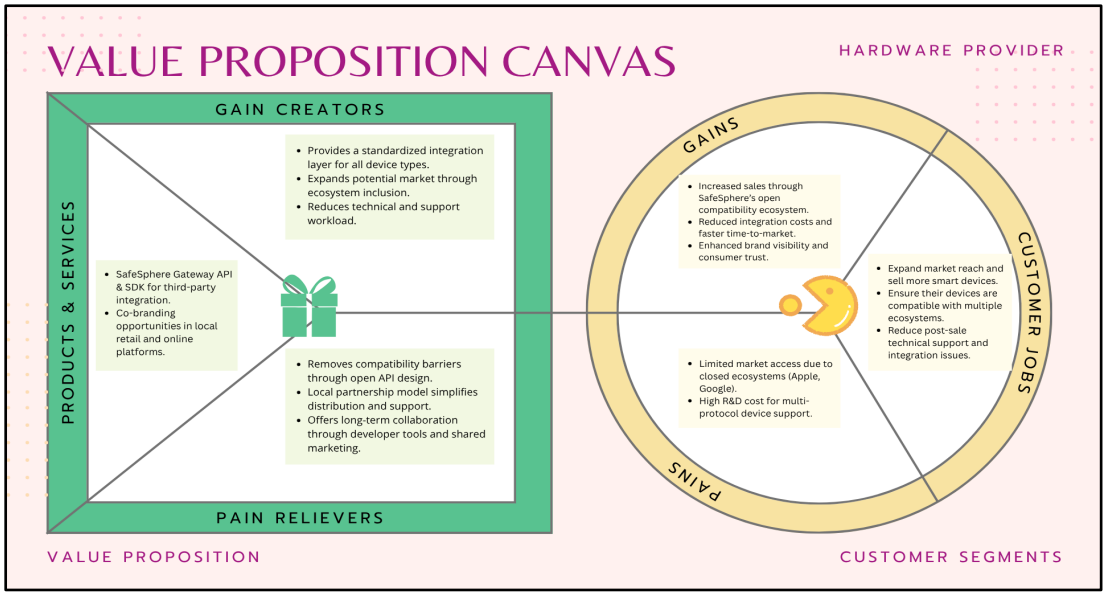

Fig.8. Value Proposition Canvas for Hardware Provider

6. CONDUCT VALIDATION OF INITIAL BM & KEY FINDINGS

To evaluate the initial SafeSphere Business Model Canvas, an online survey was distributed via Google Forms, consisting of 14 questions aimed at understanding the perceptions, preferences and expectations of our targeted customer segments. A total of 32 respondents participated in the survey. Interviews were also conducted with our customer segments to obtain deeper insights into their needs, pain points and experiences related to smart security systems. The findings from both the survey and interviews were analyzed to validate the core elements of the SafeSphere business model.

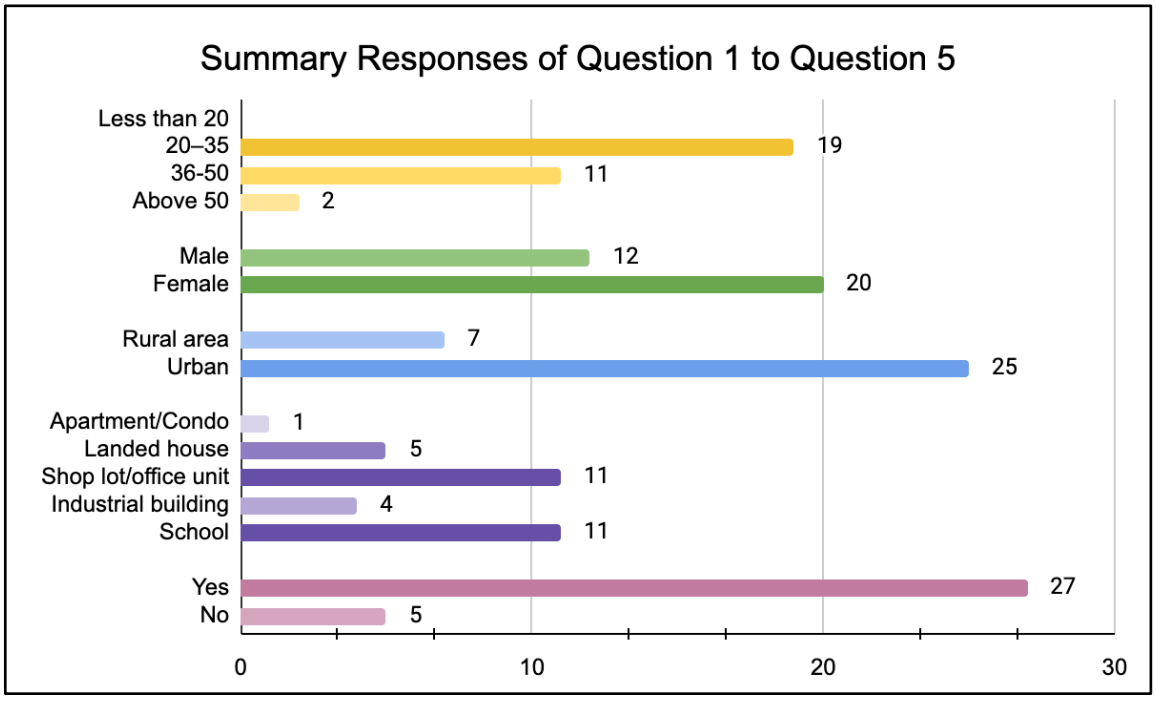

Fig.9. Summary Responses of Question 1 to Question 5

Fig. 9 illustrates the summarized responses for the first five questions of the survey, which aimed to capture the demographic background and early exposure of respondents to smart home security systems. For the first question, which asked about age distribution, most respondents were between 20 to 35 years old. This indicates that SafeSphere's potential market primarily consists of young to middle-aged adults who are generally more familiar with digital technologies and more inclined to adopting smart security solutions for convenience and safety. The second question focused on gender, where the majority of respondents were female compared to male. Furthermore, for the third question, respondents were asked about their area of residence. A large portion of 25 respondents reported living in urban areas, while only seven lived in rural areas. This shows that the concept of smart home security is more recognized and relevant in urban communities, where security challenges and access to technology are higher. The fourth question explored the type of property respondents manage or own. This variety shows that SafeSphere's solution can be adapted beyond homes to cater to commercial, industrial and educational environments, expanding its potential customer base. Lastly, 27 respondents had prior exposure to smart home security systems, demonstrating strong awareness and market readiness for a localized and user-friendly solution like SafeSphere.

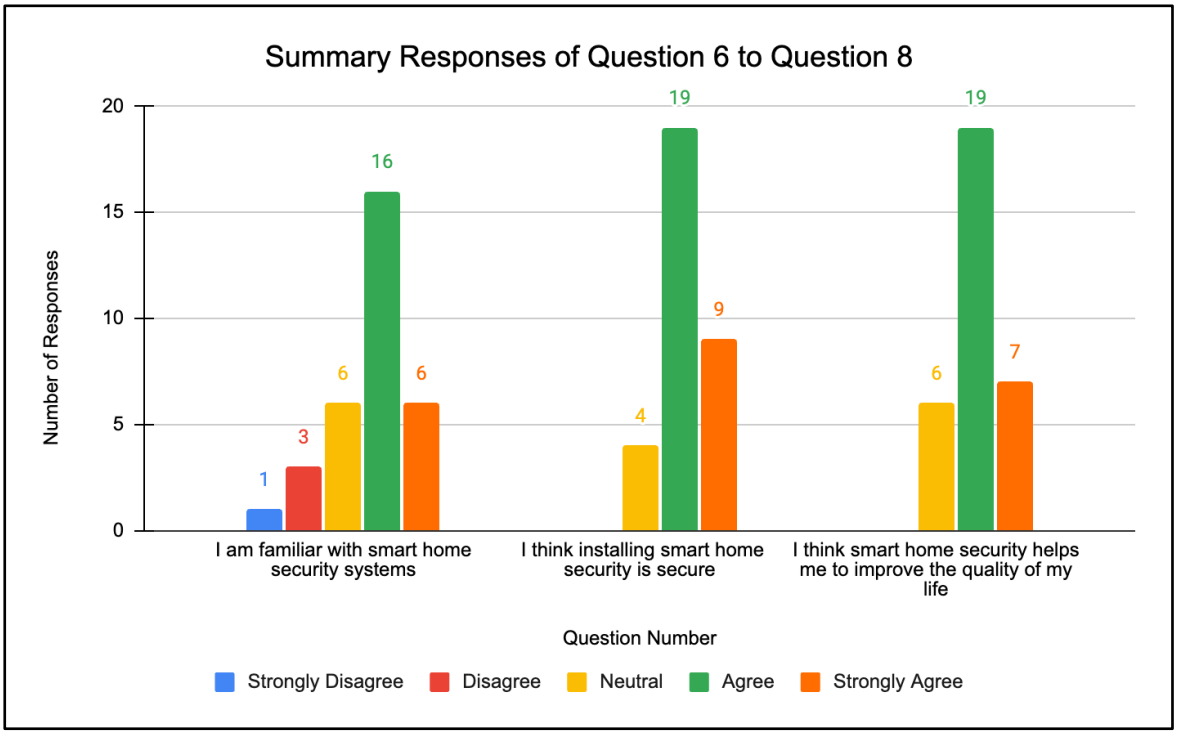

Fig.10. Summary Responses of Question 6 to Question 8

The survey shows that most people have a basic understanding of smart home security systems, as seen in Question 6, "I am familiar with smart home security systems," where 22 respondents agreed, which suggests that awareness is fairly high likely because these systems are becoming more common in homes. However, four respondents disagreed, indicating that a small group still needs more information or education. For Question 7, "I think installing smart home security is secure," and Question 8, "I think smart home security helps me improve the quality of my life," the results are very strong, with zero disagreement, which suggests that

most people already trust the technology and accept its value, likely due to positive experiences shared in media, advertising or by relatives who have tried similar security system. Additionally, 19 respondents strongly agreed with both statements, indicating that users not only recognize the benefits but also feel positive about them, likely due to these systems genuinely improving their safety and convenience.

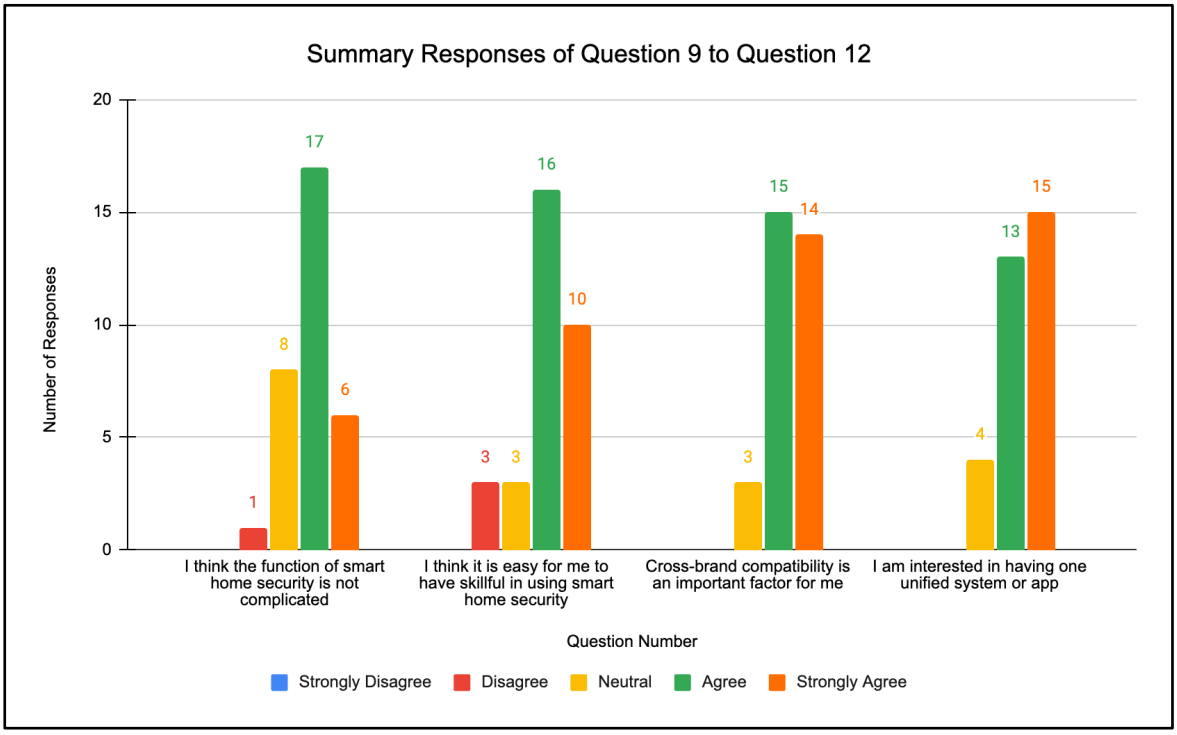

Fig.11. Summary Responses of Question 9 to Question 12

The survey responses for Questions 9 to 12 provide a clear picture of what users value and how they perceive smart home security systems. For Question 9, “Cross-brand compatibility is an important factor for me,” most respondents agreed, showing that users prefer systems that work with multiple brands rather than being limited to one. Furthermore, in Question 10, “I am interested in having one unified system or app,” where 26 respondents agreed. This shows a strong desire for a streamlined interface, likely because managing multiple apps can be confusing and time-consuming, and a unified system makes controlling smart devices easier and more convenient. Question 11, “I think the function of smart home security is not complicated,” and Question 12, “I think it is easy for me to become skillful in using smart home security,” received high positive responses. This shows that users generally feel confident in their ability to operate these systems, which is likely because modern smart home devices are designed to be user-friendly. Overall, the data suggests that the market is ready for smart home security systems that are both flexible across brands and easy for anyone to use, making adoption smoother and more appealing.

Table 1: Summary Responses of Question 13

Number	Challenges Faced in Smart Security System
1	High maintenance cost / expensive installation
2	Data privacy and security risks / sensitive data can be stolen
3	System limitations such as outdated, lag, not real-time, false alarms, hard to monitor, blind spots, no early danger detection
4	Reliance on electricity / dependency on WiFi
5	Hard to operate / not user-friendly
6	Compatibility issues / not integrated with other devices
7	Too many non-threat notifications / false alerts causing users to ignore real danger
8	Risky / general security concern / trust issues

Table 2: Summary Responses of Question 14

Number	Suggestions to Improve Smart Security Systems
1	Make the system more user-friendly / easy for staff or family to operate
2	Improve AI accuracy / AI for unusual behaviour or dangerous activity detection
3	Unified system for all security devices and school staff apps
4	Automated notifications and alerts
5	Improve cybersecurity / encrypt all data end-to-end
6	Ensure system works offline / reduce dependency on WiFi / backup energy system
7	Better hardware: cameras with wider angles, better audio, high-quality video
8	Make system more cost-friendly for people to buy
9	Make it compatible with other devices or systems

The questionnaire included an open-ended question where respondents shared challenges and suggestions for smart security systems. Key recommendations focused on making the system more user-friendly, integrating AI for threat detection, improving device compatibility and integration and providing cost-effective solutions. These insights can guide future upgrades and add-on features to improve system effectiveness and reliability.

For the interview question, the findings presented are derived from secondary data collected from industry representatives on smart home interoperability. The interviewees include Alex Yang from Tuya Smart and George Yianni from Philips

Hue, who shared their perspectives on the factors affecting cross-brand smart home device compatibility. Data were obtained from publicly available interviews published through the Connectivity Standards Alliance (CSA) channels. The insights highlight both the enablers as well as the challenges for achieving interoperability in smart home devices.

Table 3: Summary Responses of Interview Questions

Questions	Responses
What are the key enablers toward achieving interoperability among smart home devices from different brands?	For standardized connectivity ● Alex Yang highlights strong connectivity protocols like Zigbee and standards from Project CHIP, which improve data management and enable AI implementation for enhanced production. ● George Yianni emphasizes mesh networking, allowing systems to self-organize and provide reliable coverage across the home. For ease of use ● Alex Yang notes that setup must be simple, with multiple methods such as hub discovery or direct touch linking of a remote to a light. ● George Yianni notes that Philips Hue ensures devices from different manufacturers can communicate reliably through certifications.
What technical or business challenges currently limit device compatibility in the IoT or smart home industry?	For protocol and functionality ● Alex Yang notes the diversity of protocols and functions in the market makes it difficult to provide seamless device compatibility. For security standard immaturity ● Alex Yang highlights a lack of mature IoT security standards, which hinders interoperability efforts. For product longevity ● George Yianni mentions that the long life cycle of products such as bulbs lasting up to 15,000 hours which is equivalent to 15 years, requires software support and interoperability for at least five years, unlike the shorter lifespans common in most consumer electronics

7. VALIDATED BM – BMC FRAMEWORK

7.1. Validated BM

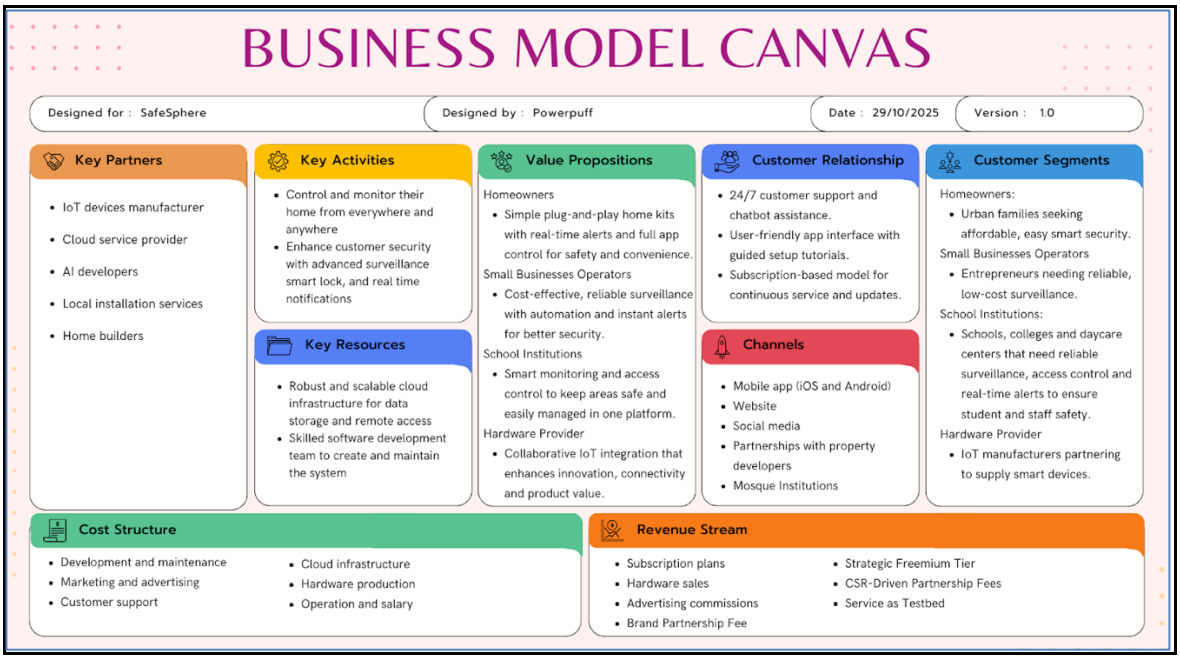

Fig.12. Validated Business Model Canvas

7.1.1. Customer Segments

Customer Segments refer to the specific groups of people or organizations a business aims to serve. In this model, SafeSphere targets four key customer groups. Homeowners, especially urban families, seek affordable and user-friendly smart security solutions to protect their homes. Small business operators consist of entrepreneurs who require reliable, low-cost surveillance to protect assets and streamline operations. School institutions, including primary schools, colleges, and daycare centres, need smart monitoring and controlled access systems to ensure the safety of students and staff in response to growing safety concerns nationwide. Finally, hardware providers represent IoT manufacturers that partner with SafeSphere to integrate and distribute their smart devices within the ecosystem.

7.1.2. Value Propositions

Value Propositions describe the products and services that create value for each customer segment. For homeowners, SafeSphere provides simple plug-and-play home security kits complemented by real-time alerts and full mobile app control, ensuring convenience and peace of mind. Small businesses benefit from cost-effective, scalable surveillance paired with automation features and instant alerts. Schools receive smart monitoring tools and access-control systems designed to keep high-risk areas safe and manageable from one centralized platform. For hardware providers, SafeSphere offers a collaborative IoT integration environment that enhances product visibility, innovation, and ecosystem compatibility.

7.1.3. Channels

Channels describe how a company communicates with and reaches its customer segments to deliver the value proposition. SafeSphere connects with customers through multiple digital channels. The mobile app (iOS and Android) serves as the primary point of interaction, allowing users to control and monitor devices. The website provides product information, onboarding guidance, and customer support. Social media acts as a platform for community engagement, awareness, and real-time updates. Additionally, partnerships with property developers enable SafeSphere to reach homeowners and schools through integrated installations in new buildings, and specialized outreach through partnerships with local religious councils helps connect with Mosque Institutions.

7.1.4. Customer Relationships

Customer Relationships outline the type of interaction a business establishes with each customer segment. SafeSphere maintains strong ongoing relationships through 24/7 customer support and a built-in chatbot assistant to address troubleshooting needs instantly. A user-friendly app interface, complete with setup tutorials, ensures customers can adopt and navigate the system easily. The business also uses a subscription-based model, which supports continuous updates, AI improvements, and long-term service engagement with users.

7.1.5. Revenue Streams

Revenue Streams represent the ways a company generates income from each customer segment. SafeSphere earns through subscription plans, which provide access to cloud storage, AI analytics, and premium features. Additional income comes from hardware sales, including smart cameras, locks, and sensors. Advertising commissions are generated when hardware providers promote their devices through the platform. The company also collects brand partnership fees from IoT manufacturers who collaborate to integrate and distribute their devices within the SafeSphere ecosystem. Furthermore, SafeSphere incorporates a strategic freemium model with the "Community Basic" tier, offering free basic service and necessary security hardware to qualified B40 social centers (like old folks' homes or disabled centers). While these centers receive the core security services at no cost, this program is designed to strengthen the primary revenue streams by attracting key corporate sponsors who pay significant Brand Partnership Fees to fund the hardware rollout as a Corporate Social Responsibility (CSR) initiative, and by utilizing these high-demand social centers as real-world testbeds to continuously improve the quality and reliability of the premium features offered to paying customers.

7.1.6. Key Resources

Key Resources refer to the most important assets required to make the business model work. SafeSphere relies on a robust and scalable cloud infrastructure that enables secure data storage and real-time remote access for all users. The company’s skilled software development team is essential for creating,

maintaining, and continuously improving the digital platform, AI detection features, and app functionalities that support its value propositions.

7.1.7. Key Activities

Key Activities describe the most important actions a company must perform to operate successfully. SafeSphere's primary activities include enabling customers to control and monitor their spaces from anywhere, ensuring seamless and responsive functionality. It also focuses on enhancing customer security using advanced surveillance systems, smart locks, and real-time notifications. These activities allow SafeSphere to deliver reliable, integrated safety solutions for households, businesses, schools, and hardware partners.

7.1.8. Key Partners

Key Partners are external organizations or stakeholders that help the business function effectively. SafeSphere collaborates with IoT device manufacturers to supply compatible hardware. Cloud service providers ensure secure and scalable data hosting, while AI developers support advanced detection capabilities. Local installation services assist with deploying devices in homes, businesses, and schools to integrate SafeSphere into new infrastructures, expanding market reach.

7.1.9. Cost Structure

Cost Structure outlines the major costs that a business must incur to operate. SafeSphere's expenses include development and maintenance of the app and platform, alongside marketing and advertising to reach target customers. The company also allocates costs to customer support, cloud infrastructure, and hardware production necessary to deliver its services. Additional expenses include operations and salaries, which ensure daily business activities and technical support are sustained.

7.2. Environment Map (EM)

7.2.1. Key Trends

a. Digital Transformation and 4IR Integration

Malaysia's ongoing transition toward the Fourth Industrial Revolution (4IR) continues to reshape industries through the adoption of Artificial Intelligence (AI), the Internet of Things (IoT) and cloud-based solutions. The National 4IR Policy promotes inclusivity and innovation to enhance productivity and quality of life (Economic Planning Unit, Prime Minister's Department, 2021). SafeSphere aligns with this policy by creating an interoperable platform that leverages AI and IoT to connect multiple smart home brands under a unified ecosystem, driving Malaysia's digital transformation forward.

b. MyDigital and Smart City Development

The Malaysia Digital Economy Blueprint (MyDigital) aims to develop a digitally-driven and high-income nation by promoting connected infrastructures and smart cities (Economic Planning Unit, Prime Minister's Department, 2021). SafeSphere supports this initiative by integrating various smart home and security brands into a centralized system, contributing to safer, smarter and more connected communities within Malaysia's growing urban landscape.

c. Interoperability and Open Ecosystems

Consumers now prefer devices that can connect across brands. SafeSphere follows this trend by becoming a central platform compatible with products from brands like Samsung and Xiaomi. Interoperability is a critical success factor in the IoT ecosystem, enabling different devices to communicate effectively and reducing user frustration caused by fragmented systems (Elmi, 2023).

7.2.2. Market Forces

a. Demand for Unified Smart Home Platforms

Consumers increasingly prefer integrated solutions that can control all devices from a single interface rather than managing multiple apps for different brands. This demand for simplicity, control and convenience drives the growth of centralized IoT management systems (Zaman et al., 2024). SafeSphere meets this need by offering one application that manages diverse brands and security systems within a secure local environment.

b. Expanding Middle-Class and Urban Population

Malaysia's expanding middle-class population and rapid urbanization continue to influence the adoption of modern and connected living solutions. Urban homeowners and small business operators increasingly seek reliable, customizable smart home ecosystems that balance affordability with functionality (Department of Statistics Malaysia, 2024). SafeSphere targets this demographic with scalable, subscription-based access that fits different income levels and security needs.

c. Platform Economy Growth

The rise of the platform economy has reshaped how businesses deliver value by connecting multiple participant groups through digital interfaces. Multisided platforms enhance innovation by enabling collaboration between users, developers and service providers (Ministry of Economy, 2025). SafeSphere leverages this model by connecting homeowners, device brands and installation service providers through a single ecosystem.

7.2.3. Macroeconomic Forces

a. Government Investment in Digital Infrastructure

Malaysia's Budget 2026 highlights increased investment in 5G, AI cloud services and IoT infrastructure to strengthen the country's digital economy (Ministry of Finance, 2025). Similarly, the Thirteenth Malaysia Plan (RMK-13) emphasizes long-term digital development and nationwide technological upgrades (Ministry of Economy, 2025). These combined initiatives support SafeSphere's scalability by enabling faster data transmission, stronger connectivity and better integration with national digital systems.

b. Inclusive and Sustainable Digital Growth

Malaysia's focus on inclusive growth ensures that digital technologies remain accessible to all social and income groups (Ministry of Economy, 2025). SafeSphere supports this through affordable subscription tiers and local partnerships that enable broader adoption among B40 and M40 households. It contributes to Malaysia's sustainable and inclusive digitalization agenda.

7.2.4 Industry Forces

a. Competition from International Ecosystems

Global brands such as Google Home, Amazon Alexa and Apple HomeKit dominate the smart home integration market but often rely on foreign cloud services that may not fully comply with Malaysia's Personal Data Protection Act (PDPA). SafeSphere differentiates itself by providing locally hosted cloud services, ensuring data sovereignty and privacy compliance.

b. Fragmentation of Smart Home Ecosystems

One of the major challenges in the smart home industry is the fragmentation of IoT ecosystems, where devices from different brands and communication protocols often cannot connect seamlessly. This technological fragmentation has been identified as a key barrier to widespread smart home adoption, as multiple connectivity standards such as Wi-Fi create compatibility issues for consumers (Phan & Kim, 2020). SafeSphere addresses this problem through an open, interoperable platform that unifies device management and simplifies user experience.

c. Local Collaboration and Supply Chain Opportunities

SafeSphere promotes collaboration with local hardware producers, software developers and installation service providers. This strengthens Malaysia's digital supply chain, supports local innovation and encourages the growth of domestic IoT businesses (Ministry of Economy, 2025).

7.3. Strategy Canvas

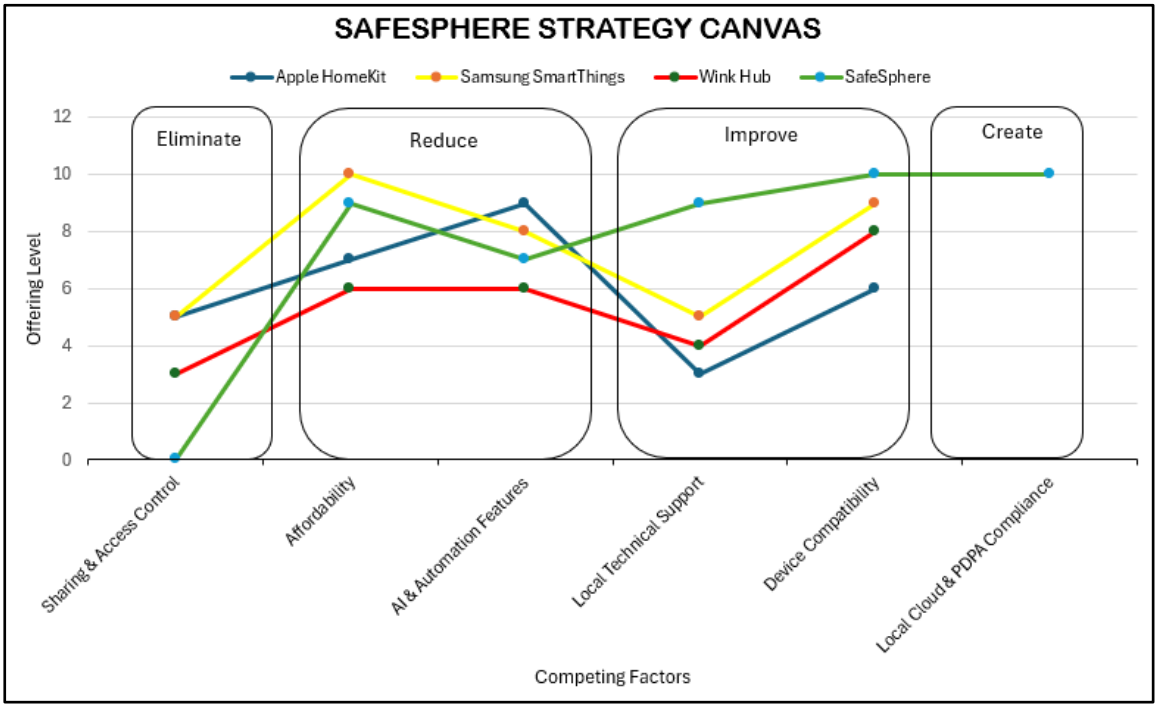

Fig.13. SafeSphere Strategy Canvas

A strategy canvas is a line graph that plots functions or factors against the value of a company and then overlays industry benchmarks. By doing this, information can be built to help create a competitive strategy. It is a central diagnostic tool that graphically shows the current strategic landscape and the future prospects for an organization (Precious, 2023). By mapping out these competitive factors on a single graph, the strategy canvas helps businesses make informed decisions about which aspects to raise, reduce or innovate, guiding product development and positioning. Based on Fig. 13, the strategy canvas compares well-known smart home platforms such as Apple HomeKit, Samsung SmartThings and Wink Hub with our platform SafeSphere. The analysis highlights SafeSphere's ability to outperform existing solutions in areas most relevant to Malaysian consumers such as compatibility, local data compliance and technical support accessibility.

Apple HomeKit dominates in AI automation reflecting Apple's premium positioning but remains limited by its high cost and closed ecosystem that primarily supports Apple-branded devices. Similarly, Samsung SmartThings denotes an affordability platform where it offers free services yet depends heavily on foreign cloud services and lacks localized data protection compliance. Meanwhile, Wink Hub offers multi-protocol connectivity but has limited regional support and a mandatory subscription model which reduces its accessibility in emerging markets.

In contrast, SafeSphere differentiates itself through its focus on interoperability, inclusivity, and local relevance. The platform introduces an open and cross-brand ecosystem that unifies devices from various brands including locally popular smart home brands such as Tapo and Xiaomi under a single, easy-to-use interface. This gateway-based design eliminates the frustration of managing multiple applications and ensures seamless integration for homeowners, schools and SMEs (Phan & Kim, 2020).

Beyond device compatibility, SafeSphere stands out by hosting all data on locally managed cloud servers that comply with Malaysia's Personal Data Protection Act (PDPA) ensuring user privacy, data sovereignty and trust. It has a feature not offered by its international competitors. Furthermore, SafeSphere enhances accessibility through affordable pricing models by having flexible subscription tiers and localized technical support, making smart home technology available to users from diverse income levels and technical backgrounds.

Overall, SafeSphere's "purple cow" lies in its localized, interoperable and inclusive ecosystem. The platform offers a unified smart security platform that connects multiple device brands, complies with Malaysia's data protection laws and provides affordable, scalable solutions for homeowners, SMEs and educational institutions. While global competitors emphasize premium features and closed ecosystems, SafeSphere prioritizes practical integration, local relevance and digital sovereignty, positioning itself as Malaysia's first unified smart security ecosystem that truly bridges innovation with national inclusivity.

7.4. High Fidelity Prototype

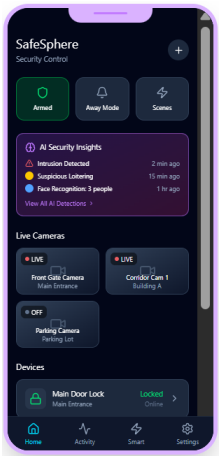

Fig. 14. SafeSphere's Homepage

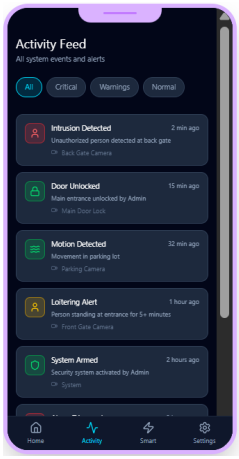

Fig. 15. SafeSphere's Activity Feed Page

Refer to Fig. 14 The Home Dashboard serves as the real-time core of the IoT management system, displaying the status of all connected security devices and enabling system-wide actions. It acts as a universal security hub by allowing the addition of devices from any brand. Central to its function is the AI Security Insights panel, which provides immediate, machine learning-powered threat detections like intrusion alerts and facial recognition, with live camera thumbnails reflecting feeds continuously processed by AI models for automated monitoring.

Refer to Fig. 15 The Activity Feed is the central Big Data Analytics hub, aggregating and displaying all chronological security events (motion alerts, access logs, AI detections) from connected IoT devices. This comprehensive audit trail captures, timestamps, and stores every event, which is then intelligently categorized and color-coded by severity using data classification algorithms. Users can quickly identify patterns and anomalies, utilizing filtering capabilities and detailed event metadata for forensic analysis and compliance reporting.

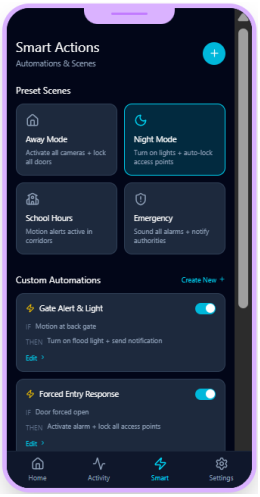

Fig. 16. SafeSphere Smart Page

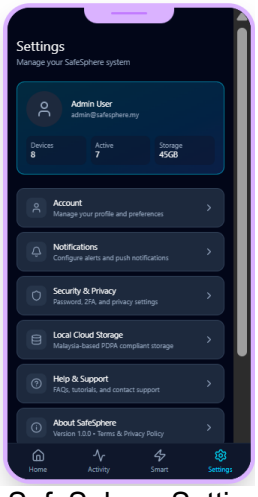

Fig. 17. SafeSphere Settings Page

Refer to Fig. 16 The smart page features preset scenes (Away Mode, Night Mode, School Hours, Emergency) for one-tap system control. Includes custom automation builder using "IF this, THEN

Refer to Fig. 17 The settings page manages account preferences, notification configurations, and security settings. Displays local cloud storage usage with Malaysia-based PDPA compliance

that" logic to create rules like "IF motion detected at back gate THEN turn on flood light + send notification."

information, plus access to help resources and system information.

8. CONCLUSION AND FUTURE WORKS

Across Malaysia's safety landscape, each customer segment, including homeowners, rental property owners, small businesses, schools, and hardware providers, faces distinct yet interconnected challenges. Homeowners struggle with complex setups, high costs, and privacy risks, while rental property owners and SMEs face difficulties managing multiple locations and ensuring affordable, scalable surveillance. Schools deal with fragmented safety systems and limited emergency responsiveness, and hardware providers encounter barriers in integrating devices and reaching local markets. Their essential job-to-do is to safeguard people, property, and data efficiently, yet they endure extreme pains such as fragmented apps, high maintenance costs, and lack of interoperability. The essential gains sought include real-time monitoring, trusted data protection, and seamless device integration. SafeSphere's core proposition is built around directly addressing the customer's pains and gains, differentiating itself through its unified digital ecosystem, a single mobile platform integrating various IoT-enabled devices (cameras, alarms, smart locks) with AI-assisted anomaly detection, PDPA-compliant local cloud storage, and plug-and-play setup. Its business model emphasizes affordability, interoperability, and inclusivity through subscription plans and local support. By serving as both a pain reliever and gain creator, SafeSphere not only simplifies smart security management for all users but also strengthens local digital sovereignty and community trust, aligning with Malaysia's MyDigital Blueprint 2030 and 4IR objectives, and ultimately contributing to the welfare of all, reflecting the spirit of Rahmatan lil 'Alamin.

Building on this foundation, future works will focus on transforming the validated business model into a comprehensive business plan that ensures strategic scalability and long-term sustainability. This plan will include market validation, financial forecasting and the development of partnership frameworks with local IoT manufacturers, installation service providers and educational institutions. Further research and development will also explore AI-driven predictive analytics for enhanced threat detection and expand SafeSphere's interoperability framework to support more device brands and emerging communication protocols. Additionally, pilot deployments in schools, SMEs and residential areas will be conducted to evaluate system performance, user satisfaction and operational feasibility. These initiatives aim to evolve SafeSphere from a conceptual model into a fully operational, multisided smart security platform that contributes to Malaysia's digital transformation and sustainable innovation goals.

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A CONCEPTUAL "QUICK FOODY" MULTI- SIDED BUSINESS MODEL: NURTURE B40-PRENEURS AND ENHANCE JOB OPPORTUNITIES IN AFFORDABLE BREAKFAST BUSINESS

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ABSTRACT: This paper presents the "Quick Foody" conceptual business model, an innovative digital platform designed to address the distinct needs of various customer segments like breakfast consumers, breakfast food providers, and donors, with a specific focus on the B40 community and food-preneurs. The model adopts a multi-sided business platform, aiming to deliver affordable, trusted, and personalized breakfast services to economically disadvantaged groups namely the B40s, while nurturing B40 food-preneurs through re- & up-skilling initiatives. Adapting on the Design Thinking framework, using business tools like the Business Model Canvas (BMC), Value Proposition Canvas (VPC), Strategy Canvas (SC), and Environmental Map (EM), this paper outlines a clear path to sustainable business success while addressing both economic and social issues. Key output and findings from the research include the validation of this business model through surveys and interviews, which revealed a strong demand for more affordable breakfast options and a high level of interest in platforms that support social entrepreneurship. The model's digital marketplace connects breakfast providers with a diverse consumer base, allowing B40 foodpreneurs to improve their livelihoods by creating and selling food products and services. The results underscore the viability of QuickFoody as a platform for both economic empowerment and social innovation, offering real solutions to the challenges faced by various stakeholders, including financial constraints, competitive pressures, and customer preferences. Furthermore, the proposed model holds potential for scalability, targeting other underprivileged communities and meal categories. The paper concludes by outlining future research and development directions, including creating a business plan that focuses on expanding the relevancy and usefulness of the platform and refining its technological capabilities in enhancing operational efficiency and customer experience. This conceptual platform business model offers innovative implications for the breakfast and food services eco-system, social entrepreneurship, and public welfare programs for the societal well-being.

KEY WORDS: *Online Food & Delivery Services, Multi-Sided Platform Business Model, B40 Community, Up- and Re-skilling, B40 Food-preneurs*

1. INTRODUCTION

The importance of breakfast in maintaining a healthy lifestyle is widely acknowledged, with studies affirming that nearly 89% of Malaysians consume breakfast regularly, emphasizing its critical role in meeting daily nutritional needs (Mognard et al., 2023). Yet, despite this widespread habit, many low-income individuals and families, particularly those from the B40 community, face significant challenges in accessing affordable, nutritious breakfast options (Noor et al., 2018). The B40 segment, which comprises the bottom 40% of income earners in Malaysia, often struggles with financial constraints, limiting their ability to secure convenient and healthy breakfast (Ahmad Dahlan & Ibrahim, 2021). Additionally, breakfast providers face extreme challenges, including competitive pressures, limited infrastructure, and the need to cater to diverse dietary preferences while keeping prices low (Ahmad Dahlan et al., 2014; The State of Food Insecurity in Malaysia, 2023). As economic inequality continues to widen, there is an urgent need for innovative business models that can address these gaps and offer sustainable solutions for marginalized communities and breakfast providers.

The "Quick Foody" business model is developed to address these challenges. It aims to alleviate or reduce the extreme pains of breakfast customers who often face high prices, limited choices, and inconvenient delivery options. At the same time, it creates substantial gains by helping and nurturing B40 foodpreneurs, offering them a platform to develop their skills, sell affordable meals & services, and expand their market reach through digital channels. In doing so, "Quick Foody" goes beyond being just another food delivery service; it acts as a catalyst for economic empowerment, bridging the gap between food providers, consumers, and donors.

By incorporating digital capabilities such as a mobile app and online platform, the model efficiently connects these diverse groups, allowing for seamless interactions and transactions. For foodpreneurs, the platform provides a digital storefront where they can showcase their offerings, while customers benefit from affordable, trusted, and personalized breakfast options tailored to their needs. Moreover, donors and sponsors can contribute through the platform, ensuring that their contributions and supports directly impacts and benefits the B40 community, thus promoting greater transparency and efficiency in charitable contributions.

The paper builds on the Design Thinking methodology, a widely recognized problem-solving framework, to identify the pain points of target users/customers and develop a solution that meets their unique needs. Tools such as the Business Model Canvas and Value Proposition Canvas are employed to refine the business strategy, while the Environmental Map helps assess external factors that could affect the platform's viability. The result is a validated business model that has the potential to revolutionize the breakfast and food-related market, especially for underserved populations.

The objective of this paper is to not only introduce the Quick Foody concept but also validate its potential platform business model and usefulness through rigorous testing and evaluation. By employing surveys, interviews, and prototype testing, the study provides insights into the demand for such a platform and highlights areas for improvement. The findings suggest that a multi-sided business model can successfully balance social impact and commercial viability, offering a replicable framework for other mealtimes and geographic locations. The plan concludes by

discussing future areas of research, including the integration of advanced technologies such as AI-driven personalization and blockchain for secured donation tracking, which can further enhance the platform's functionality, relevancy, and market reach.

2. OBJECTIVES STATEMENT

The main objective of this paper is to develop a conceptual QuickFoody business model including digital platform & apps that offers and provides products/services as pain relievers and as gain creators including fulfilling breakfast experiences and tackles the extreme pains of breakfast customers and breakfast providers (Ahmad Dahlan & Ibrahim, 2021; The State of Food Insecurity in Malaysia, 2023). Secondly, it provides up- and re-skilling development initiatives in helping and nurturing of B40s as food-preneurs; and to offer reasonably priced and quality breakfast menu for the B40 community and the public. Additionally, it is to enhance the overall breakfast ordering and delivery eco-system - operation effectiveness and efficiency; enhance customer experience; and transparency experience for donors & sponsors by leveraging on an innovative digital platform and application. QuickFoody business model incorporates a digital platform as a multi-sided marketplace - connecting breakfast consumers, breakfast providers, and donors/ sponsors on a common digital platform. This enables and facilitates a seamless and efficient interactions, transactions, while enhancing the relevancy and overall customer experience in the breakfast industry.

3. METHODOLOGY

According to the Interaction Design Foundation (IxDF), design thinking is a problem-solving approach which consist of five stages (IxDF, 2016). This design thinking will be adapted in this paper – empathize & defining the key challenges and problems of various customer segments; then ideating, designing, testing & validating, and build 'QuickFoody' conceptual business model in providing relevant and innovative solution as pain relievers and gain creators to address the key challenges and problems, thus accomplishing the objectives stated above.

3.1. Empathize Stage

The empathize stage focused on understanding the key challenges faced by different stakeholders, including breakfast consumers, B40 food-preneurs, and donors. Literature review including benchmarking of current breakfast/food companies using the BMC framework were conducted. An online survey was conducted with 79 participants – students and working adults representing the normal consumers; working adults representing the donors; B40s as consumers and B40 food-preneurs; and food operators. The survey gathered data on their breakfast consumption habits, financial constraints, and attitudes toward food delivery platforms. The results indicated that affordability and accessibility were the primary concerns for the normal and B40 consumers, while food quality and variety were important for students and working adults. Donors expressed a desire for

greater transparency in how their contributions would be used and benefited the B40s.

3.2. Define Stage

In the define stage, the insights from the empathize stage were synthesized to identify key issues. The main problems included limited access to affordable breakfasts, a lack of opportunities for B40 individuals to participate in the food-related businesses, and insufficient transparency for donors. Based on these insights, the problem statement and objectives for the Quick Foody model were defined: providing affordable breakfast options, offering job creation opportunities for B40 food-preneurs, and building a transparent platform for donor engagement.

3.3. Ideate and Prototype Stages

In the ideate phase, several potential solutions were brainstormed, including different business models and platform features. After careful consideration, a multi-sided platform was selected as the best approach. The Business Model Canvas (BMC) and Value Proposition Canvas (VPC) were used to map out the key components of the initial QuickFoody business model, namely customer segments, value propositions, channels (CH), customer relationships (CR), revenue streams, key resources (KR), key activities (KA), key partnerships (KP), and cost structure (Osterwalder & Pigneur, 2010; Osterwalder et al., 2014). Low-fidelity prototypes of the Quick Foody app were developed, including a user-friendly interface for ordering breakfast and managing donations.

3.4. Test Stage

During the test stage, the initial QuickFoody business model with the low-fidelity prototype was shared with selected key customer segments, including members of the B40 community, breakfast providers, and donors. Feedback was collected on the functionality, user experience, and pricing models. The results of this testing phase were used to refine the business model, ensuring that it effectively addressed the needs of all stakeholders while remaining financially viable.

4. LITERATURE REVIEW

4.1. Breakfast Culture in Malaysia

Studies have long shown the significance of breakfast in promoting better health and productivity. A recent report by Mognard et al. (2023) reveals that 89% of Malaysians consume breakfast regularly, making it a cultural staple. However, despite this high participation, a large portion of the B40 population faces difficulties in securing affordable, nutritious meals. Noor et al. (2018) highlight that financial constraints often force the B40 community to skip meals or consume less nutritious options, impacting their overall health and well-being. Globally, the breakfast business is estimated to grow steadily, with a projected compound annual growth rate (CAGR) of 6.3% between 2022 and 2029, reflecting increasing consumer

demand for convenience and health-focused meals (Grand View Research, 2023). In Malaysia, the online food delivery market has also grown significantly, driven by changing lifestyles and digital adoption, presenting opportunities to address supply gaps for underserved communities like the B40 (MyDIGITAL, 2021). This underscores the need for solutions that cater specifically to the B40 segment, ensuring they have access to affordable, healthy breakfast options.

4.2. MyDIGITAL Malaysian food industry

Malaysia's Digital Economy Blueprint (MyDIGITAL, 2021) emphasizes the role of digital platforms in driving entrepreneurship, particularly within marginalized communities. These platforms provide the infrastructure needed to reduce operational costs, improve market access, and offer new income-generating opportunities. Quick Foody aligns with this vision by offering a digital platform that allows B40 food-preneurs to enter the market with minimal capital investment. The platform not only connects them to customers but also offers training and support to help them run successful food businesses. This approach is critical in creating sustainable job opportunities for the B40 community while addressing food insecurity.

Globally, the online food delivery market is projected to reach $223.7 billion by 2027, growing at a CAGR of 9.8% from 2020 to 2027, driven by increasing demand for convenience and home delivery services (Allied Market Research, 2022). In Malaysia, the food delivery segment alone is expected to generate approximately $1.5 billion in 2023, with a growing share of transactions attributed to the breakfast category (Statista, 2023). Furthermore, initiatives such as central kitchens and soup kitchens have seen an increase in utilization, addressing food waste and improving accessibility for underserved populations (Ahmad Dahlan et al., 2021). These trends underscore the potential for platforms like Quick Foody to create scalable, impactful solutions for marginalized communities.

4.3. Multi-Sided Business Models and Social Impact

Multi-sided business models have gained popularity in recent years, particularly in the food delivery industry. Platforms like Foodpanda and McDonald's have successfully utilized multi-sided models to connect consumers, food providers, and third-party partners. However, Quick Foody differentiates itself by integrating a social impact component, focusing on supporting B40 food-preneurs and providing a transparent system for donors. By emphasizing social entrepreneurship, Quick Foody aligns itself with the principles of impact-driven business models, where profitability is combined with societal benefit (Amarsy, 2015). This dual focus ensures that the platform not only generates revenue but also contributes to addressing pressing social issues such as poverty and food insecurity.

4.4. National 4IR Malaysian food industry

Human capital development is emphasized extensively in Malaysia's National 4IR strategy as a crucial element of its 4IR adoption initiatives. This guideline becomes extremely essential when considered in the context of our 'QuickFoody'

business model. The policy acknowledges that workforce preparation is essential for any business operating in the digital sphere because of the swiftly evolving character of the workplace (National 4IR Policy, 2021). The National 4IR policy encourages competency frameworks, the incorporation of redesigned positions, and the development of new roles and skills in the workforce to attain national productivity and competitiveness. These concepts can have a direct positive impact on our business model since we want to provide employment possibilities by increasing the skill set of our workers, particularly the B40 community, in addition to providing delivery services. The policy's emphasis on adaptation and preparedness works in perfectly with our aim of offering employment possibilities in a fast-paced corporate environment. This demonstrates that the business model proposed should have a fundamental strength in terms of digital capabilities as example, having an online platform, delivering a user-friendly application. Should be a minimal minimum for ‘QuickFoody’ to become a pertinent business model.

4.5. mKitchen

The aim of the mosque kitchens is to support the B40 community by functioning as charity kitchens, generating employment, and assisting B40 individuals in becoming culinary entrepreneurs. Furthermore, the plan proposes that mosques might generate revenue by licensing out their facilities. The model seeks to solve the issues the B40 community is confronting, notably those made worse by the COVID-19 epidemic, by making use of underutilised community resources including mosque facilities (Ahmad Dahlan et al., 2021). This shows that by creating the B40 foodpreneurs, it will help them obtain income by selling cuisines that they can prepare with the facility provided and surmount the pangs of financial problems. The mosque kitchen also proposed an upskilling program which will enhance the B40 skills as a foodpreneurs which will enable them to start construct business from beginning on their own.

4.6. Benchmark

4.6.1. FoodPanda

One of the prominent benchmarks for our breakfast delivery multi-sided business model is Foodpanda (https://whitelabelfox.com/foodpanda-business-model/), a leading food delivery platform in Malaysia. Foodpanda has effectively established an extensive network of restaurants and consumers, providing a valuable reference point for our venture. Foodpanda's digital infrastructure and user-friendly app have streamlined the ordering and delivery processes, ensuring efficiency and customer satisfaction. By analyzing Foodpanda's business model, we can obtain insights into customer acquisition, partnership strategies with restaurants, and delivery logistics. Moreover, Foodpanda's experience in adapting to the digital economy and ministering to a diverse variety of consumers corresponds with our vision for enhancing employment opportunities while offering a convenient breakfast delivery service.

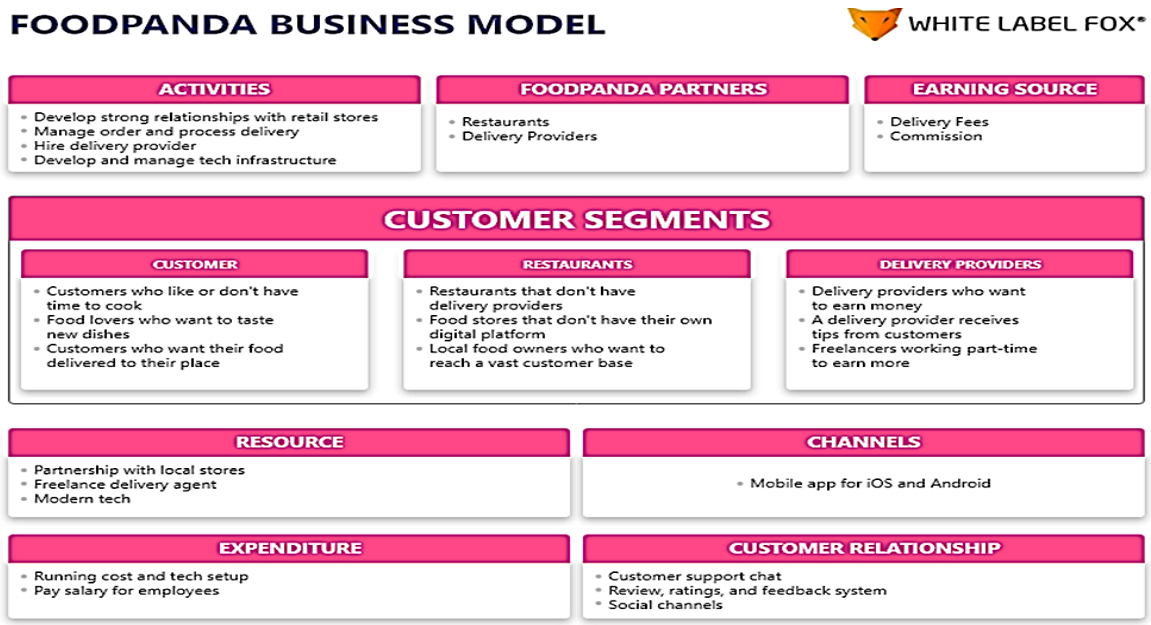

Fig.1. Foodpanda Business Model

4.6.2. McDonald's

McDonald's is well-known for its distinctive fast-food business model (https://businessmodelanalyst.com/mcdonalds-business-model/) and for producing exceptional cuisine rapidly while also nurturing strong customer relationships. McDonald's concentration on operational efficiency through reduced procedures and standardised formulas is the main factor propelling its achievement. Using a highly developed supply chain, advanced kitchen technology, and well-trained employees, McDonald's guarantees prompt service without sacrificing the quality of the meal. Crucial roles are also performed using modern consumer relationship methods including the development of mobile ordering, loyalty programmes, and interactive feedback mechanisms. These programmes enhance client convenience while also contributing to a customised and gratifying dining experience. McDonald's persistent success in the fast-paced and competitive fast-food market is attributed to its ability to combine proactive customer relationship management with operational excellence in a seamless manner.

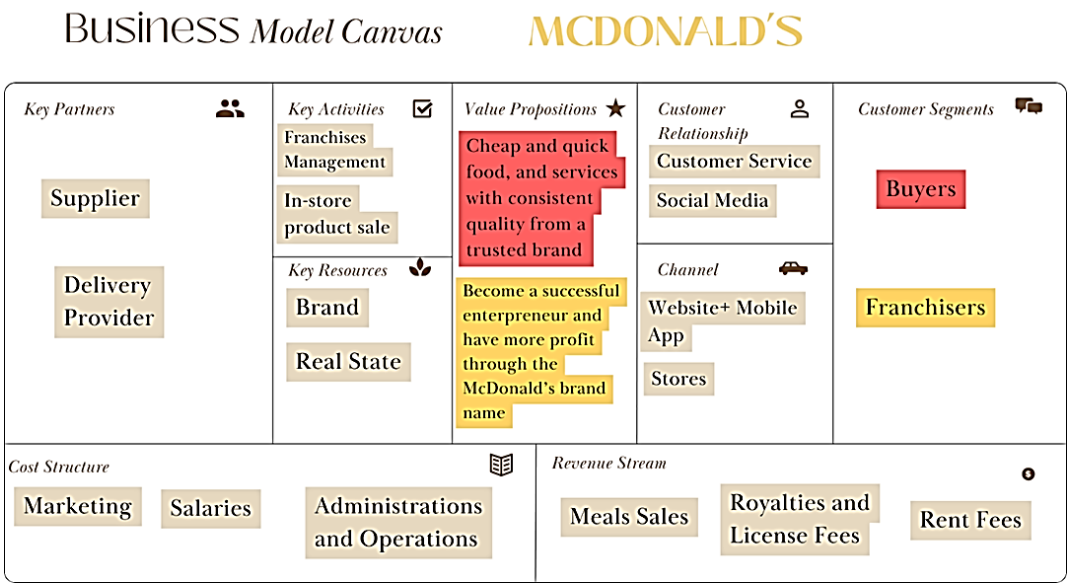

Fig. 2. Transcribed McDonald's Business Model Canvas

4.6.3. mKitchen

The mKitchen model is a comprehensive strategy for managing the numerous challenges that the B40 community encounters. With a concentration on nutritional security, skill development, economic empowerment, and community participation, the approach endeavours to provide possibilities and long-lasting, positive change for individuals and families in the B40 segment. Giving them access to the resources and training necessary for the B40 to become foodpreneurs, along with the freemium features, is a crucial input for the "QuickFoody" business model.

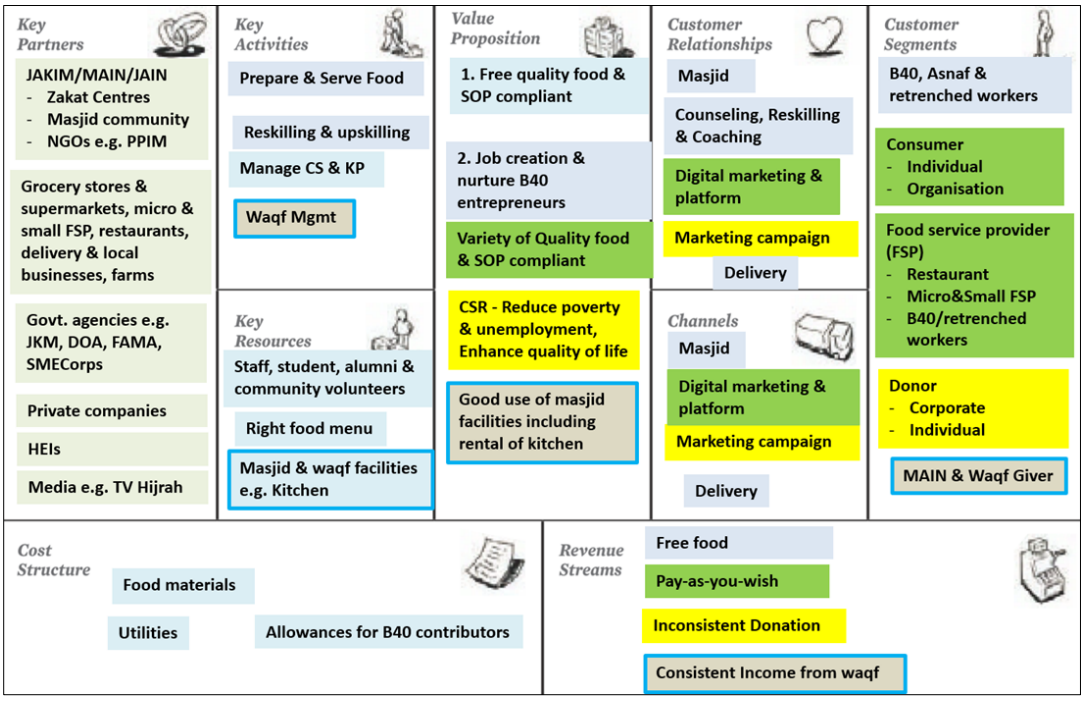

Fig. 3. mKitchen Business Model Canvas (Ahmad Dahlan et al., 2021)

5. INITIAL BUSINESS MODEL (BM)

Based on the literature review conducted above, the initial business model of QuickFoody is shown in Fig. 4 below.

5.1. Initial BMC

Business Model Canvas	Quickfoody		Ikhtiar, Affif,Syahmi	18/10/2023	1.0

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
A. Local wholesale supplier. B. Online transaction gateway Marketing partner	A. Order management and delivery coordination. B. Take product from wholesale supplier. C. Review section	A. Quick and convenient breakfast delivery with a diverse breakfast menu is available to suit various tastes. B. Platform to increase sales	A. Online ordering and payment system for self-service. B. Live chat between deliveryman and customer C. Live chat between store and customer	A. Breakfast Customer • Individuals seeking convenient breakfast delivery • Busy professionals and students who lack time to prepare breakfast. B. Breakfast Provider • Local • Big Company
	Key Resources		**Channels**	
	A. Online platform and mobile app. B. Kitchen C. Human Resource		A. Website and mobile app for online orders. B. Social media and online advertising. Delivery services.	

Cost Structure		Revenue Streams		
A.Marketing and advertising expenses. B.Website and mobile app development and management	C. Rent kitchen for making food.	A. Sales revenue from breakfast orders.	B. Subscription for platform	C. Advertisement

Fig. 4. Initial Business Model Canvas

5.2 . Initial VPC

5.2.1. VPC for Breakfast Customer

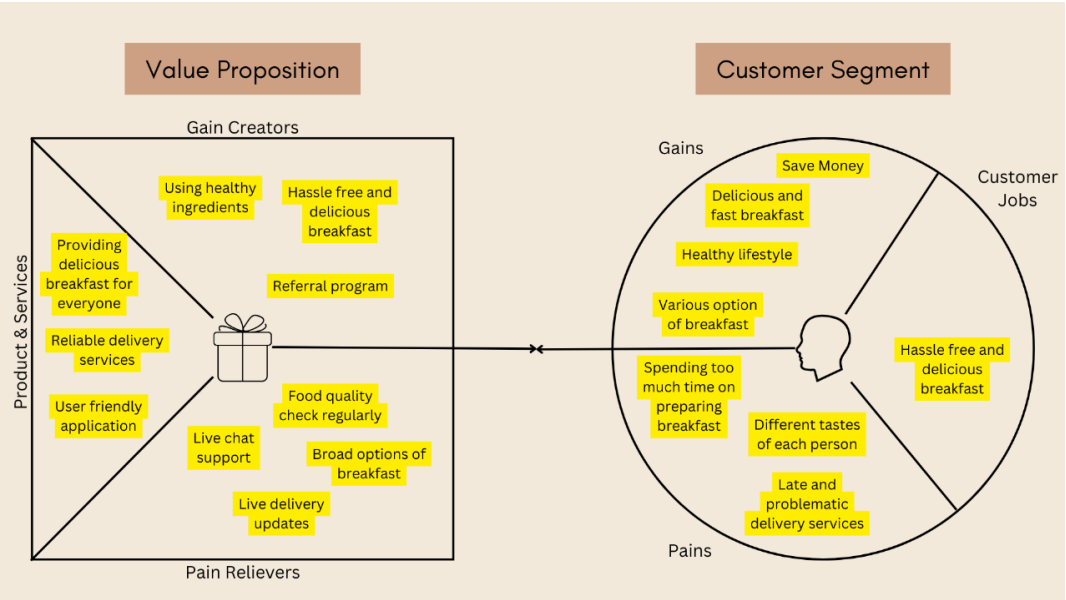

Fig. 5. Initial VPC for Breakfast Customer

5.2.2. VPC for Breakfast Provider

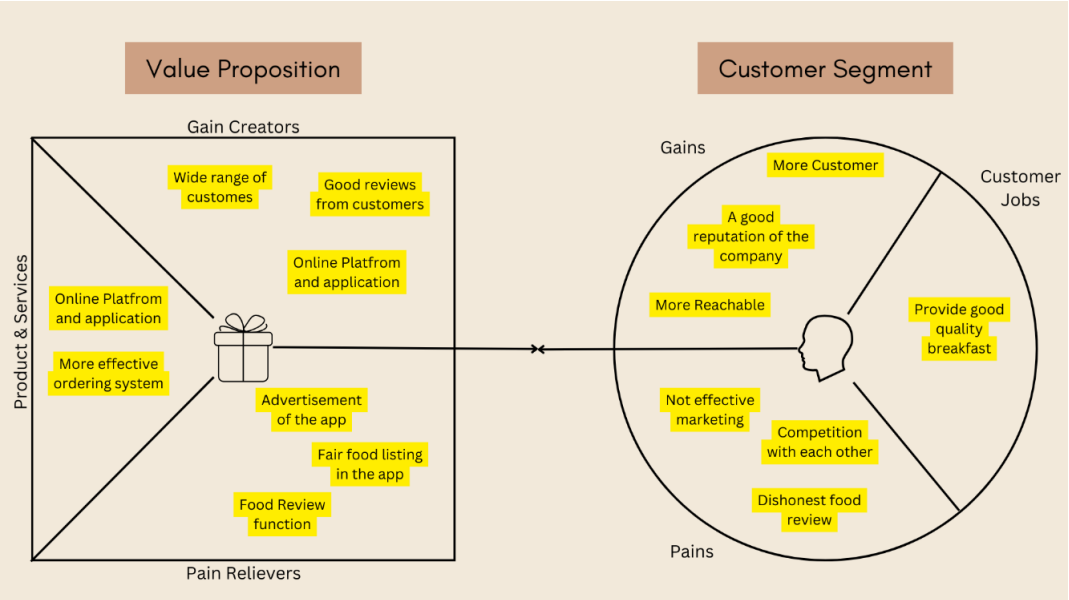

Fig.6. Initial VPC for Breakfast Provider

6. CONDUCT VALIDATION OF INITIAL BM & KEY FINDINGS

To validate our business model, eight queries was formulated and get 79 respondents have responded. Each respondent's response is analysed to each topic. The results of the survey queries are shown in Fig. 7.

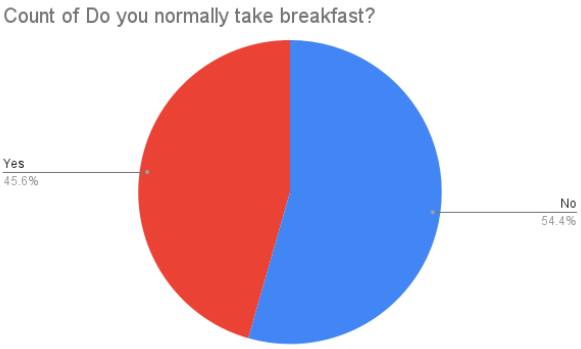

Fig. 7. Percentage of people who took breakfast regularly or not.

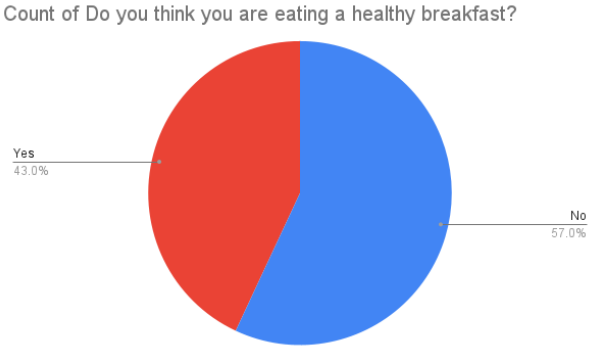

Fig. 8. Percentage of people who took breakfast in healthy way or not.

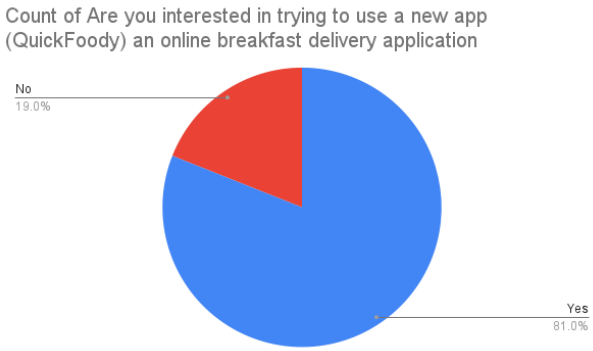

Fig. 9. Percentage of people who interested in trying Quick Foody

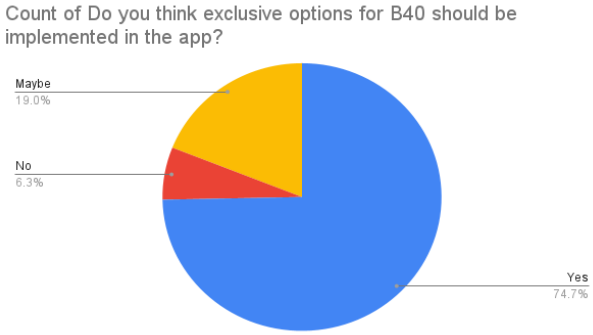

Fig. 10. Percentage of people who agrees in giving aid to B40 community.

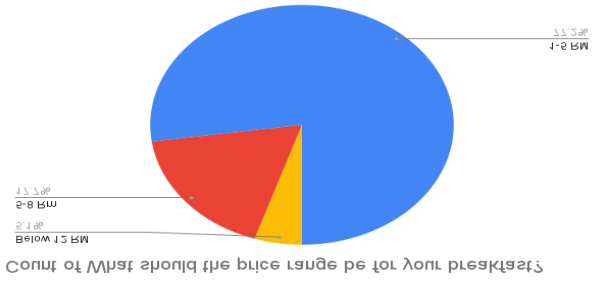

Fig. 11. Percentage of people's opinion on price range

The validation process for QuickFoody, the online breakfast delivery platform, yielded several critical insights that emphasize the platform's potential impact on the breakfast delivery market, particularly for the B40 community. Survey responses revealed a strong demand for affordable meal options, with over 70% of respondents expressing interest in a service tailored to their needs. This presents a valuable opportunity for QuickFoody to establish itself as a reliable option for those seeking budget-friendly breakfast choices.

User feedback highlighted the importance of personalization within the app. Many participants emphasized the need for a varied menu that accommodates different tastes and dietary requirements, suggesting that offering customizable meal options could enhance user satisfaction. The desire for balanced nutrition assurances and calorie counts indicates a growing trend toward health-conscious eating, further underlining the necessity for diverse and nutritious offerings.

One of the standout findings was the enthusiasm among B40 foodpreneurs for the upskilling programs integrated into the QuickFoody platform. Many expressed

a desire to expand their businesses but cited barriers like digital literacy and marketing knowledge as significant challenges. By incorporating training and mentorship programs, QuickFoody can not only empower these entrepreneurs but also foster a vibrant community that supports local food businesses, enhancing the app's value proposition.

However, the results also revealed some challenges. While most users appreciated the focus on affordability, there was hesitancy regarding the introduction of subscription models for premium services. Future iterations of the platform will need to strike a balance between offering cost-effective solutions and generating sustainable revenue streams. This could involve careful consideration of how subscription models are designed and marketed to ensure they align with users' perceptions of value.

QuickFoody has a promising opportunity to resonate with users by emphasizing affordability, health, and customization while addressing the needs of the B40 community. By integrating feedback from the survey and focusing on upskilling local foodpreneurs, the platform can enhance user satisfaction and build a loyal customer base, positioning itself as a unique player in a competitive food delivery landscape.

7. VALIDATED BM – USING BMC FRAMEWORK

7.1. Validated BM

For open ended query, respondents were asked if there any enhancement that can be applied in QuickFoody. The responses are positive which there are many suggestions that can be implemented and enhance the business.

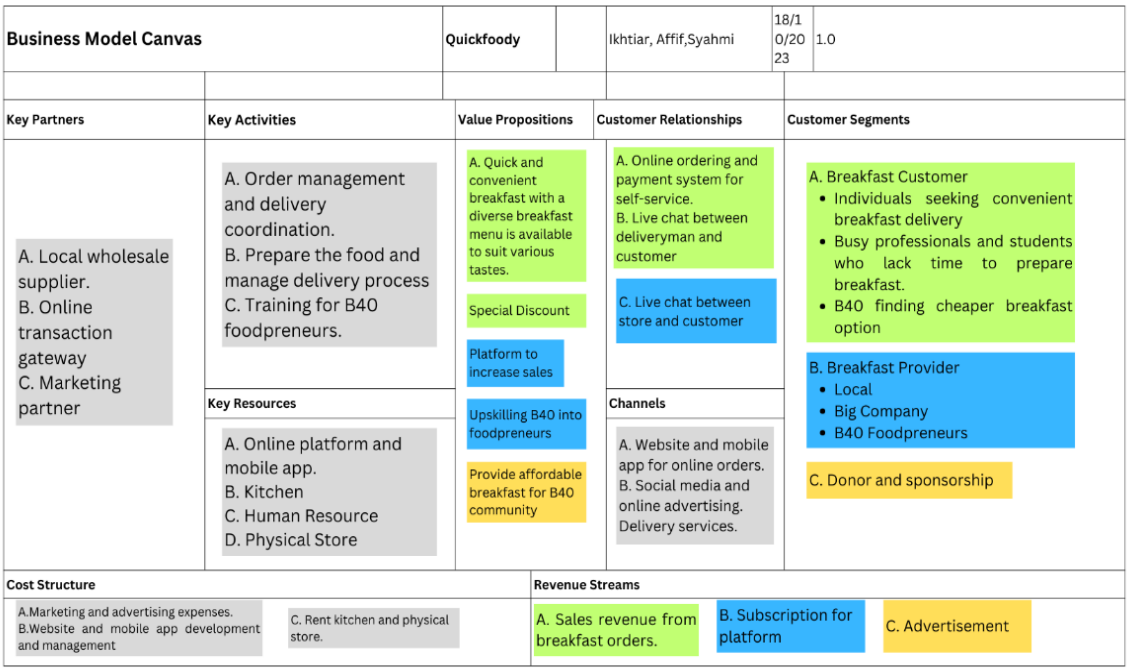

Fig. 12. Validated Business Model for QuickFoody

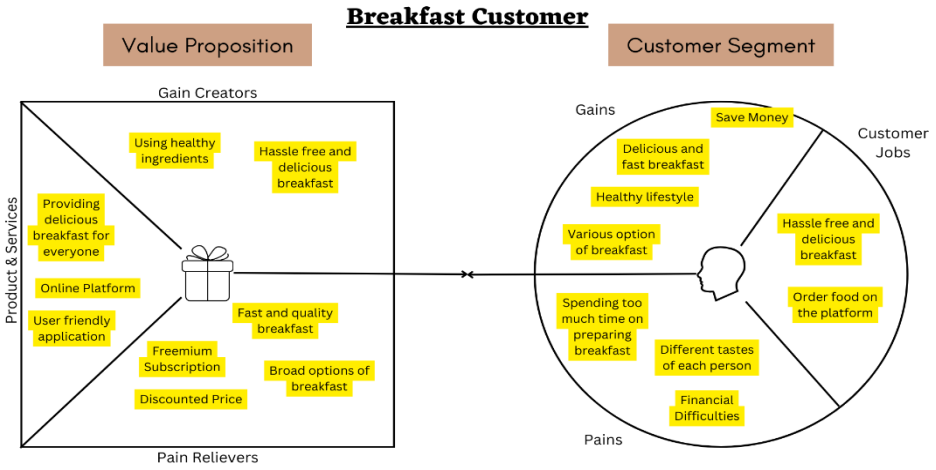

Fig. 13. VPC for Breakfast Customers

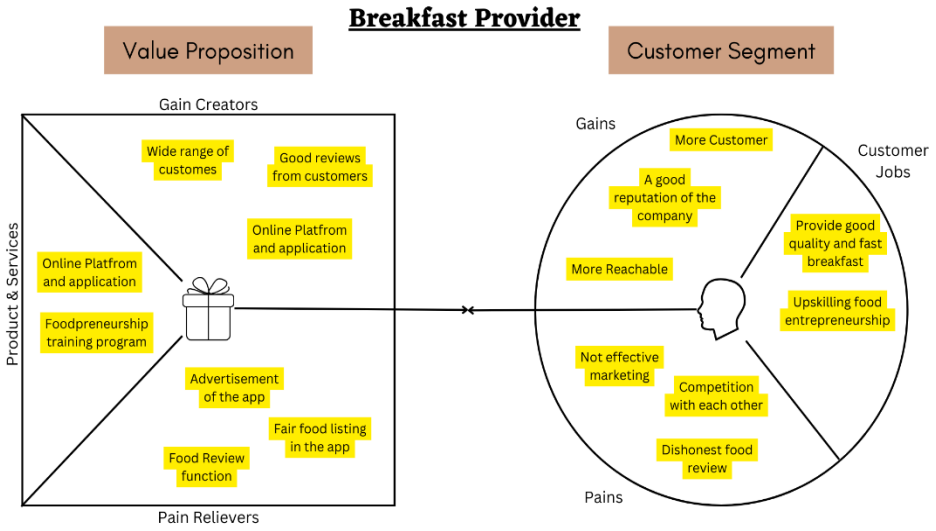

Fig. 14. VPC for Breakfast Provider

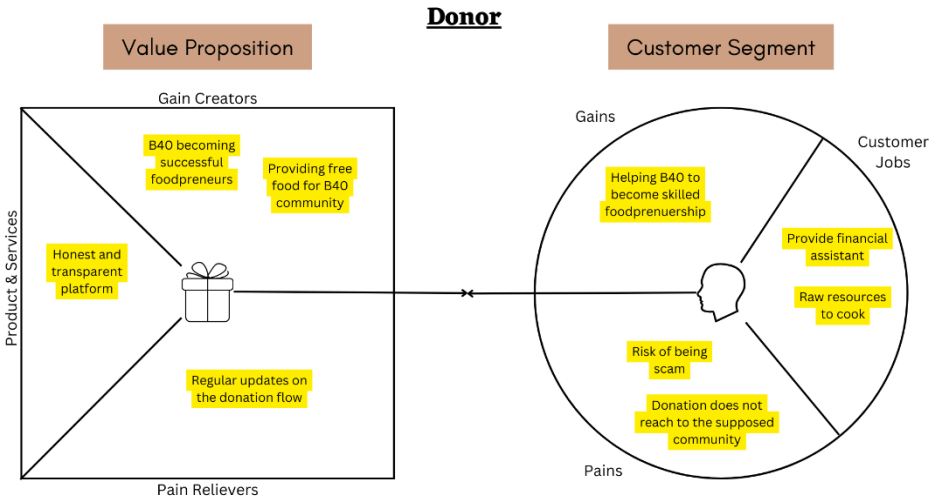

Fig. 15. VPC for Donor

7.1.1. Customer Segment (CS)

There are three main CS served by this breakfast delivery business. The first CS consists of students and working adults searching for affordable and practical breakfast alternatives. Because of time factors, they place a premium on rapidity and accessibility. To address the community's need for rapid and varied breakfast options, the second CS represent the local SME food businesses and fledgling B40 food entrepreneurs. The aim is to enhance the food ordering and delivery eco-system as well as up-&re-skill the B40 foodpreneur and enhance their competencies in the food business. The third CS is the donor which will provide the funds to assist the B40 community to get affordable sustenance and up-&re-skill them.

7.1.2. Value Proposition (VP)

Offering quick and easy breakfast alternatives with a varied menu that accommodates various palates is the primary value proposition, which appeals to the time-conscious client segments. By offering exclusive discounts in support of the B40 community, the service lowers the cost of breakfast. Moreover, it establishes a forum for B40 people to upgrade their skills and provides opportunities for them to become food related entrepreneurs, promoting community development, economic empowerment and enhance effectiveness & efficiency of the food ordering and delivery eco-system.

7.1.3. Channels

Customers can simply order breakfast online by using a website and a mobile app as the primary channels and physical channels like community centres & masjid. Utilizing online advertising and social media increases exposure and draws in a larger audience. Furthermore, effective delivery services, leveraging on existing community centres like network-of-mosques (Hamid et al., 2013; Ahmad Dahlan et al., 2014), guarantee dependable and timely delivery, enhancing the clientele's experience in general.

7.1.4. Customer Relationship

By employing an online platform that prioritizes simplicity in ordering and payment processes, our service endeavours to cultivate strong customer relationships. The incorporation of live chat assistance is a strategic move to enhance communication between delivery personnel and clients, ensuring seamless delivery experiences. Moreover, sustaining an open live chat feature between the store and customers facilitates quick resolution of any queries or issues. This not only creates confidence but also establishes a sense of dependability. In addition to customer engagement features, the service integrates a review and rating system, allowing customers to provide feedback and contribute to the continuous enhancement of our offerings. Furthermore, as part of our commitment to social impact, coaching and mentoring programs are incorporated to support B40 foodpreneurs, empowering them with the skills and knowledge

required to succeed in their ventures. This multifaceted approach seeks to establish a customer-centric and socially responsible business model.

7.1.5. Revenue Stream

Several sources of income are generated, but the primary one is sales revenue from breakfast orders that are submitted on the platform. Possible membership or subscription fees for premium services, as well as money from platform advertisements, are potential additional revenue streams.

7.1.6. Key Resources

The mobile app and web platform serve as integral consumer interfaces, representing essential resources for our service. To assure efficient food preparation and delivery, we recognize the significance of having sufficient human resources, and as co-founders, our collaborative efforts contribute to operational success. Regarding the kitchen facilities, we've opted for a rental strategy rather than purchasing to manage costs effectively. This approach corresponds with the bootstrapping strategy, comparable to successful models employed by companies like AirBnB and GrabFood. By utilizing shared kitchen spaces, we can optimize resources while maintaining flexibility. Additionally, while the digital platforms are primary, a physical store is considered occasionally for operational purposes and direct customer interaction, enhancing our overall business model.

7.1.7. Key Activities

Efficiently managing orders, delivery schedules, and food preparation procedures constitute the fundamental activities of the service. This involves supervising the entire delivery process to ensure accurate and expeditious order fulfillment. Moreover, the service allocates funds for training initiatives, empowering B40 individuals with the necessary tools to thrive as food entrepreneurs. In tandem with these efforts, continuous development and enhancement of the digital platform and applications are integral, assuring a seamless and responsive system that supports the overall operational efficiency and customer experience.

7.1.8. Key Partners

Forming partnerships with local wholesalers guarantees a reliable and reasonably priced supply of ingredients. Secure online transaction gateway collaboration makes it simpler to manage payments in a secure and efficient manner. Furthermore, collaborating with marketing companies or agencies enhances promotional tactics and broadens the service's consumer base. Collaborating with essential partners, such as KKM, JKM, masjids, and Zakat centres, plays a pivotal role in enhancing the service's overall effectiveness and reach. Partnering with KKM ensures regulatory compliance and access to health guidelines, nurturing customer trust. JKM collaboration aids in community outreach, particularly in identifying and supporting potential beneficiaries within the B40 community. Masjids, functioning as community centres, offer valuable connections

and communication channels for targeted outreach and promotional activities. Partnering with Zakat centres not only provides financial support for B40-focused initiatives but also enables the identification of individuals or families who could benefit from the service. These collaborations contribute to a more comprehensive and socially responsible business model, aligning with the service's mission to provide reliable, reasonably priced food solutions while positively impacting the communities it serves.

7.1.9. Cost Structure

The service's marketing and advertising costs are included in the cost structure. For a faultless user experience, it also entails administering and developing websites and mobile applications. For food preparation to be facilitated and, if applicable, a storefront presence to be maintained, funds for kitchen and physical store rent must be allocated.

7.2. Environmental Map

Fig. 15. Environmental Map

7.2.1. Market Forces

Quickfoody's mission is to provide accessible, diversified, and cheap breakfast alternatives to meet the different requirements and demands of busy professionals, students, and the B40 community. The study will look into market difficulties, evaluating potential obstacles such as competition and shifting tastes. Understanding how readily customers may move from other breakfast providers to Quickfoody requires assessing switching costs. Furthermore, assessing the revenue attractiveness of each consumer category will be critical for strategic planning. ("Pricing Strategies for Online Food Delivery Services" by Harvard Business Review (2020)).

7.2.2. Industry Forces

A focus on the dependability and cost-effectiveness of the local wholesale supplier, as well as the availability and cost-effectiveness of resources in the food preparation value chain, is critical among supplier and value chain players. Identification of funders and sponsors interested in sponsoring activities linked to inexpensive breakfast and upskilling B40 persons is one of the stakeholder concerns. Analyzing rivals in the breakfast delivery sector, both local and large, as well as the influence of B40 Foodpreneurs, will give insights. Identifying replacement products and services, such as other breakfast alternatives, and

removing barriers to entry for new entrants are critical components. ("Social Impact Investing in Malaysia: A Landscape Report" by UNDP (2021)).

7.2.3. Key Trends & Foresight

A full examination of income levels impacting the cost of breakfast for the B40 community, as well as the social impact of upskilling programs, is required under the socioeconomic trends area. Considerations of cultural preferences impacting breakfast choices, as well as the social move toward online ordering and payment systems, are examples of sociological and cultural trends. Monitoring health and safety standards in the food business, as well as any changes influencing internet advertising, are examples of regulatory developments. Staying up to speed on technological improvements in online ordering systems and mobile applications, as well as trends in last-mile delivery services, is essential. (Breakfast Skipping Among Adults in Malaysia: Prevalence and Associated Factors" by Nurul Izzati Mohd Noor et al. (2018)).

7.2.4. Macro-economic

The influence of transportation infrastructure on delivery services, as well as the quality of digital infrastructure impacting online platforms, require serious consideration under economic infrastructure. Commodities and other resources entail monitoring the stability of food prices, which affects the cost of food preparation, as well as the availability and cost of human resources, particularly in the context of B40 Foodpreneur training. Considerations for capital markets include the availability of funds for marketing, app development, and other company operations. Finally, worldwide market circumstances entail monitoring global economic trends that may have an indirect impact on local market dynamics, as well as reviewing global supply chain conditions that affect ingredient sourcing. ("Food Prices in Malaysia: Trends and Drivers" by Department of Statistics Malaysia (2023)).

7.3. STRATEGY CANVAS

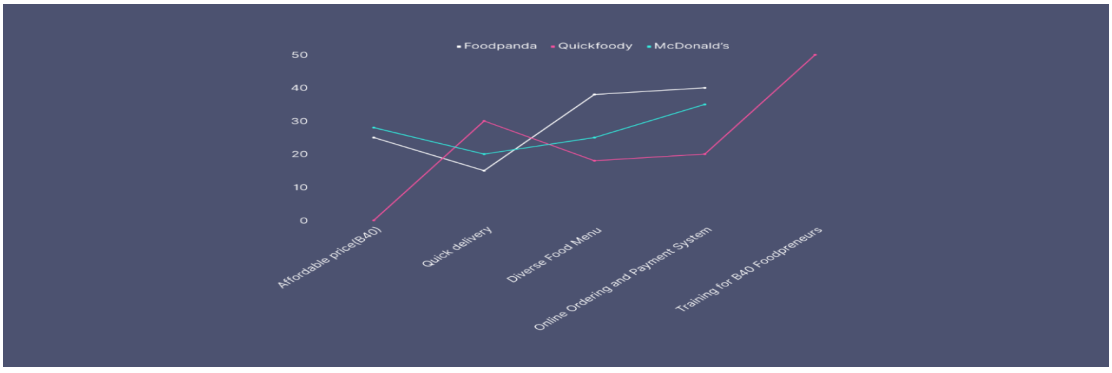

Fig. 16. Strategy Canvas

Quickfoody uses the Blue Ocean Strategy (BOS) to position itself competitively against FoodPanda and McDonald's in the breakfast delivery sector across various dimensions. Quickfoody prioritizes timely and easy delivery & pickup services,

distinguishing itself via speedier and more trustworthy services. While FoodPanda and McDonald's emphasis on speed varies, Quickfoody strives for a distinct BOS by stressing great speed and dependability, while helping and nurturing B40 food-preneurs.

Quickfoody distinguishes itself by emphasizing a wide breakfast menu with unique and inventive selections. The offers of competitors differ, but Quickfoody hopes to create a blue ocean by delivering unique and diverse breakfast options. Quickfoody is generating a blue ocean by targeting an underrepresented market segment by focusing on affordability for the B40 group. While FoodPanda and McDonald's place different focus on different aspects, Quickfoody aims to break market limits by making affordability a primary value proposition. Quickfoody distinguishes itself by emphasizing an easy-to-use online ordering and payment system, so generating a blue ocean of smooth and efficient digital transactions. FoodPanda and McDonald's online experiences vary, but Quickfoody stands out by offering an amazing online ordering procedure.

Quickfoody distinguishes itself by focusing the up-and-re-skilling of B40 community to become foodpreneurs, with high social impact outcomes through community engagement. While FoodPanda and McDonald's may not share Quickfoody's emphasis on community upskilling initiatives, the company aspires to alter industry norms. Quickfoody forms long-term, mutually beneficial collaborations with local wholesale suppliers of foodstuffs, with the goal of creating a blue ocean through innovative suppliers and partnership initiatives. While rivals' techniques may differ, Quickfoody seeks distinctiveness through unique supplier connections. Quickfoody establishes itself as a blue ocean player in the breakfast delivery sector by innovating across all aspects of its business strategy. Quickfoody distinguishes itself by providing a quicker, more variety, and affordable breakfast, as well as a strong internet presence, community participation, and unusual collaborations. FoodPanda and McDonald's may have different positioning, but Quickfoody intends to create a blue ocean by giving a distinct and new value proposition, eventually rewriting industry limits.

7.4. Low Fidelity prototype apps

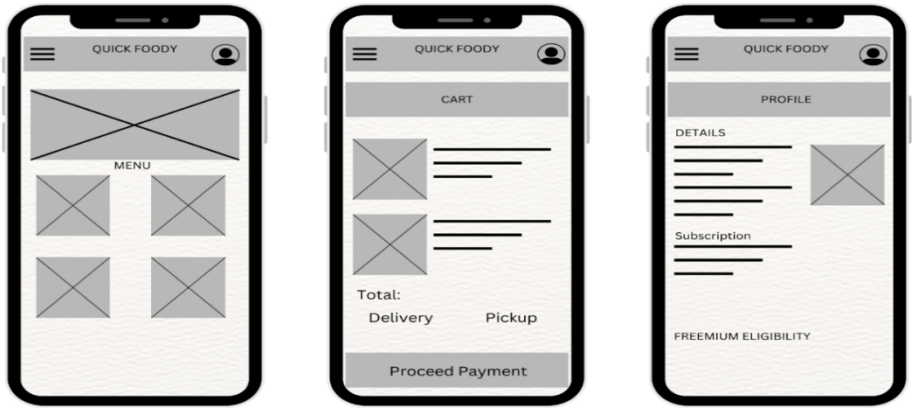

Fig. 17. Low Fidelity app of Quick Foody

Fig 17 above shows the low fidelity app of Quickfoody. In the first picture show the homepage of the app. In consists of menu button, profile button, and also

several hot selling menus. From the homepage, customer can navigate through the app to get suggested food.

The second picture is the cart page where customers can review their order for confirmation and payment. In this page, the menu selected by the customers is viewed with the details of the food and the total price.

In the profile page, customers can review and edit their personal details, manage their subscription information, and, specifically for the B40 community, assess their eligibility for free food. To access the privilege of receiving free food, B40 community members need to apply through the designated process. Additionally, the profile page may incorporate features allowing customers to provide reviews and ratings based on their experiences, contributing to a transparent and community-driven platform.

8. CONCLUSION AND FUTURE WORKS

In conclusion, our exploration in establishing the conceptual and validated "Quick Foody" business model revealed key challenges encountered by diverse customer segments, including busy professionals, students, retrenched workers, and food providers & couriers within the B40 or low income bracket, as well as breakfast providers in general. The primary job-to-do for these individuals is to access a convenient, diverse, and affordable breakfast. The extreme pains they encounter include financial constraints, schedule limitations, and a dearth of wholesome options. Conversely, the essential gains pursued are not just limited to a meal but incorporate speed, convenience, and overall well-being. The conceptual solution of "Quick Foody" shines out as a significant differentiator in addressing these challenges. Our conceptual business model concentrates on creating value and benefits through innovative platform/app as gain creators and suffering relievers. Key features of our digital platform/app include a user-friendly interface for seamless online ordering and payment, a diverse breakfast menu tailored to individual preferences, and efficient delivery coordination and eco-system. By strategically positioning as a blue ocean player, emphasizing rapid and reliable services, affordability for the B40 community, and community engagement through food-preneur training up-skilling, and re-skilling, "Quick Foody" business model redefines the breakfast delivery landscape.

The next phase for Quick Foody is to build a business plan including expanding the platform to other meal categories, such as lunch and dinner. At the same time, exploring to increase its market potential and enhancing its relevancy to the various customer segments. Additionally, the integration of advanced technologies like AI for personalized meal recommendations; driver delivery app which provides step-by-step directions from restaurant and breakfast providers to customer to ensure smoother delivery processes in highly populated urban areas; and blockchain for ensuring transparency in donations will be explored to enhance the platform's functionality and usefulness. Future research should also investigate partnerships with government agencies like *Jabatan Kebajikan Masyarakat* and Zakat centres, NGOs including mosques, and international organizations to scale the model geographically and extend its social impact to other underserved communities.

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