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'QALBCONNECT' PROJECT BUSINESS MODEL: BUILDING A UNIFIED AND TRUSTED DIGITAL PLATFORM FOR PROGRAM ALERTS AND WELL-CONNECTED MUSLIM COMMUNITY

NURSYAZWANA ATHIRAH SAMSUL BADRI[1*], NUR FAIZAH OMAR[2], NURDIYANA SHAHIRAH AZLAN[3], SHAZA SHAMSUL[4], ABDUL RAHMAN AHMAD DAHLAN[5]

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ABSTRACT: This paper presents a conceptual QalbConnect project business model (BM) for a digital platform/app designed to unify and consolidate Islamic programs on a single, integrated, and trusted platform. This is to help addressing the challenges, extreme pains, essential gains, and important job-to do of various customer segments (CS) by program organizers and participants. The platform addresses the challenges faced by program participants in discovering, attending & engaging with these programs as well as an easy side income for programs organizers. Currently, programs promotion is in silo and fragmented, relying on local mosque announcements, words of mouth, and from various social media platform creating "island of automation". These uncoordinated and silo approaches are no longer sufficient to meet the needs of the society in the digital era, making it difficult for Muslims to easily find and follow relevant programs on a single, integrated, and trusted platform. The platform resolves this silo and uncoordinated issue by consolidating all programs information in a single platform, streamlining the promotion process and making programs more accessible to a wider audience among the community. Employing the Design Thinking (DT) methodology, this paper explores the insights faced by programs organizers and participants through literature reviews, benchmarking, interviews and surveys to understand and define the key challenges, extreme pains, essential gains & important job-to-do of all of the customer segments. Followed by ideation and designing an initial BM with a digital platform/app prototype, using business modelling tools i.e. the Environmental Map (EM), Business Model Canvas (BMC), and Value Proposition Canvas (VPC). The initial BM was tested and validated with the CS. After testing, the validated project business model was established. A strategy canvas was created to compare the validated project business model against other platforms. Finally, this paper offers a validated conceptual business model for QalbConnect as a solution, pain reliever, and gain creator in addressing the important job-to-do, extreme pain, and essential gain of CS. Future works include the development of a detailed Project Management Plan (PMP) for QalbConnect digital platform/app.

KEY WORDS: *Islamic programs promotion, Unified & Trusted Digital platform, Entrepreneurship, Knowledge-seeking, Community Engagement*

1. INTRODUCTION

There is a limit of understanding of how individual Muslims and the community understand and make use of social media (Larsson, 2024), thus making it difficult to analyze the true impact of *Da'wah* dispersing the community. Therefore, there must be a need to assist the community in spreading the *Da'wah* at an utmost action in this digital era. This is proven based on the document from World Bank (2018) where most Malaysians are connected to the internet and engage in the digital world. The existing digital solutions play a huge role in promoting the *da'wah* programs. However, the media content distributed is inconsistent. In many cases, participants only become aware of programs after they have already taken place, further highlighting the inefficacy of current promotion methods and the need for a more cohesive digital solution. Promotion signaling distortion exists across various settings and can even occur in the form of inefficiencies concerning who is promoted (Waldman, M., & Zax, O., 2016). Thus, there is a risk of creating islands of automation among various digital platforms (Guan et. al, 2017), where efforts to promote Islamic programs remain fragmented.

Therefore, 'QalbConnect' is the proposed digital platform that would provide a unified and trusted solution for the participants to discover current and future programs which enhance their participation in the community. The participants have a wide advantage of accessing a variety of Islamic programs, receive programs calendar with relevant information, receive a real-time notification reminder update, and participate through live streaming options, access to programs materials like videos, recordings and notes. All in all, this digital platform would foster greater community involvement which offers a streamlined approach gathering the community to spread the Islamic knowledge in Islamic programs.

In conjunction with the Sustainable Development Goals (SDG), this platform supports SDG Goal 4: Quality Education, as it enables the participants to participate in Islamic knowledgeable programs and remotely through live streaming breaking the barrier of demographic constraints. Aside from supporting the programs organizers with analytics insight provided by QalbConnect for each program, this platform also helps to promote the Islamic programs to a larger audience and provides options to find volunteers as programs managers of Islamic programs which relatively contributes to SDG Goal 8: Decent Work and Economic Growth. This platform also encourages Muslims to create their own individual or organization programs or class to gain easy income with an easy steps and affordable cost to foster even more entrepreneur among Muslim community. This proposed project also aligns with SDG Goal 16: Peace, Justice, and Strong Institutions, which provides a trustworthy platform for deepening Islamic knowledge, and giving access to everyone to participate, regardless of social status, location, or financial means. Finally, the SDG Goal 17: Partnerships for the Goals correlates to one of the features of the app which foster partnerships with Islamic programs organizers, Muslim-related government agencies, Muslims NGOs, and mosques, across Malaysia, which bridges the gap between the community and large organizations.

2. OBJECTIVES

The main objective of this paper is to develop a conceptual business model for the 'QalbConnect' digital/IT project, which provides up-to-date Islamic programs, promotes Islamic teaching, fosters well-connected Muslims and non-Muslims community engagement, while enhancing societal well-being. 'QalbConnect' aims to serve as a platform for both programs organizers to promote their program effectively and participants to discovering, attending & engaging with Islamic programs. Thus, the paper proposed a unified and trusted digital platform for programs alerts and community connection with these following features to address pain points and creating value:

a) Unified and trusted Islamic program information, enabling participants to effortlessly discover upcoming Islamic programs across Malaysia.

b) Offers multiple access options, allowing participants to either attend programs in person or stream them live through the app.

c) Personalizes profile preferences, enabling participants to tailor their experience by selecting specific interests and speakers, notification settings, preferred venue and programs types they wish to engage with.

d) Participants have access to programs calendars with detailed information, receive real-time notification for programs updates, reminders and cancellations as well as access to programs materials like videos, recordings and notes.

e) Community forum to discuss and connect as well as a question-and-answer forum in each program in real-time.

f) Improves programs promotion by providing program organizers with user-friendly tools to easily list and update programs, track RSVPs, analytical insights and engage wider audiences through advertisement, sponsors and notifications.

3. METHODOLOGY

This paper adapts the Design Thinking (DT) methodology to develop a conceptual business model (BM) for ‘QalbConnect' - the Islamic programs management application. The methodology involves conducting a literature review (LR) (Cronin, Ryan, & Coughlan, 2008), benchmarking along with interviews and surveys to understand the challenges and problems faced by various customer segments (CS) (Meyer & Schwager, 2007). This is followed by the ideation and development of the initial business model (Osterwalder & Pigneur, 2010) and finally establishing the validated business model.

Firstly, we empathized with the problem and requirements for the project through a literature review including benchmarking, interviews, and surveys. The literature review was conducted to explore the current challenges faced by customer segments (CS) in promoting and attending Islamic programs. The LR aimed to gather insights about the problems of fragmented programs promotion methods, the effectiveness of current digital platforms for religious engagement, and the business models of similar applications that have been developed.

Following the literature review, interviews and surveys were conducted with various customer segments, including IIUM mosque community (i-Masjid) as program organizer and potential program participants. The main goal of this phase is to define the pain points these challenges impact in their engagement with Islamic programs, as well as the gains through a solution.

Based on the insight gathered from LR, interviews, and surveys, ideation sessions were held to explore creative solutions to address the key challenges and opportunities identified. Business modeling tools such as the Business Environmental Map (EM), Business Model Canvas (BMC), and Value Proposition Canvas (VPC) (Osterwalder et al., 2014) were utilized to develop an initial business model with a digital platform/app prototype for the Islamic Programs Management application. This model outlined key features such as providing tools for organizers to promote programs effectively and revenue stream.

The initial project business model with the digital platform/app prototype were then tested and validated with customer segments. The feedback include the usability of the digital platform/app and its potential to solve the identified challenges. Based on the feedback, the business model was refined, leading to the development of a validated conceptual business model.

Finally, a Strategy Canvas will be developed to compare the current state of Islamic programs promotion with and without the platform, highlighting the improvements provided by the proposed solution (Kim & Mauborgne, 2005; Kim & Mauborgne, 2014). This comparison will demonstrate how the platform effectively addresses key community pain points and enhances overall participation and accessibility.

4. LITERATURE REVIEW

4.1. Humanizing 4IR in the post COVID-19 era

4IR refers to the disruptive transformation of industries through the application of emerging technology (National 4IR, 2021). The Fourth Industrial Revolution (4IR) was shaped by the rise of advanced technologies. It is marked by the emergence of technology including robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the Internet of Things, and the 5th wireless technology (). In the 21st century, this technology has become a big part of daily life in many societies. Information Technology (IT) brought many changes in people's lives, influencing their behavior, communication, and lifestyle (Khairudin, Sheikh, 2021). This advancement is not limited to general use but has also permeated humanizing practices and community engagements, particularly within communities. For example, Covid-19 emerged in December 2019, and in March 2020 was declared a pandemic by the World Health Organization (Mishra, S. K., & Tripathi, 2021). In such a situation, it disrupts religious activities not only in Malaysia but also around the world. The coronavirus outbreak forced many religious leaders to accommodate themselves and become content creators by focusing more on social media users and their online engagement (Heilweil, 2020). Many Muslims now use Internet tools for a variety of purposes, such as spreading Islamic teachings, practicing their faith, and engaging in everyday activities (Evolvi, 2021). Increasingly advanced technology has eliminated time and space limits so that *da'wah*, one of the core Islamic tenets, that was traditionally a person-to-person spiritual interaction can now be done through electronic interfaces (Rouet, 2020). Classical sources inform us

how Muslims before used to travel long distances and over long periods of time just to acquire single hadith from a scholar (Cangara et al., 2022). These difficulties during the early waves of the pandemic have led many individuals and religious organizations to imply different strategies by utilizing virtual spaces to communicate with their people beyond the traditional ways (Altawil, Abdulaziz, 2022). Nowadays, technology enables us to reach out to the entire world. Studies have shown that digital platforms enhance participation and awareness in religious events and help create a more interconnected community (McClure, 2017). This proves that advancing technology is important to humanizing the 4IR by focusing on improving lives and building a more inclusive society.

4.2. Bridging Faith and Innovation for the Well-Connected Muslim Community

As technology continues to reshape our world, Islamic community gatherings are embracing innovative approaches to transform how people connect, engage, and celebrate their faith. This evolution fosters deeper connections among community members, encourages more meaningful interactions, and creates a more inclusive experience while blending traditional values with modern influences. Previously, participants traveled from different homes or work locations to attend these traditional conferences together in person (Skrodzki & Damrau, 2022). This meant that people had to physically be present at the event to participate and gain knowledge. However, this approach required significant time, money, and energy. Today, people of all ages are adopting technology in their daily lives. Social media is being used for a variety of purposes, including messaging, emailing, knowledge sharing, chatting, advertising, buying and selling, booking of airlines and hotels, and studying (Gulzar, Ahmad, & Rasheed). This adoption implies that knowledge can now be accessed through digital platforms like Instagram, Facebook, and TikTok. This shift allows for instant connectivity, transcending geographical boundaries and time constraints (Miller et al., 2016, as cited in Omar & Ondimu, 2024). The convenience of using technology has made life easier for a lot of people.

4.3. Event-Enabled Mobile Applications: Seamless and Smart Technological Platforms for Managing Virtual and Hybrid Events and Festivals

The recent catastrophic COVID-19 pandemic has changed the business practice scenario worldwide, the event management market was also affected very much and brought major technological transformation in event management system (Kulshreshtha, S. K., Akoijam, S. S., Kumar, P., & Shukla, U. N. 2024). It is notably known that the COVID-19 has brought anything around us to be digitized. Unconsciously, we need to adapt with this digital era in order for you to not be left behind and this also includes on how we have to adapt a whole new way on how we handle events all this time. However, despite all of these challenges to adapt to the new changes it actually has also opened up the doors to new forms of contextual marketing – the ability to personalise an attendee experience by engaging with them at the right time and in the right place (based on an attendee's location, behaviour or preferences) (Kulshreshtha, S. K., Akoijam, S. S., Kumar, P., & Shukla, U. N. 2024). Mobile Apps can serve both informative needs with personalized (Cheng et al., 2020). The Android app displays a user-friendly interface (Bhanot, et al., 2024). Personalization techniques to keep users engaged (Grua et al., 2022). Consequently, all of these actually create an advantage for people in the market industry as it creates a customized, personalized, interactive and engaging platform for the customers. With hybrid, virtual, and innovative events being expected for the

coming years (Werner et al., 2022). COVID-19 has rapidly changed virtual environment in the global events sector (Lekgau & Tichaawa, 2022). The technological innovation in applications and platforms for web and mobile, have changed the business tourism and event industry (Rady Mohamed, 2022) The attendee can view inside the app, event schedules, maps, speakers' information, and even advanced interesting options that can set a more participatory experience with gamification and augmented reality, as well as giving them direct feedback for their satisfaction and involvement (Aggarwal and Ansari, 2014).

4.4. Collaboration with Islamic Organizations for Streamlined Event Information Sharing

Collaborations with Islamic Organizations across each state in Malaysia is vital to build a comprehensive platform providing recent and accessible information on Islamic events. Therefore, the Islamic Organizations representing various regions, could bridge the communication gap in establishing a dependable platform for updating events (Yaqin, 2022), such as religious talks, Quran recitations and community gatherings. In addition to that, the platform would ease networking among participants and collect valuable data for organizers through engagement tracking (Parab, 2024), by monitoring participation patterns in events and understanding the participants' preferences of Islamic events. This matter also aligns in strengthening bonds of Islamic Ummah (Mohamad et al., 2015) to foster unity in Muslim community (also known as Islamic Ukhuwah) in Da'wah events and gatherings. According to Rismayanti & Rahman (2021), Islamic Ukhuwah is rooted in Islamic teachings. It is emphasized in the Quran and Prophet's teachings about the importance of Islamic society (Saleh, 2012).

4.5. Benchmarking of Programs Organizer Business Models

4.5.1. Cvent

Cvent is a platform that offers tools for event management and attendance tracking (See Fig. 1). Cvent has a feature to mark participant attendance individually or in bulk, which users could opt for manual input or automated check-ins by using the OnArrival app (Jones, 2022). The mobile application is available on both iOS and Android devices, where every 10 minutes, it streamlines on-site check-in process and synchronizes data with Cvent, which enhances real-time attendance monitoring. The BMC for Cvent is in (See Fig. 2).

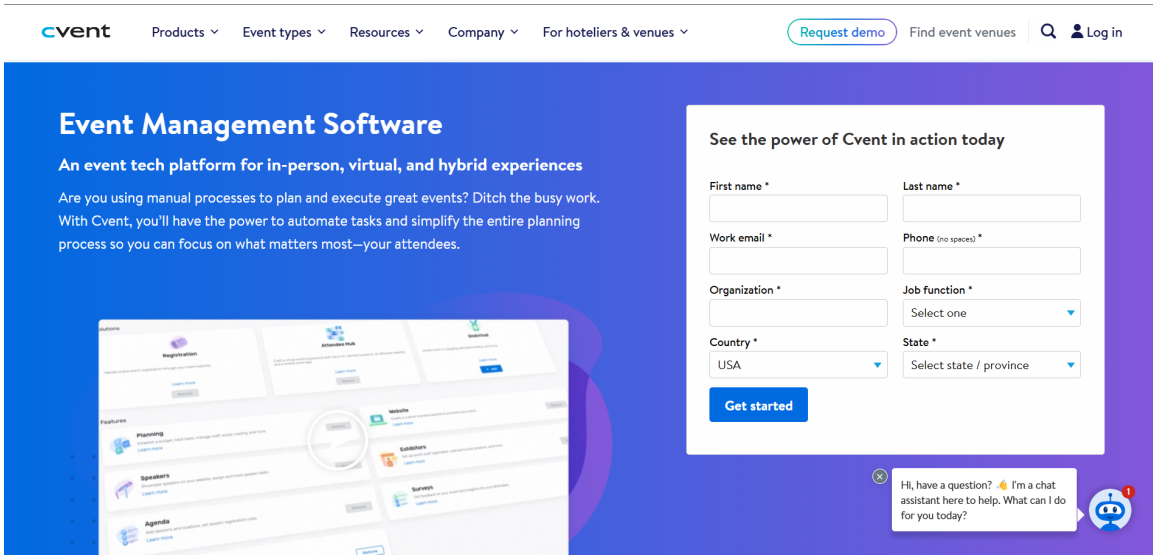

Fig. 1. Web interface of Cvent (https://www.cvent.com/en/event-management-software)

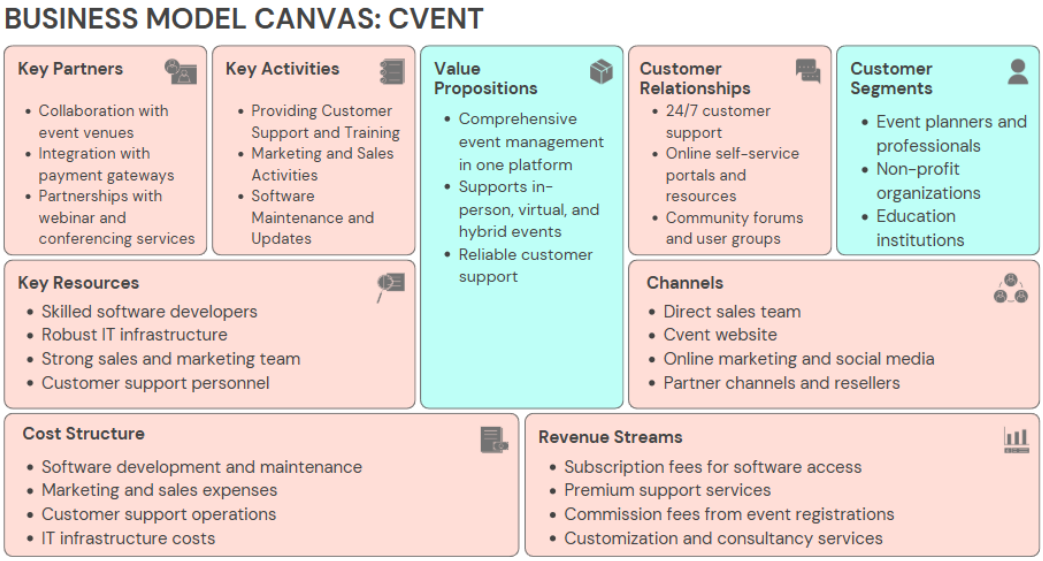

Fig. 2. Business model canvas (BMC) of Cvent

4.5.2. Eventbrite

Eventbrite is an international marketplace that correlates and caters to two customer groups which are for the event organizers and event attendees (See Fig. 3). With the help of numerous features and tools, it enables the attendees to search, find and buy online tickets while also enabling event planners to plan, advertise, and sell tickets for events. Eventbrite apply a classic freemium business model to operate as the business takes an allocation of payment out of paid events but will not charge on any free events. Every attendee may easily buy tickets to the event that they are interested in as well as discover many new events based on the filtered location and interest such as conferences, music festivals, gaming competition, political rallies and many more. Even so, Eventbrite's main targets are intentionally for smaller functions and corporate events such as business conventions. However,

in addition to the ticket pricing, the business charges a 2.5% fee, up to a maximum of $9.95 per ticket, plus $0.99. The processing fee for credit cards is an additional 3%. (Free events are not charged.) There is no advertising from the company (Tomio Geron, 2011). The company processed more than 200 million tickets in more than 180 countries and more than $3.5 billion in gross ticket sales as of 2015 (Connie Loizos, 2015). (See Fig. 4).

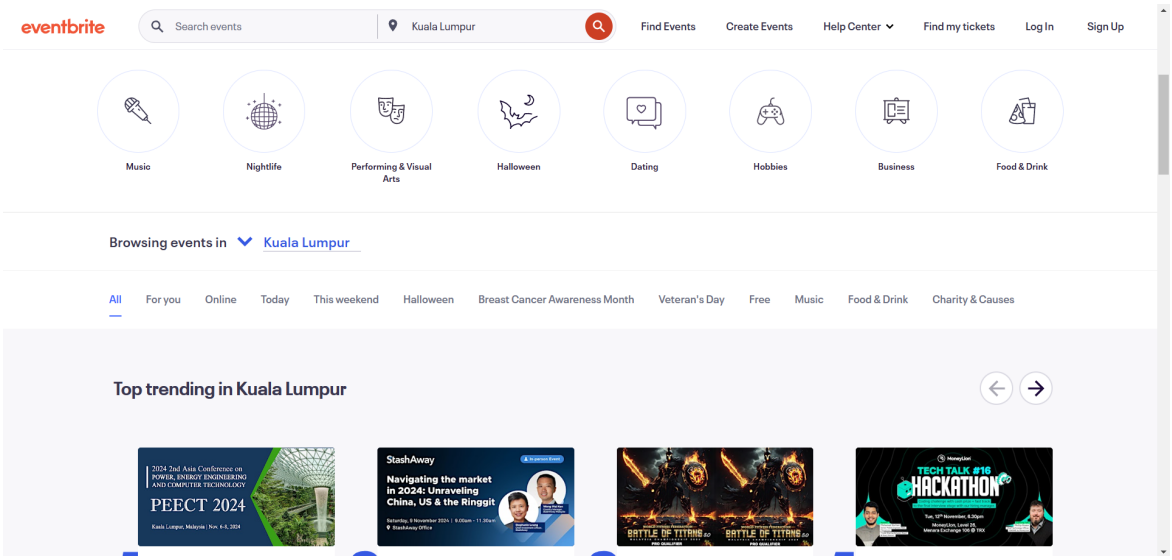

Fig. 3. Web interface of EventBrite (https://www.eventbrite.com/)

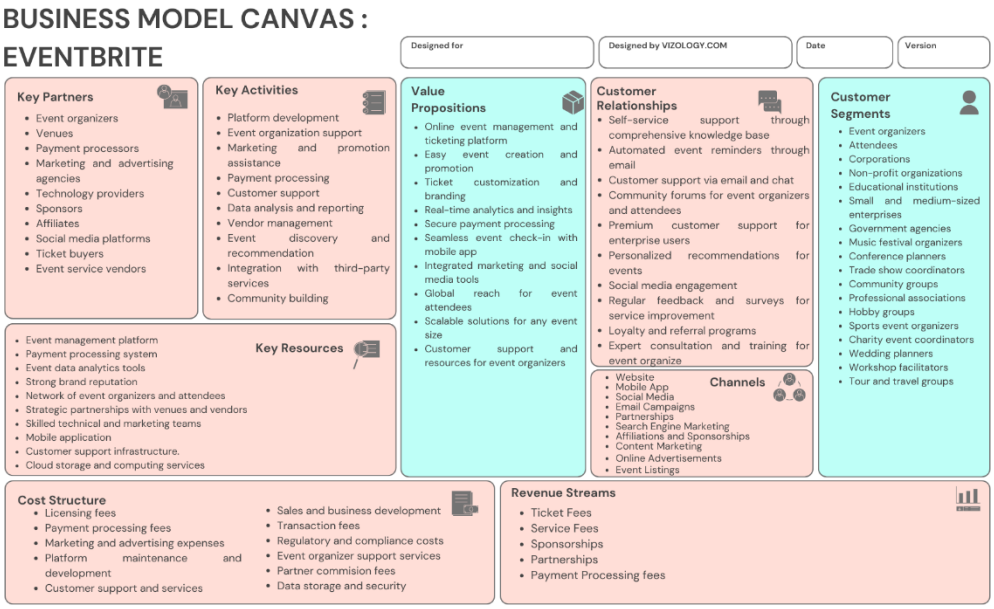

Fig. 4. Business Model Canvas (BMC) of EventBrite

4.5.3. Bizzabo

Bizzabo is one platform that helps people plan, promote, and manage events, all in one place (See Fig. 5). With Bizzabo, organizers can handle everything from ticketing and registration to creating a website and promoting the event, both in person and virtually. Bizzabo was developed to make events more engaging with attendees. It offers interactive tools like live polls, Q&A sessions, and chat channels

to keep people connected and involved. The app also lets the attendees customize their schedules, receive important notifications of event updates, and connect with others. Next, the Bizzabo app has a feature called Klik SmartBadge, a wearable device that lets attendees exchange contact details with a simple tap, making networking easy and efficient. For the event organizers, Bizzabo provides analytics and reporting tools that help track event success in real-time. The platform's dashboard will provide data on ticket sales, attendees, and engagement rates, helping organizers see what worked well and what could be improved. Bizzabo is particularly useful for small to medium-sized businesses that need a reliable and user-friendly event management solution without relying on multiple tools and vendors. (See Fig. 6).

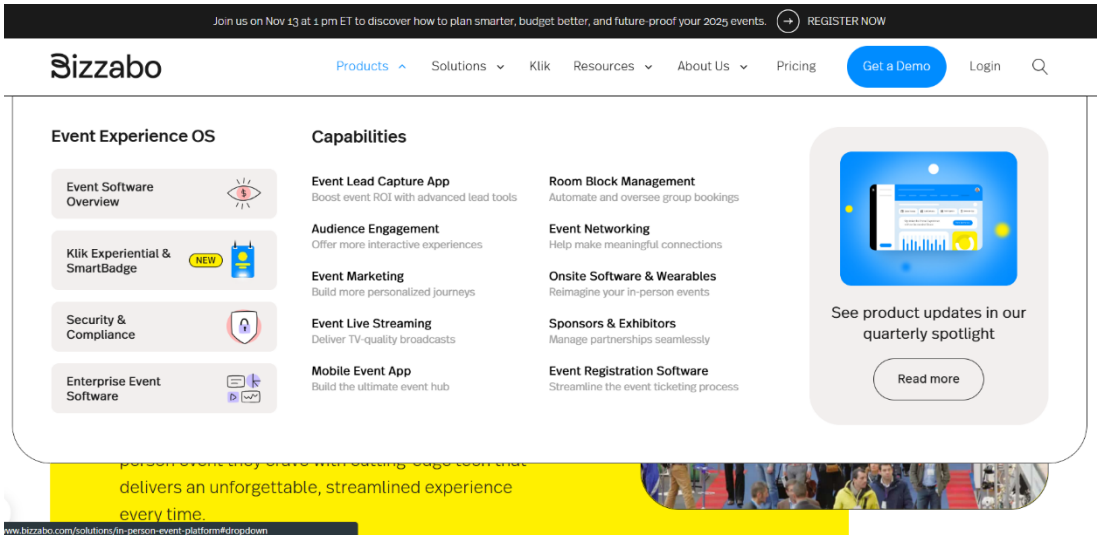

Fig. 5. Web Interface of Bizzabo (https://www.bizzabo.com/)

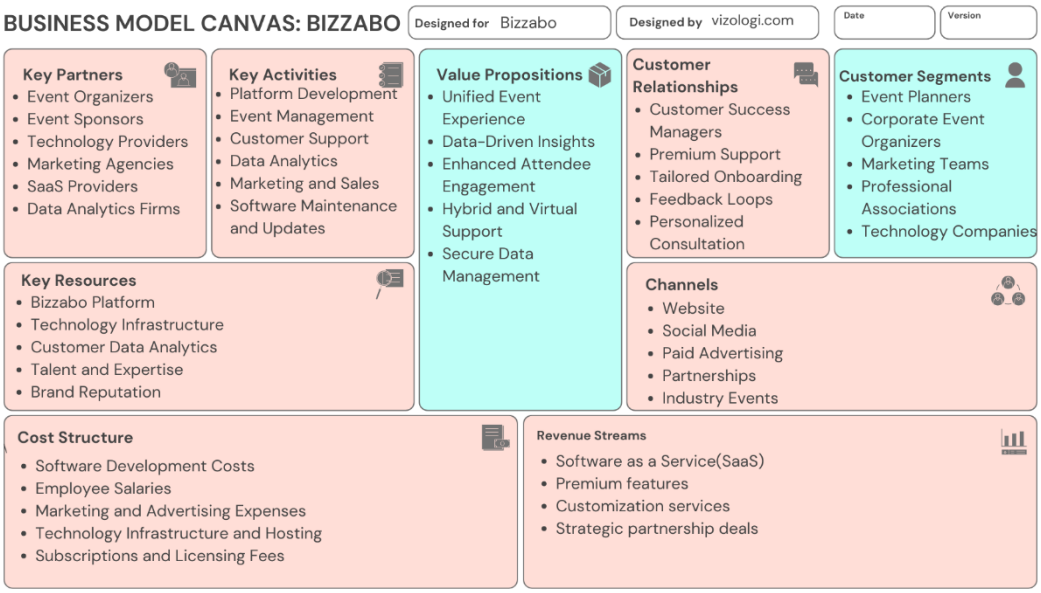

Fig. 6. Business Model Canvas (BMC) of Bizzabo

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

5.1. Initial Business Model Canvas (BMC)

QalbConnect is a user-friendly digital platform designed to bring Islamic programs for well-connected Muslim and non-Muslim community in Malaysia. It makes it easy for everyone to find out where and when these programs are happening, ensuring that no one misses out on opportunities to connect with their community. Program organizers can easily promote their programs and events, and to attract participants, fostering a vibrant community spirit and societal well-being. QalbConnect will take into account participants preferences by offering personalized recommendations and seeking feedback to improve their experience.

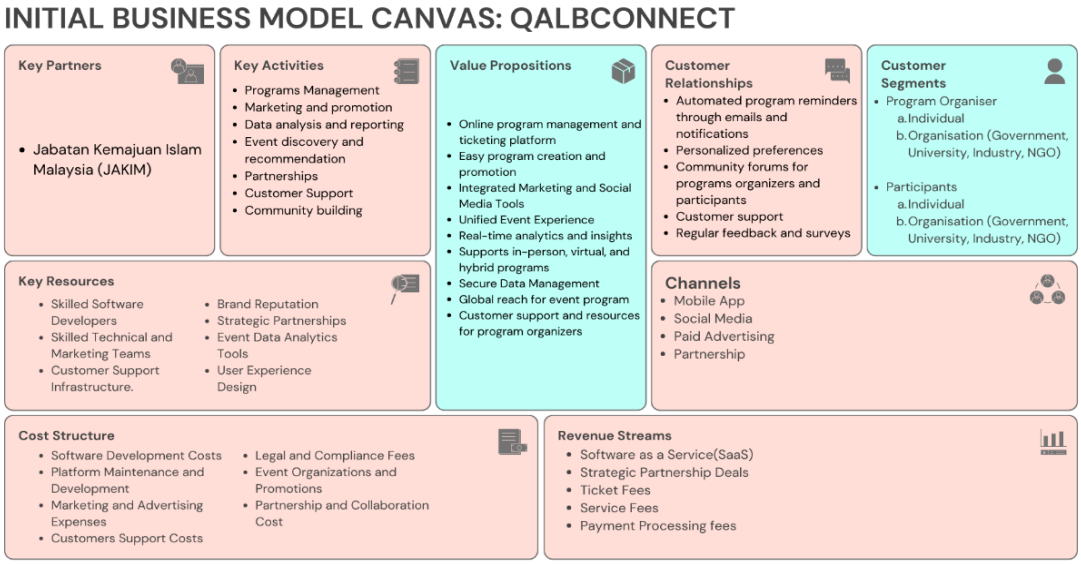

Fig. 7. Initial QalbConnect Business Model Canvas (BMC)

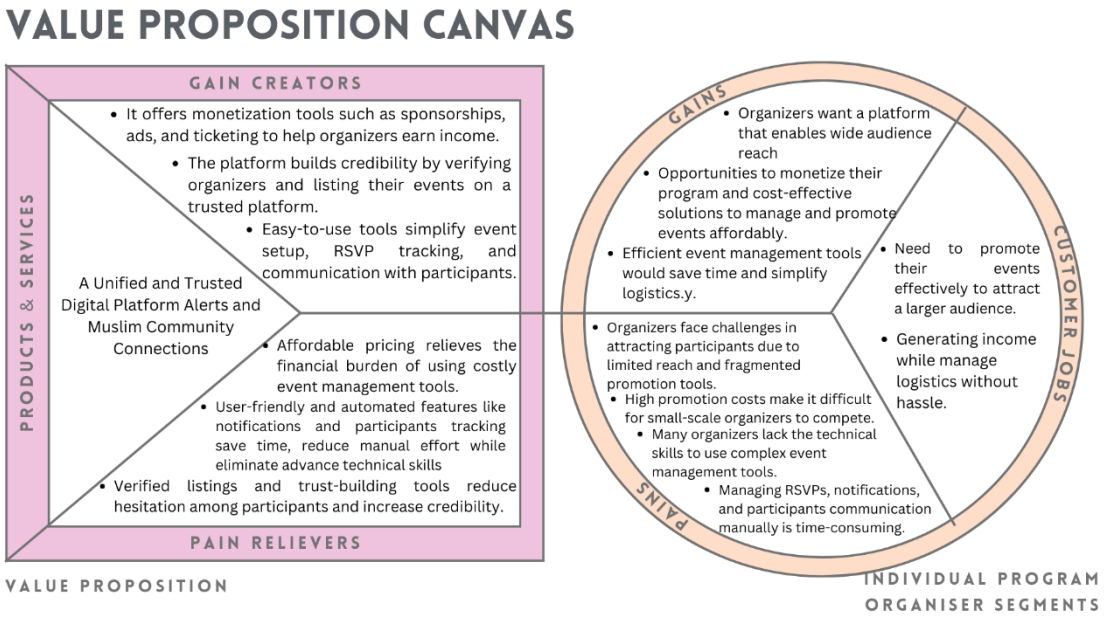

Fig. 8. Individual Program Organizer Value Proposition Canvas

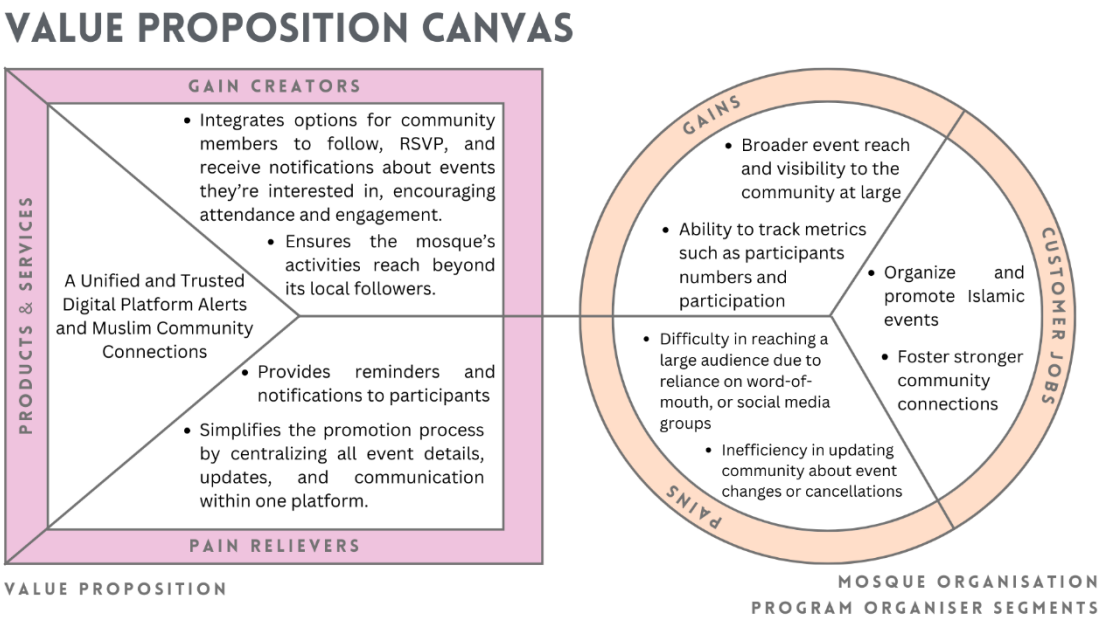

Fig. 9. Mosque Organization Program Organizer Value Proposition Canvas

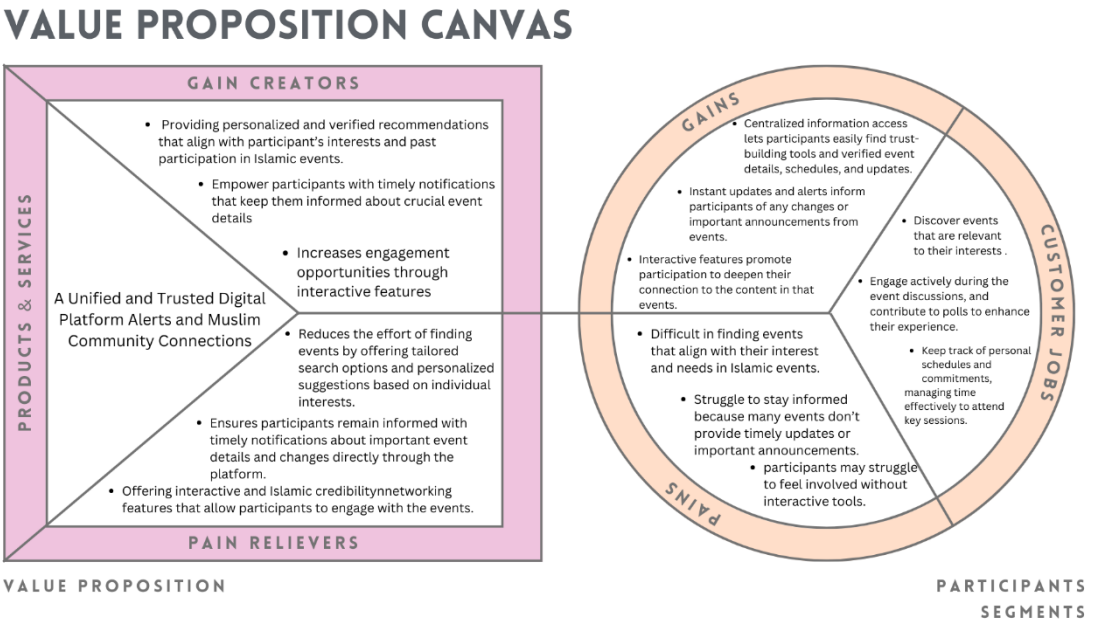

Fig. 10. Participants Value Proposition Canvas

6. CONDUCT VALIDATION OF INITIAL BM & KEY FINDINGS

Surveys are disseminated to different customer segments to ensure the correct validation of the initial business model and key findings of this project. The customer segments are drawn from a mosque community representative and individuals. The key findings are derived from interview questions to Sultan Haji Ahmad Shah Mosque (SHAS Mosque) as a Program organizer and survey questions to Muslim community as participants. The question topics below have been answered by the committee of SHAS Mosque.

Interview Topic	Responses
Organizing and Promoting programs	• Primary promotion methods include social media and direct promotion. • Currently updates/changes communicated through WhatsApp groups for each programs.
Challenges in Community Engagement	• Limited engagement, with challenges including reaching maximum participants, students' lack of interest, and insufficient budget.
Encouraging Participation	• Benefits of participation are emphasized. • Incentives offered include star points and refreshments.

Fig. 11. Findings from Mosque Committee

Interview Topic	Responses
Broader Event Reach and Visibility	• Methods include social media, direct promotion, and announcements through mosque speakers after prayers. • Expressed a need for a platform to expand reach with minimal effort.
Tracking Attendance and Participation	• Attendance are tracked via pre-submitted Google Forms and confirmed with lists before programs. • Desire to track feedback more effectively, as some participants avoid filling evaluations.
Desired Features in Centralized Platform	• Interest in a platform with attractive animations to draw participants. • Preference for daily notifications to keep the community informed.

Fig. 12. Findings from Mosque Commitee

It is found that the mosque committee faced hardships in handling programs currently using multiple platforms such as social media, Google Forms and physical announcements at the mosque. Furthermore, the mosque committee expressed their support for this project, as it has potential as their alternative in providing a unified and trusted platform for all announcements and communications of programs managements.

As for participants, we distributed a few questionnaires through the WhatsApp platform, targeting a wide range of Muslim community. In total we received responses from 30 individuals ranging from 13 years old to 48 years old. To validate the problem discuss in this paper, we included inquiries in our survey beginning with asking our respondents to choose multiple options on how they usually find out about programs going on around them and the majority of the respondents (29 individuals) choose social media platform and another majority of the respondents

(19 individuals) choose WhatsApp announcement, while as many as (13 individuals) find out about Islamic programs only via each physical advertisement and word of mouth indicating the existence of scattered and fragmentation of the programs promotion among the community (See Fig. 13). Additionally we also ask the respondents challenges that they face in order to try to find information about Islamic programs in their area and more than half of the respondents (16 individuals) express that they hear about programs too late to attend while (14 individuals) state that the information is scattered across different platforms, (11 individuals) even voice out their opinion on how they don't even know where to look for programs announcements while (8 individuals) agree that there are no centralize platforms to manage these programs (See Fig. 14).

Next, as one of the main purposes of our project is to achieve SDG8, were trying to ask our respondent a few questions to explore whether the functionality provided by our platform will actually help to drive a progress for economic growth among the community. As seen in the chart (See Fig. 15), (9 individuals) from the respondents willingly to pay amount of fee while the other (19 individuals) are willing to pay depending on the price, indicating that (28 individuals) are willing to pay and agree to spend their money on the programs as long as it is a reasonable price. Moreover, to see whether this platform will encourage and foster everyone to gain easy income through the features we will provide, we asked the respondent about their interest in getting paid for their very own program (See Fig. 16). Half of the respondents are very interested while the other half are somewhat interested in indicating that everyone is interested in utilizing this platform to generate their own easy income.

Additionally, we also give inquiries on the respondent's preference of this platform to gather and meet their needs. (See Fig. 17) Based on this question, most of the respondents (21 individuals) agreed that timing that fits the schedule is a significant factor to attend the program in which this also explain on why the majority answer (22 individuals) on question (See Fig. 18) choose features they would find the most useful for this platform would be programs calendar with detailed information. In another question (See Fig. 19) on what would encourage the respondent to use this platform, the majority (21 individuals) express that they love a user-friendly interface with easy navigation for programs findings and registering while another majority (18 individuals) express that they love the ability to receive timely notification about programs updates and reminders. In which this explain on why the second majority (18 individuals) answer of feature most useful (See Fig.18) is programs reminders and notification. In this question also, almost half of the respondent agree it is very useful to have livestream or recording of programs. All of this explains the majority answer for (See Fig. 20) the features they think are the most important for programs management with (18 individuals) choosing both a user-friendly interface and access to programs materials like videos, recordings and notes. While another (17 individuals) wants a detailed programs calendar with all necessary information and another (16 individuals) love to receive real-time notification for programs updates, changes or cancellations.

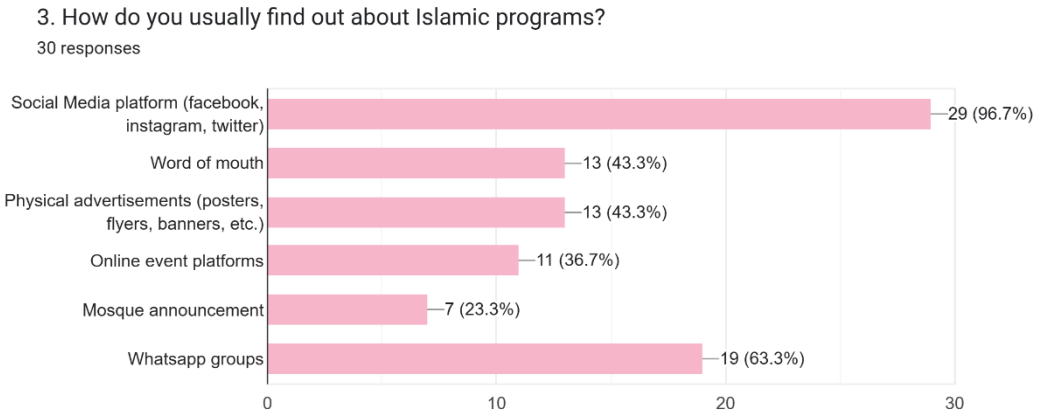

Fig. 13. Findings from participants on promotion of programs

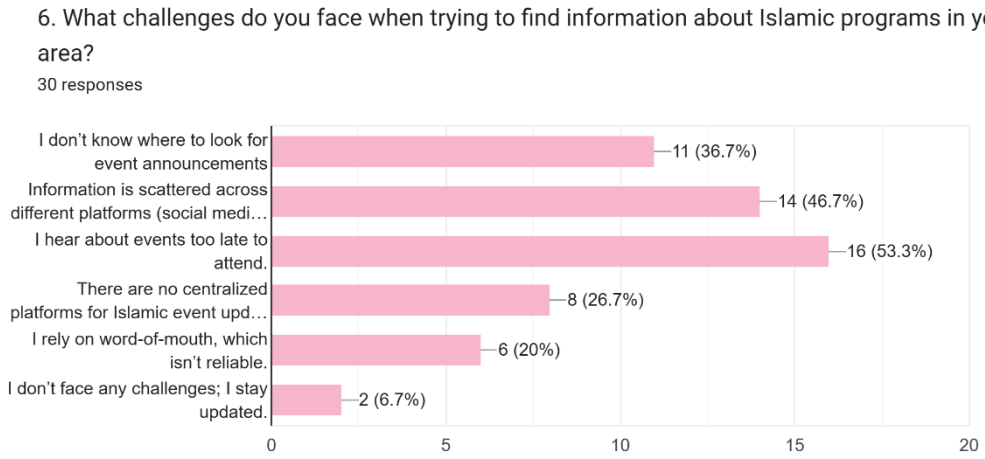

Fig. 14. Findings from participants on challenges to discover programs

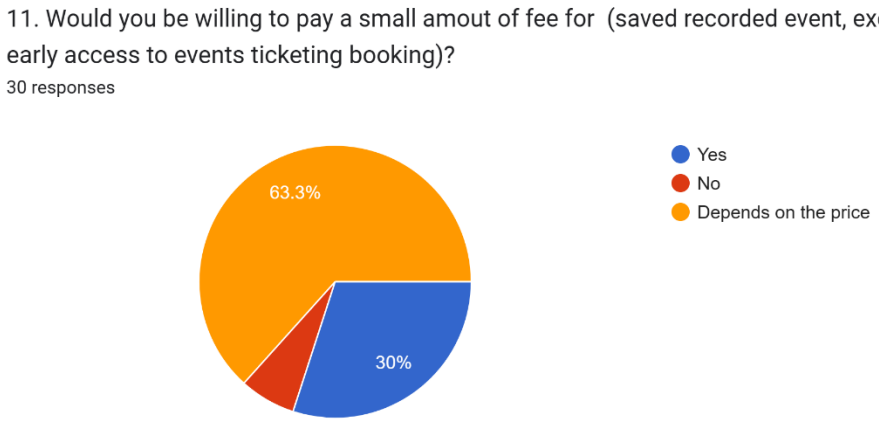

Fig. 15. Findings from participants on the willingness to pay

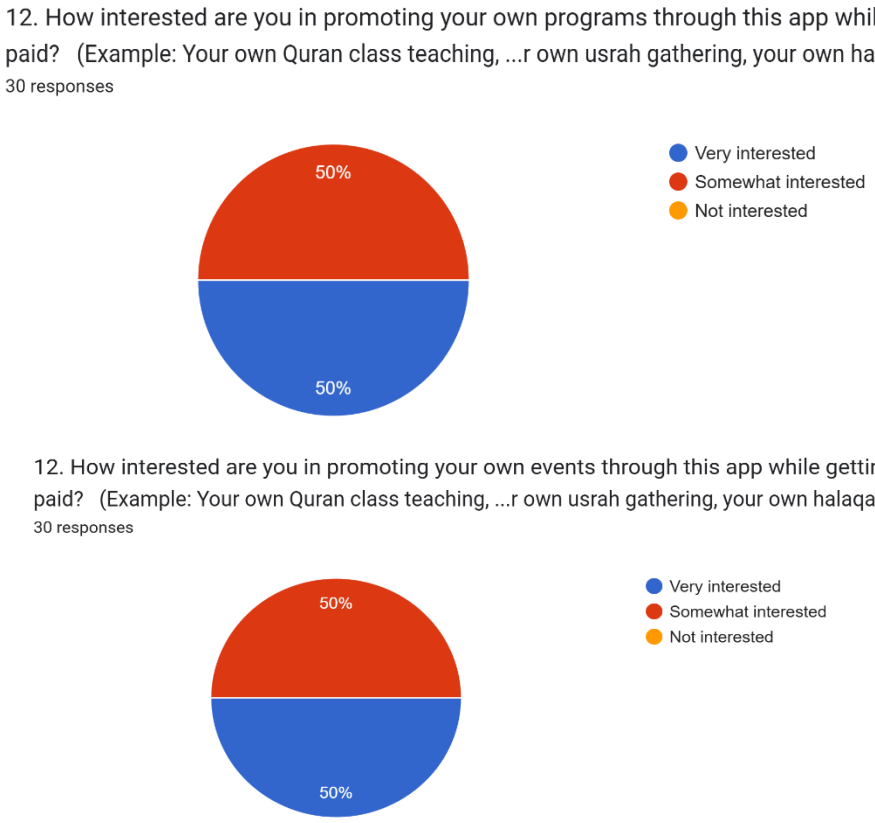

Fig. 16. Findings from participants on the interest to generate their own income by creating their own program

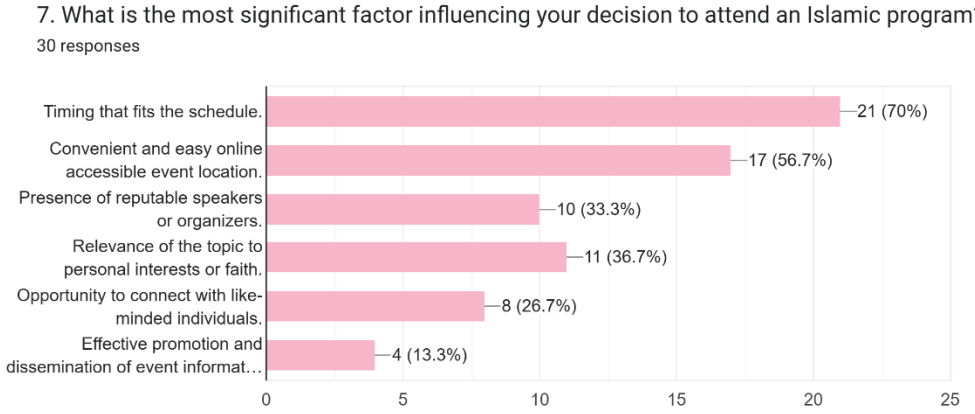

Fig. 17. Findings from participants on factor influencing attending Islamic programs

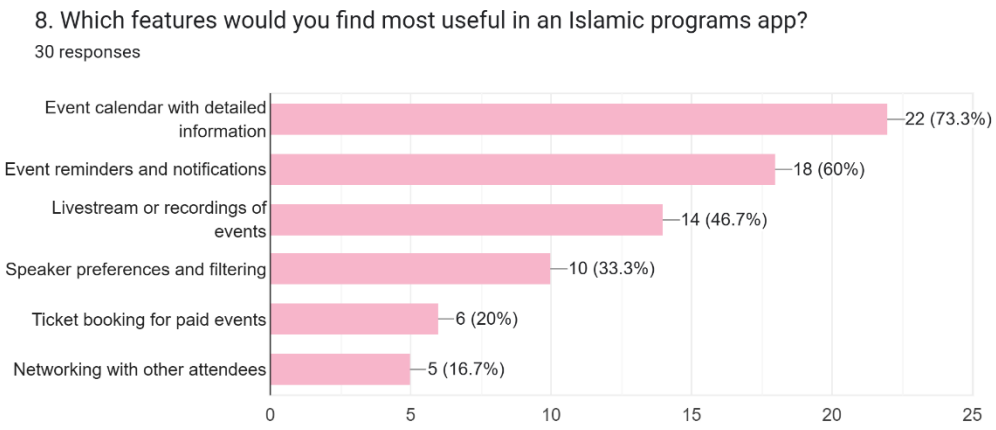

Fig. 18. Findings from participants on most useful features in Islamic program platform

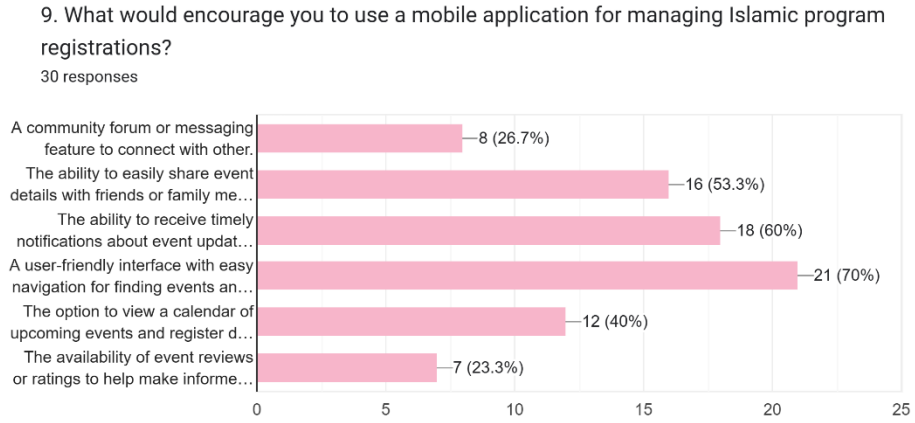

Fig. 19. Findings from participants on factors encourage them to use application in managing Islamic program registration

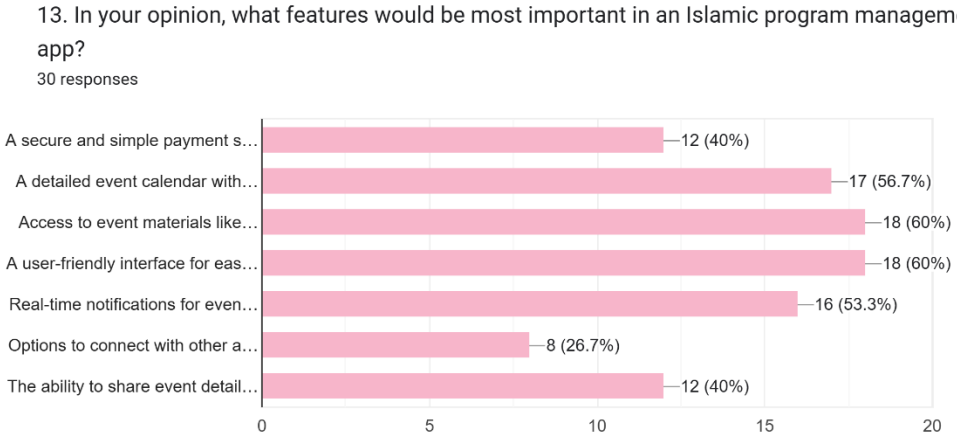

Fig. 20. Findings from participants on features they think the as the most important in Islamic program management platform

7. VALIDATED BUSINESS MODEL – USING BMC FRAMEWORK

7.1. Validated IT/Digital Project BM

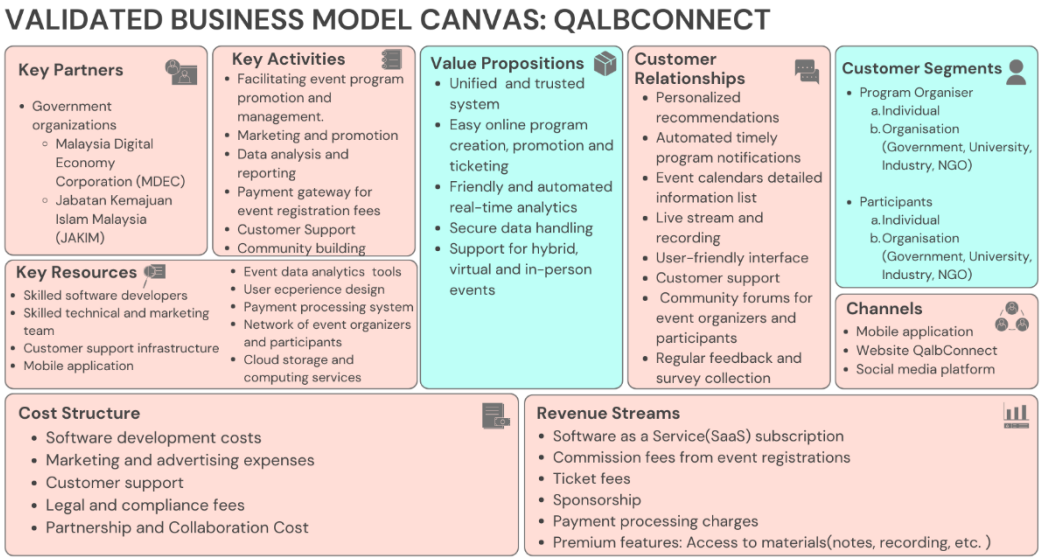

Fig. 21. Validated QalbConnect Business Model Canvas (BMC)

This section provides an overview of the validated project Business Model (BM) for QalbConnect digital platform/app using BMC framework. The BMC is a strategic tool for outlining critical aspects of the project's business model, such as the value proposition, customer segment, revenue streams, and other key components (Maria et al., 2023). Exploring each of the BMC's nine blocks provides us with a better understanding of how QalbConnect operates and delivers value.

Firstly, the platform serves two distinct customer segments which is program organizers, which include individuals or organizations such as government bodies, universities, industries, mosque and NGOs, as well as participants who attend these programs. Organizers use the platform to promote and manage their programs, and participants use it to find and attend programs of interest.

The value propositions then emphasize the platform's main objective to foster economic growth of program organizer from individual and organization by providing a user-friendly feature. It offers a unified and trusted system that combines easy and convenient online program creation, promotion, and ticketing. It offers friendly and automated real-time analytics, secure data handling, and support for hybrid, virtual, and in-person programs.

In terms of channels, the platform primarily relies on a mobile application to give participants easy access to its features and physical channels like Network-Mosque (Dahlan et al., 2016; Saleh et al., 2013). The platform also utilizes website to ease the operation of programs management and insight catering to program organizer from organization such as government, university, industry and NGO. It also uses social media to promote programs and establish an online community as they are the most effective way to reach participants because they usually depend on social media daily.

Moreover, customer relationships are built through personalized program recommendations and automated timely program notifications to address key concerns such as late information and dispersed programs sources. QalbConnect

also provides programs calendars detailed information list allowing participants to keep track of any on-going or upcoming program that fits their personal time to participate. This platform also offers a built-in live streaming and recording program to enhance the participant's participation and break the demographic constraints. It also provides a user-friendly interface, which is respondents top priority. The platform also fosters community engagement by offering community forums where participants can interact. Regular feedback and survey collection helps participants experience and ensure the platform remains aligned with community needs.

Moving on, the platform generates revenue through several streams through Software as a Service (SaaS) subscription, where organizers pay for advanced programs management tools. Additional revenue comes from commission fees from programs registration, ticket fees, sponsorship, payment processing charges, and premium service fees for access to exclusive materials such as notes and recordings of all programs. Partnerships with Islamic organizations also provide sponsorship opportunities. The payment must be affordable because the participants are willing to pay if the prices are reasonable.

In addition, the platform relies on several key resources to effectively deliver its services. These include skilled software developers to maintain the platform remain function and stay updated. Skilled technical and marketing teams focus on outreach and promotions to address challenges such as late programs notifications and scattered information. Customer support infrastructure helps assist participants. Mobile application allowing an easy participations and interaction between users and digital platform/app. Event data analytics tools add value by giving organizers insights into participants behavior and user experience design helps to design a user-friendly interface for all customer segments and enhance their experience using this digital platform/app. Payment processing system to build a secure and trusted digital platform/app. Network of programs organizers and participants to foster a connected community and allowing any possible collaboration between all customer segments.

Next, the platform focuses on key activity centers that address both organizers and participants' needs. This includes facilitating program promotion and management, which assists organizers in planning, promoting and managing programs efficiently, which was highlighted as a key challenge for organizers. Marketing and promotion have become essential for increasing programs visibility as participants use social media as their primary source for programs searching. Data analysis and reporting help organizers understand engagement and attendance, while customer support and community-building activities promote a sense of belonging. Payment gateways facilitate secure and seamless transactions for programs registration fees.

Moreover, the platform's success is dependent on strong key partners. The platform works with MDEC (Malaysia Digital Economy Corporation) on digital resources and technical support. Other potential partners include Jabatan Kemajuan Islam Malaysia (JAKIM), which is responsible for approving Islamic programs in Malaysia and ensuring compliant to religious guidelines.

Finally, for the cost structure, expenses include software development costs, such as platform maintenance and feature updates, along with marketing and advertising expenses to reach a broader audience. Other significant costs involve

customer support, legal and compliance fees, and investment in partnership and collaboration initiatives as well as cloud storage and computing services.

7.2. Business Environmental Map (EM)

The EM provides an overview of the external factors influencing the development and operation of the QalbConnect business model. It evaluates different aspects of the business environment, including social, technological, economic, legal, regulatory and environmental factors (Mahesh et al., 2020) (See Table 1).

Table 1: Business environmental map for QalbConnect

<table>
<tr><td>Social Factors
The platform addresses the growing demand for digital solutions that meet both technological and cultural requirements. QalbConnect supports community engagements by connecting participants and program organizers in a Shariah-compliant manner.</td><td>Technological Factors
The advancements in technology make the QalbConnect platform efficient and user-friendly. Cloud-based services, real-time data analytics, and mobile apps play a vital role in streamlining and improving user interaction during the streamlining online platform (Salleh et al, 2023). This platform integrates these technologies while integrating the Shariah-compliant tools.</td></tr>
<tr><td>Economic Factors
QalbConnect provides a cost-effective solution for programs organizers, both individuals and large institutions. By providing affordable pricing structure and simplifying the programs management, the platform helps organizations reduce costs while increasing participation. This is aligned with the government initiatives to help smaller organizations access affordable digital tools and technologies (Economic Planning Unit, 2021).</td><td>Legal and Regulatory Factors
Collaboration with JAKIM to ensure all programs comply with Shariah law and it is important to comply with Malaysian Law regrading delivery of religious lecturers. To ensure legal compliance while using the platform, only certified individuals can lead or give talks to the religious programs, under the Syariah Criminal Offences (Federal Territories) Act 1997 (AKJSWP), Section 11 (Ibrahim et al, 2022). This is to build trust among organizers and participants.</td></tr>
<tr><td colspan="2">Environmental Factors
QalbConnect is influenced with Islamic ethical standards, which ensure all interaction and programs management practices follow Islamic principles. This emphasis on ethical compliance not only addresses legal and religious standards but also strengthens the platform's credibility and trust within the Islamic community.</td></tr>
</table>

7.3. Strategy Canvas (SC)

(a) Before & after QalbConnect implementation

Table 2: Before & After Implementation of QalbConnect

Factor/Issue	Before implementation	After implementation	Explanation
Program promotion	Fragmented and siloed with possible of island of automation	Unified and centralize platform with comprehensive listings including filter for speakers, topics and venues	Centralize program information allowing participants to easily discover and find relevant programs
Program accessibility	Limited access for participants specifically for remote areas	Built-in live streaming for remote participation	Expand access and reach wider audience for participants
Trust and credibility	Hesitation among participants about the reliability of scattered program information	A trusted and verified platform consolidating all Islamic program with credential and licensing from religious authority	Build confidence of participants with the program promotion from reliable and verified organizers
Economic opportunities	Few opportunities for Muslims to generate any easy income from religious activities	Program organizers and participants both can create their own program/class engaging in Islamic entrepreneurship	Fostering and encouraging the Muslims to generate income
Program organizer support	Limited structured avenues for earning from Islamic program organization	Tools for organizers for monetization from ticketing, advertisements and sponsors as well as analytics analysis to gain insight for future programs	Provide supports for program organizers to generate income making Islamic programs more sustainable
Youth engagement	Limited structured engagement for participation	More accessible opportunities for youth to participate	Opportunities for youth to participate, learn and grow through entrepreneurial program works.
Community engagement	Lack of interactive platforms	Open discussion space and feedback systems	Encourage users to engage, fostering a connected Muslim community

(b) QalbConnect vs Eventbrite vs Cvent vs Bizzabo

Table 3: Comparison of QalbConnect vs other platforms

Key Factors	QalbConnect	Eventbrite	Cvent	Bizzabo
Program discovery	Centralize platform for Islamic program with tailored filter of speaker, venue and topics	All type of programs generally form casual to large-scale	Corporate and professional programs and meetings	Business programs and professional networking gathering
Program promotion	Simplified promotion tools for individual or small Muslim entrepreneur ease	Basic promotion tools provided mainly for casual organizers	Sturdy marketing tools specially to cater to professional organizers	Advance marketing tools focusing on enterprise wise
Program accessibility	Provide a built-in streaming for remote participation in live streaming recording	Limited streaming option relying from the external integrations	Integrate some visual capabilities but primarily focus on physical program	Robust hybrid program supporting large-scale and corporate programs
Trust and Credibility	Verified and trusted Islamic content with credential and licensing from religious authority	General trust system with no verification caters for any specific community	Professional reliability but lack for verification for any specific community	General trust system specifically made for professional clients
Customization	Personalized recommendations for individuals based on speakers, topics, venue and Islamic program types.	Limited personalization with its general recommendation based on category or location	High customization specifically for corporate and professional requirements and branding	Customization provided for corporate programs
Organizers income opportunities	Tools for monetizing via ticketing, sponsorships and ads	Tools for monetization limited to ticketing	Revenue generation mainly focusing on cost management	Revenue generation via professional program management
Cost effectiveness	Affordable for small organizers and individuals as well as a large-scale organizer	Affordable for casual organizers but less features offered	Expensive and inaccessible for small-scale program organizers	High-cost suitable for enterprise organizer
Community engagement	Discussion spaces provided as well as am interactive feature for all customers segments	No community engagement tools available	No community driven engagement tools as focus are shifted to logistics	Networking features available but specifically tailored to professional needs

7.4. High Fidelity/mock-up prototype apps

QalbConnect app uses JavaScript frameworks like Flutter (which uses Dart as its computer language) as it is ideal for developing a cross-platform mobile application with interactive user interface. Furthermore, it offers flexibility and allows rapid development by using a single framework which reduces the likelihood of errors during developing the application process. Internet of Things (IoT) would be integrated to enable real-time notifications like reminders of nearby programs, and track attendance when participants arrive at the program's venues. Additionally, Big Data Analytics (BDA) will be utilized to analyze the participant attendance patterns which will provide insights of participation trends for future programs planning.

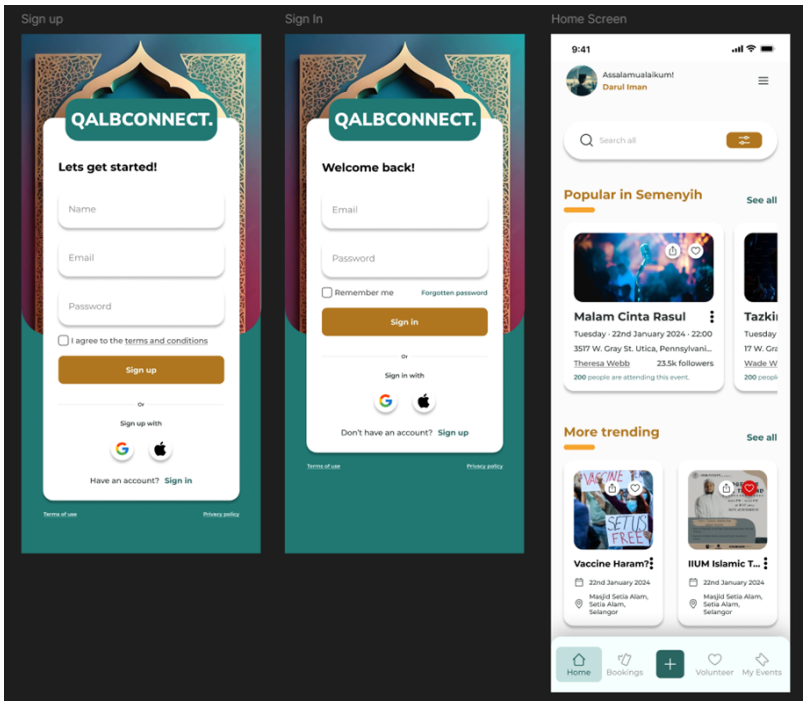

Fig. 22. Login Credentials and Homepage

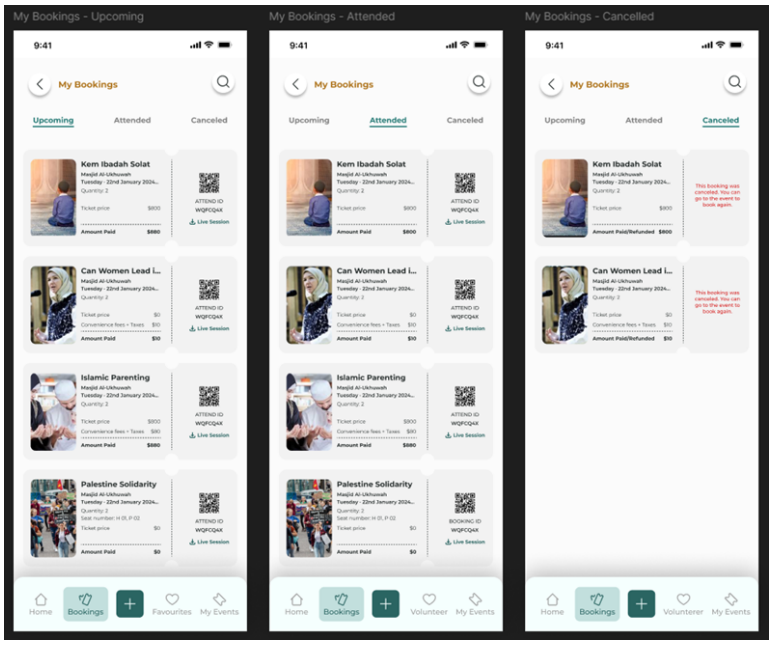

Fig. 23. Programs Listing

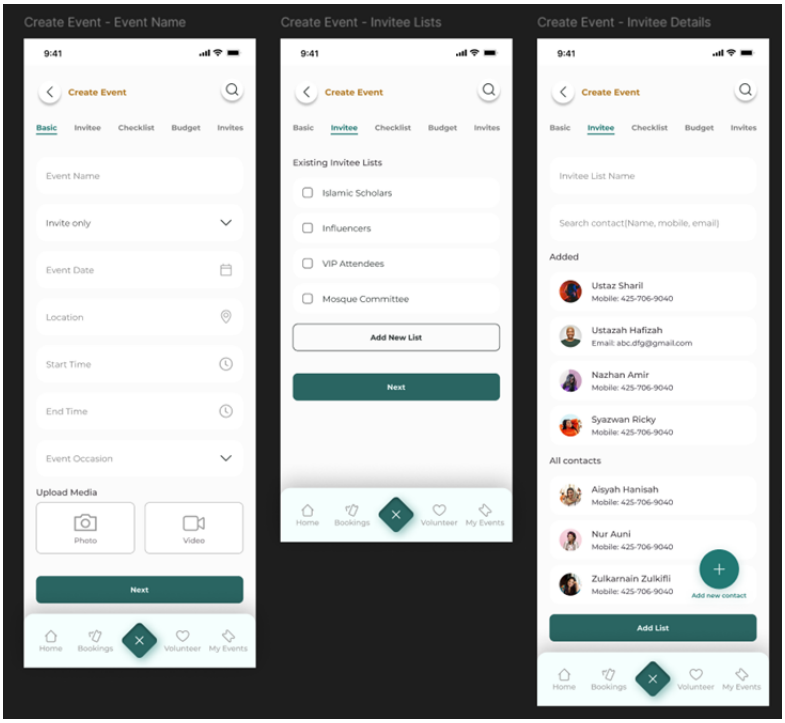

Fig. 24. Create Programs Features

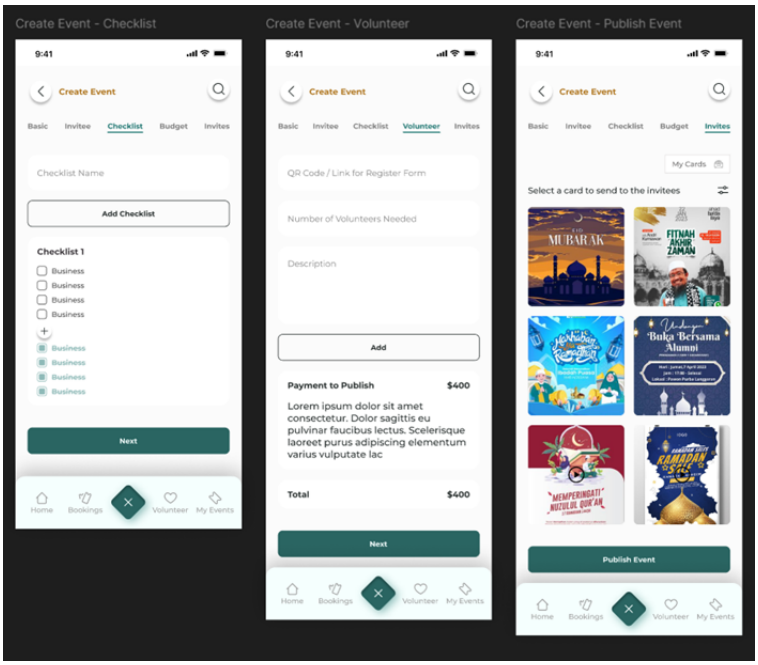

Fig. 25. Create Programs Features

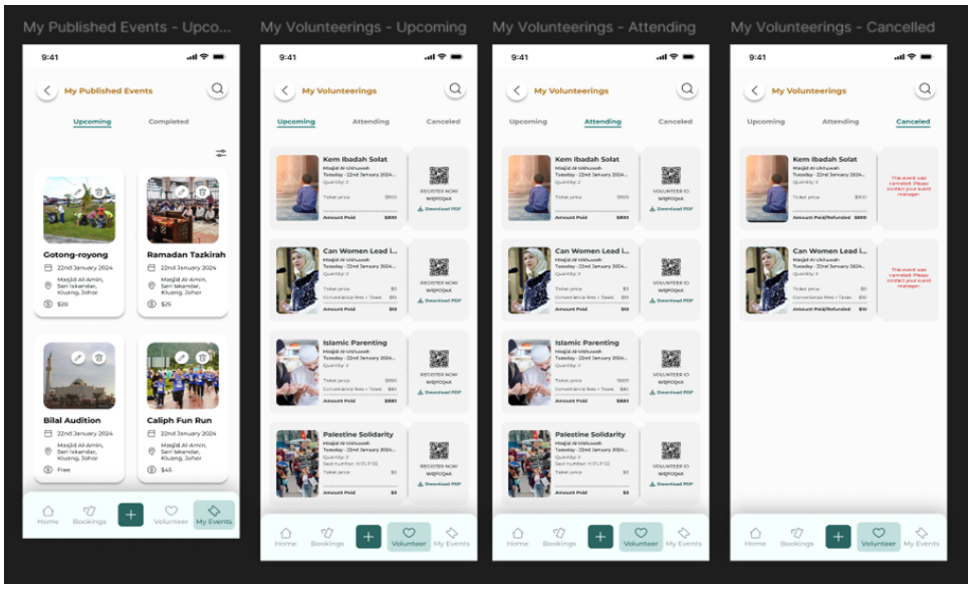

Fig. 26. Published Programs and Volunteering in Programs Feature

8. CONCLUSION AND FUTURE WORKS

In summary, QalbConnect seeks to address several key challenges including fragmented and siloed programs promotion. This digital project aims to establish a unified platform that simplifies programs discovery and promotion, offers live streaming for remote audiences, and encourage Muslim community to become entrepreneurs with our platform providing organizers with tools to generate easy income. Based on survey findings, the primary pain points identified by audiences include fragmented programs promotion. In response, this project delivers solutions such as unified verified programs listings, expanded access, and monetization tools for organizers. Key differentiators of this project include a user-friendly interface with filters for Islamic programs, live streaming capabilities, personalized programs

recommendations, easy tools for programs creation, affordable cost, and community engagement programs including Islamic entrepreneurship for youth.

Future work includes creating a detailed project management plan for the development of QalbConnect platform that covers timelines, resource allocation, and risk management. Additionally, the platform will be enhanced with more features and integrated with other systems to improve its functionality. To ensure continuous improvement, feedback will be collected regularly from program organizers, mosques and participants to evolve the platform and serve the community better.

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ETHICS IN THE DIGITAL AGE: EXPLORING THE ETHICAL CHALLENGES OF TECHNOLOGY

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ABSTRACT: This research paper delves into the ethical challenges arising from rapid technological advancements in the digital age, focusing on Islamic perspectives. It seeks to establish a comprehensive framework based on Islamic principles from the Qur'an, Hadith, and scholarly interpretations to guide human behaviour amidst these changes. While innovations like artificial intelligence, social media, and data analytics offer substantial benefits, they also present ethical dilemmas requiring careful consideration. The study examines challenges in areas such as privacy and surveillance, social media conduct, artificial intelligence, automation, and data security, exploring how Islamic ethics can guide individuals and communities in navigating these issues. Utilizing qualitative research methods, the study collects data from libraries, online sources, and researchers' experiences, which are then analysed to extract meaningful insights. By referencing relevant Qur'anic verses and authentic Hadiths, the study demonstrates the application of Islamic ethics to technological challenges. It explores various Islamic ethical frameworks, including *maqasid al-shari'ah* (objectives of Islamic law), *fiqh al-mu'amalat* (Islamic jurisprudence of transactions), and ijtihad (independent legal reasoning), to address these challenges. The paper recommends integrating Islamic ethical principles into educational curricula, professional codes of conduct, and technology-related policy frameworks. This integration is crucial for fostering ethical practices and decision-making, ensuring that technological advancements align with Islamic values and ethical standards. The study concludes that incorporating Islamic ethics into technology discussions enables individuals and societies to effectively navigate the digital age's challenges while upholding values that promote justice, truthfulness, and responsible conduct. It emphasizes the importance of understanding Islamic ethics in the context of the digital age to address contemporary ethical dilemmas and ensure that technological progress aligns with Islamic values.

KEY WORDS: *Islamic Ethics, Digital Age, Technology, Ethical Challenges, Qur'an, Hadith*

1. INTRODUCTION

The advent of the digital era has brought about significant changes in human interaction, communication, and daily life. Technological advancements have revolutionised our surroundings, providing unprecedented convenience, interconnectedness, and information accessibility (Brookings Institution, 2022). Nevertheless, these developments have also given rise to numerous ethical concerns that warrant thorough scrutiny, particularly from an Islamic ethical perspective. As Muslims navigate technology's influence on their lives, it is imperative to investigate the moral implications and potential conflicts emerging in this rapidly evolving landscape. Islamic ethics, grounded in Qur'anic teachings, Hadith (the Prophet Muhammad's sayings and actions), and scholarly interpretations, offer a comprehensive framework for guiding human conduct and addressing moral challenges. With its emphasis on justice, compassion, responsibility, and accountability, Islamic ethics provides valuable insights into navigating the ethical challenges presented by technology in the digital age (Maydan, 2021).

Through the adoption of Islamic ethical principles, Muslims can critically evaluate the impact of technology on individual and societal well-being, endeavouring to align their actions with religious tenets. This study aims to investigate the ethical concerns that arise in the digital age from an Islamic perspective, elucidating key issues and proposing ethical frameworks to address them. Through this discourse, we seek to enhance our understanding of how Islamic ethics can inform the ethical and judicious use of technology. To establish the context for this discussion, we first delineate the significance of Islamic ethics in guiding human behaviour across all domains of life. This foundation will facilitate the elucidation of how Islamic principles can be applied to technological challenges in the digital era. We will subsequently examine the impact of technological advancements that have permeated various facets of our lives, from artificial intelligence and social media to data analytics and automation (Harvard Business Review, 2021). While these innovations offer numerous benefits, they also present ethical challenges that must be addressed through an Islamic ethical lens.

Subsequently, this study explores specific ethical concerns arising in the digital age by drawing on Islamic teachings. Issues such as privacy and surveillance, social media conduct, artificial intelligence, and data privacy and security are examined. Through analysing these challenges, the aim is to highlight the complex nature of ethical dilemmas and the necessity for thoughtful deliberation within the Islamic context. Furthermore, this research proposes Islamic ethical frameworks to assist individuals, policymakers, and society in navigating ethical issues brought about by technology. Consequently, concepts such as *maqasid al-shari'ah* (objectives of Islamic law), *fiqh al-mu'amalat* (Islamic jurisprudence of transactions), and the principle of ijtihad (independent reasoning) have been explored to provide practical guidance and adaptation to the evolving technological landscape.

To demonstrate the applicability of Islamic ethics to digital age challenges, this study investigated case studies that assess the ethical implications of social media usage, the balance between security and privacy, and the ethical dimensions of artificial intelligence and automation. These case studies underscore the importance of applying Islamic ethics in real-life scenarios, emphasising the

relevance of Islamic principles in guiding responsible and ethical decision making. This research contributes to the ongoing discourse on Islamic ethics in the digital era by offering a comprehensive examination of the ethical issues posed by technology. By integrating Islamic ideas and frameworks, the aim is to provide guidance to individuals, policymakers, and society in navigating these challenges responsibly and ethically. Through this exploration, the study aspires to foster a deeper understanding of the intersection between Islamic ethics and technology, ultimately promoting virtuous and ethical engagement through digital innovation.

2. AN OVERVIEW OF ISLAMIC ETHICS

By definition, ethics in Islam (known as "*akhlaq*" or "*adab*") refers to a set of values, principles, and guidelines that Muslims are expected to uphold in their behaviour and decision-making differentiating what is right and what is wrong (Udin et al., 2018). In the Cambridge online dictionary (2022), ethics is defined as "a system of accepted beliefs that control behaviour, especially such a system based on morals" while moral is defined as "behaving in ways considered by most people to be correct and honest". These ethics are deeply rooted in the teachings of the Qur'an and the Sunnah, and they aim to promote virtuous character, social responsibility, and spiritual development among believers. They serve as a comprehensive moral compass guiding human actions and inactions. Central to Islamic ethics is the concept of tauhid, or the oneness of God, which emphasizes that all actions and decisions must align with the will of Allah (Fadl, 2017). This belief in God's absolute sovereignty underscores the importance of moral accountability, with each individual responsible for their actions and their consequences before the divine.

Also, at the heart of Islamic ethics is the pursuit of justice, compassion, and the well-being of both individuals and society (Albar & Chamsi-Pasha, 2015). The Qur'an highlights the significance of virtuous character traits, such as honesty, integrity, and kindness, while obligating Muslims to avoid harmful and unethical practices. The concept of *maqasid al-shari'ah,* or the higher objectives of Islamic law, further illustrates the holistic nature of Islamic ethics, aiming to preserve and protect five essential elements of human well-being: religion, life, intellect, lineage, and wealth. Islamic scholars have developed a rich tradition of ethical reasoning and jurisprudence, known as *fiqh al-mu'amalat,* which addresses the totality of ethical dimensions of human interactions, transactions, and societal relations. This body of knowledge provides guidance on a wide range of issues, from financial and economic practices to social and interpersonal relationships, emphasizing the balance between individual and collective interests, as well as the need for adaptability and contextual analysis in deriving ethical judgments.

3. KEY PRINCIPLES OF ISLAMIC ETHICS

Islamic ethics comprise a collection of values and principles that Muslims endeavour to adhere to in their conduct and relationships (Siddiqui, 1997). At its core, Islamic ethics aim to promote virtuous behaviour, honesty, social responsibility, and spiritual development. By providing a moral compass, Islamic ethics foster harmony and justice in society, guiding individuals in making ethical decisions. The key principles of Islamic ethics include:

i. ***Tauhid* (Monotheism):** This principle emphasizes the unity and oneness of Allah (God), forming the foundation of Islamic ethics. It underscores the ultimate accountability to a single divine authority, guiding Muslims in their ethical conduct (McKechnie et al., 2007). The Qur'an states, "Say, 'Obey Allah and obey the Messenger. But if you turn away, then he is only responsible for his duty and you are responsible for yours.'" (Qur'an 24:54).

ii. ***Adl* (Justice):** Justice is a central tenet of Islamic ethics (Mirakhor & Askari, 2019). Muslims are called to uphold justice in all aspects of life, ensuring fair and equitable treatment of others and promoting social harmony. The Qur'an commands, *"Indeed, Allah commands justice, grace, as well as courtesy to close relatives. He forbids indecency, wickedness, and aggression"* (Qur'an 16:90).

iii. ***Ihsan* (Excellence):** The principle of *ihsan* encourages Muslims to strive for excellence in all endeavours, demonstrating sincerity and excellence in their actions and interactions. A Hadith narrated by 'Umar (RA) describes ihsan as "*to worship Allah as if you see Him, for even though you do not see Him, He sees you.*" (Ibn Majah, Hadith 63).

iv. ***Amanah* (Trust) and Responsibility in Islam:**The concept of *amanah* underscores the importance of trustworthiness and responsibility that Muslims are expected to uphold in their roles and duties. The Qur'an emphasizes this by stating, "Indeed, Allah commands you to render trusts to whom they are due and when you judge between people to judge with justice" (Qur'an 4:58). This highlights the ethical obligation to fulfil trusts and act justly in all matters.

In addition to trust, Islamic ethics place a strong emphasis on personal responsibility and accountability before Allah (SWT). As Siddiqui (1997) notes, Muslims are encouraged to be conscious of their actions and the consequences they carry, both in this life and the hereafter. The Qur'an further reinforces this by reminding believers, "Be mindful of the Day when you will ˹all˺ be returned to Allah, then every soul will be paid in full for what it has done, and none will be wronged" (Qur'an 2:281). This serves as a powerful reminder of the ultimate accountability each individual faces.

v. ***Itqan* (Perfection and Precision):** The principle of *itqan* emphasizes the importance of performing tasks with precision, thoroughness, and excellence. Itqan encourages Muslims to approach their duties and responsibilities with dedication and care, ensuring that their work reflects the highest standards of quality (Harahap et al., 2024). This principle is rooted in the belief that all actions should be carried out with sincerity and a commitment to excellence, as a reflection of one's faith and devotion to Allah (SWT). The Qur'an highlights this concept by stating, "*And do good; indeed, Allah loves the doers of good*" (Qur'an 2:195). Additionally, the Prophet Muhammad (ﷺ) said, "Allah loves that when anyone of you does a job, he should perfect it" (Al-Bayhaqi, Shu'ab al-Iman). By incorporating itqan into their daily lives, Muslims are encouraged to strive for excellence in all their endeavours, whether in personal, professional, or spiritual pursuits. This commitment to quality and precision not only enhances individual performance but also contributes to the betterment of society as a whole.

By adhering to these principles, whether in physical or virtual life, Islamic ethics provide a robust framework for individuals to navigate moral challenges and contribute positively to society.

2.1. Sources of Islamic Ethics

The Qur'ān, Hadith, and scholarly interpretations are the basic sources of Islamic ethics. These texts establish the fundamental ideas and provide advice for ethical behaviour within the Islamic context.

i. **The Qur'ān:** The Qur'an is the revealed speech of Allah that was conveyed to the last Prophet Muhammad through the Angel Gabriel. It was transmitted to us by numerous individuals (*tawatur*), both orally and in written form, in its exact meaning and precise wording (von Denffer, 1994). It is the major source of guidance, delivering ethical lessons and moral principles for the whole of humanity. The Qur'ān covers a variety of ethical issues, with a focus on justice, compassion, honesty, and integrity etc. (Halstead, 2007) (Liu, 2011) (Rizk, 2008).

ii. **Hadith:** The Hadith are the recorded sayings, actions, and approvals of Prophet Muhammad, the last Messenger of Allah (Azami 1978). The Hadith offer further clarification and expansion on the ethical tenets outlined in the Qur'an. Collections of Hadith, curated by subject matter experts, provide supplementary guidance and examples of ethical conduct. Alternatively, they provide practical insights on how the Prophet Muhammad (SAW) practiced Islamic ideals in his daily life, serving as a role model for Muslims.

iii. **Scholarly Interpretations:** In the context of Islamic law, scholarly interpretations refer to the secondary sources of Shariah, such as ijma' (consensus), qiyas (analogical reasoning), and *istihsan* (juridical preference). Islamic scholars, often known as jurists or theologians, play a crucial role in interpreting and applying Islamic ethics to specific situations and circumstances (Albar & Chamsi-Pasha, 2015). Their scholarly contributions, collectively known as *fiqh* (jurisprudence), provide comprehensive explanations, analyses, and practical applications of ethical principles across diverse contexts. These interpretations are instrumental in guiding Muslims as they navigate ethical challenges in various aspects of life, ensuring that their actions align with Islamic values and teachings.

4. THE DIGITAL AGE: TECHNOLOGICAL ADVANCEMENTS AND THEIR IMPACTS

The digital age has been marked by rapid technological breakthroughs that have fundamentally transformed how people communicate, access information, and interact with the world. This section provides an overview of some of the major technological developments that have shaped the digital age:

i. **Artificial Intelligence (AI):** AI involves the development of computer systems capable of performing tasks that typically require human intelligence, such as speech recognition, decision-making, and problem-solving. Technologies like machine learning and robotics have seen significant advancements, impacting a wide range of industries including healthcare, finance, transportation, and customer service (Furman &

Seamans, 2018). A notable example of AI is generative AI tools like OpenAI's ChatGPT, Google's Gemini, Islamic AI chatbot, 'Ansari', Microsoft's Copilot etc. which can generate human-like text and assist in tasks ranging from customer support to content creation. Other AI tools include image recognition software, autonomous vehicles, and virtual assistants like Siri and Alexa, which enhance user interaction and automate routine tasks.

ii. **Social Media:** Social media platforms have become powerful tools for communication, connecting individuals across geographical boundaries. Platforms such as Facebook, Twitter, Instagram, and LinkedIn have revolutionized the way people interact, share information, and engage in social and political discussions (Boulianne et al., 2024). These platforms have facilitated global connectivity, allowing for real-time information exchange and the mobilization of social movements, while also raising concerns about privacy, misinformation, and the impact on mental health.

iii. **Data Analytics:** In the digital age, data analytics plays a crucial role in extracting valuable insights from the vast amounts of data generated daily. Organizations leverage advanced analytics technologies and algorithms to analyse data, enabling them to make informed decisions, improve efficiency, and personalize user experiences (Alonge et al., 2024). Data analytics is used in various sectors, from optimizing supply chains and enhancing marketing strategies to predicting consumer behaviour and improving public services.

iv. **Internet of Things (IoT):** The Internet of Things (IoT) represents a significant technological advancement, connecting everyday devices to the internet, allowing them to collect and exchange data. This interconnected network includes everything from smart home devices like thermostats and refrigerators to industrial sensors and wearable health monitors. IoT technology enhances efficiency and convenience by enabling real-time monitoring and control of devices, improving energy management, and facilitating predictive maintenance in industries (Gubbi et al., 2013). However, the widespread adoption of IoT also raises concerns about data privacy, security vulnerabilities, and the potential for increased surveillance, necessitating robust ethical and regulatory frameworks to protect users' rights and data integrity.

These technological advancements have brought about significant benefits, enhancing convenience, efficiency, and connectivity. However, they also pose ethical challenges and require careful consideration to ensure that their impact aligns with societal values and ethical standards.

4.1. Positive Aspects and Benefits of Technology in Various Domains

Technological advancements in the digital age have brought numerous positive impacts and benefits across various domains of life. Some notable advantages include:

i. **Communication and Connectivity:** Technology has revolutionized communication, making it faster, easier, and more accessible (Mohamed , 2022). Individuals can connect with others around the globe, fostering cross-cultural understanding, collaboration, and knowledge sharing. Video

conferencing tools, instant messaging apps, and social media platforms have bridged geographical distances, enabling real-time interaction and collaboration.

ii. **Information Access:** The digital age has democratized access to information. The internet serves as a vast repository of knowledge, empowering individuals to seek information, conduct research, and engage in lifelong learning (Laufer et al., 2021). This advancement has enabled the provision of online courses, digital libraries, and other educational platforms, thereby offering opportunities for personal and professional development, and enhancing the inclusivity and accessibility of education.

iii. **Efficiency and Productivity:** Technology has streamlined processes and improved efficiency in various sectors. Automation, digital tools, and software applications enhance productivity, enabling organizations to accomplish tasks more effectively (Tisdell, 2017). In industries such as manufacturing, logistics, and finance, technology has optimized operations, reduced costs, and increased output.

iv. **Healthcare Advances:** Technological innovations have also led to significant advancements in healthcare. In this guise, telemedicine, electronic health records, wearable devices, and AI-powered diagnostics have the potential to improve healthcare access, diagnosis, and treatment outcomes (Senbekov et al., 2020). These technologies facilitate remote consultations, continuous health monitoring, and personalized treatment plans, enhancing patient care and reducing healthcare disparities.

v. **Environmental Monitoring and Sustainability:** Technology plays a crucial role in environmental monitoring and promoting sustainability (Bublitz et al., 2019). Advanced sensors, data analytics, and satellite imagery are used to track environmental changes, manage natural resources, and develop sustainable practices. Renewable energy technologies, such as solar and wind power, contribute to reducing carbon emissions and combating climate change (Gomes et al., 2024).

vi. **Education:** Technological advancements have equally reshaped the educational domain, rendering learning more interactive, captivating, and widely available. Digital tools and platforms enable personalized learning experiences, catering to diverse learning styles and needs. Virtual classrooms, online courses, and educational apps provide students with flexible learning opportunities, breaking down geographical and financial barriers to education. Additionally, technology facilitates collaboration among educators and students worldwide, fostering a global learning community (Ahmad et al., 2023).

These positive aspects of technology demonstrate how digital advancements can enhance quality of life, promoting innovation, and addressing global challenges. However, it is essential to balance these benefits with ethical considerations to ensure that technological advancements contribute to the well-being of society as a whole.

5. ISLAMIC ETHICS IN ADDRESSING ETHICAL CHALLENGES OF TECHNOLOGY IN THE DIGITAL AGE

The rapid advancement of technology in the digital age has introduced a multitude of ethical challenges that require careful examination through the lens of Islamic ethics. As technology increasingly permeates various aspects of our lives, from social interactions and communication to data management and decision-making, the need to align these technological developments with Islamic ethical principles becomes ever more pressing. Therefore, Islamic ethics offer profound insights and principles that can effectively guide individuals and societies in tackling the ethical challenges brought forth by technology in the digital age. By applying Islamic ethical frameworks, Muslims can navigate these challenges in a manner that harmonizes with their religious beliefs and encourages a responsible and conscientious use of technology. While technological advancements bring forth numerous benefits, they also give rise to ethical challenges that warrant careful consideration. Among the key ethical challenges in the digital age that necessitate thorough examination within the Islamic ethical framework are privacy and surveillance, social media and online behaviour, artificial intelligence and automation, digital divide and access, intellectual property and copyright, and data privacy and security.

5.1. Privacy and Surveillance

Islamic ethics place great emphasis on the significance of privacy and the protection of personal information. The concept of "*satar*" (concealment) encourages individuals to safeguard their privacy and respect the privacy of others. Islamic ethics advocate for informed consent and prohibit unauthorized intrusion into personal affairs. Muslims can draw upon these principles to advocate for robust privacy protections and promote responsible data collection and usage. The increasing collection, storage, and analysis of personal data raise concerns about privacy and surveillance through CCTV camera and its modern variant chipsets. Issues such as data breaches, unauthorized access, and the commodification and commercialization of personal information pose ethical dilemmas regarding individual autonomy, consent, and the protection of personal privacy. Hence, privacy and surveillance has become critical ethical challenges in the digital age.

In both principle and practice, Islamic ethics underline the preservation of privacy rights and the sanctity of personal information. The Qur'an and Hadith provide guidance on respecting individual privacy and maintaining confidentiality. For instance, the Qur'an states in Surah Al-Hujurat (49:12): "*O you who believe! Avoid much suspicions, indeed some suspicions are sins. And spy not, neither backbite one another. Would one of you like to eat the flesh of his dead brother? You would hate it (so hate backbiting). And fear Allâh. Verily, Allâh is the One Who accepts repentance, Most Merciful."* As such, Muslims can leverage this verse to advocate for responsible use of technology, promoting transparency, informed consent, and safeguarding individuals' privacy rights. Islamic ethics encourage individuals to strike a balance between the benefits of technological convenience and the preservation of privacy, ensuring that the collection and use of personal data adhere strictly to ethical principles.

5.2. Social Media and Online Behaviour

Undoubtedly, social media platforms have become a prominent lifewire of our lives, raising ethical concerns related to privacy, cyberbullying, and the spread of misinformation. As a safety net, Islamic ethics provide valuable guidance in navigating these challenges and promoting ethical online behaviour while safeguarding digital footprints. Islamic ethics emphasize virtuous conduct and place significant emphasis on values such as kindness, respect, and integrity in interpersonal relationships (Al-A'ali, 2008). Thus, Muslims can employ these ethical teachings to foster a positive and ethical online environment. They are encouraged to responsibly use social media platforms, refraining from engaging in cyberbullying, spreading misinformation, or participating in hate speech. Sterling Islamic teachings on constructive communication, truthful speech *(sidq al-qawl)* and excellent manners (*husn al-khulq)* can guide individuals in promoting ethical and respectful online behaviour. The ubiquity of social media platforms has raised a multitude of ethical concerns pertaining to digital behaviour and online conduct. Issues such as cyberbullying, harassment, misinformation, and the dissemination of hate speech challenge societal norms, values, and the psychological well-being of individuals (Swenson-Lepper & Kerby, 2019). This trend gives rise to numerous ethical questions concerning individuals' digital footprints, which often diverge significantly from their real-world actions and behaviours.

Observably, the pervasive use of social media platforms has consequently resulted in ethical challenges associated with people's online behaviour. In the Qur'ān , Allah (SWT) highlights the importance of truthful speech and discourages spreading false information. He says in Surah Al-Hujurat (49:6), "*O you who have believed, if there comes to you a disobedient one with information, investigate, lest you harm a people out of ignorance and become, over what you have done, regretful*." This verse reminds Muslims of the ethical responsibility to verify information before sharing it and to refrain from engaging in spreading false rumours or misleading content. As trivial as some social media posts might look, they have caused serious tensions among various religious communities in Nigeria. Moreover, the Prophet Muhammad (peace be upon him) stressed the importance of good character and gentle speech (الكلمة اللطيفة). It is narrated that he (SAW) said: "*Whoever believes in Allah and the Last Day should speak good or keep silent*" (Sahih al-Bukhari). This Hadith encourages Muslims to practice restraint in their online interactions, promoting respectful and ethical dialogue while refraining from engaging in cyberbullying, hate speech, or character assassination. By reflecting on these teachings, Muslims can apply ethical guidelines to their social media usage, emphasizing honesty, integrity, and responsible behaviour. They can foster a positive online environment by promoting kindness, respect, and thoughtful engagement, thereby upholding Islamic ethics in the digital realm.

5.3. Artificial Intelligence and Automation

Islamic ethics advocate for justice, fairness, and accountability in decision-making processes. In the context of artificial intelligence and automation, Muslims can scrutinize the ethical implications of algorithms and ensure their alignment with Islamic values. The concept of "*istihsan*" (equity) could be invoked to guide efforts to mitigate biases and ensure that the use of AI technologies does not lead to biases, discrimination or unjust outcomes. Muslims can also advocate for

transparency, human oversight, and ethical frameworks in the development and deployment of AI systems. The deployment of AI and automation raises ethical questions concerning job displacement, socioeconomic inequalities, and the potential biases embedded in algorithms (Hagerty & Rubinov, 2019). The ethical implications of AI decision-making, accountability, and the preservation of human agency require careful consideration. Concerns regarding the potential replacement of human workers by AI-powered tools have gained prominence. At this point, it is crucial to reiterate that individuals who fail to embrace and ethically leverage AI tools are at risk of being supplanted by those who do.

Therefore, from an Islamic perspective, artificial intelligence (AI) and automation raise ethical concerns. Islamic ethics underscore justice, fairness, and accountability in decision-making processes. Muslims should diligently reflect upon the Qur'anic verse in Surah Al-Ma'idah (5:8), which states: *"O you who believe! Stand out firmly for Allâh and be just witnesses and let not the enmity and hatred of others make you avoid justice. Be just: that is nearer to piety, and fear Allâh. Verily, Allâh is Well-Acquainted with what you do."* Also, in Surah Al-Hadid (57:25), Allah says: "*Certainly, We sent Our messengers with clear proofs and sent down with them the Scripture and the balance that the people may maintain [their affairs] in justice*." By applying this principle, Muslims can advocate for and uphold ethical considerations in the deployment of AI and automation technologies. Therefore, they are motivated to call for measures that ensure job security, address socioeconomic inequalities resulting from technological advancements, and embed ethical principles within AI systems to avoid biases and encourage moral agency and accountability.

Likewise, when considering the impact of AI and automation on employment, Muslims can refer to Islamic principles of economic justice. The Prophet Muhammad (peace be upon him) said: "*Give the worker his wages before his sweat dries*" (*Sunan Ibn Majah* (Vol. 3, Book: 16, Hadith 2443). This Hadith emphasizes the importance of fair compensation and timely payment for labour, ensuring that workers' rights are protected in an era of increasing automation. As such instant remuneration or swift pay on delivery should be the norm. Additionally, Islamic ethics require decision-making processes to be transparent, accountable, and free from bias. In the event of cyber disputes, alternative dispute or conflict resolution technique is offered to Muslims in the Qur'ān, where Allah says in Surah Al-Hujurat (49:9): "*And if two factions among the believers should fight, then make settlement between the two. But if one of them oppresses the other, then fight against the one that oppresses until it returns to the ordinance of Allah*." This verse highlights the importance of resolving disputes and ensuring just decision-making that adheres to the ordinance of Allah (SWT).

5.4. Digital Divide and Access

Islamic ethics indorse the principles of social justice and equity. On this note, Governments, MDAs (Ministries, Departments and Agencies) in charge of technology and awareness together with other stakeholders from NGOs and civil society groups are encouraged to address the digital divide and strive to ensure equitable access to technology and digital resources. Initiatives such as providing affordable internet access, implementing digital literacy programs, and offering technology education in underserved communities can align with Islamic ethics,

promoting inclusivity and bridging socioeconomic disparities. In retrospect, the digital age has exacerbated inequalities in access to technology and digital resources. As such, bridging the digital divide and ensuring equitable access to technology, especially in marginalized communities, is an ethical imperative.

5.5. Intellectual Property and Copyright

Islamic ethics recognize the significance of safeguarding intellectual property rights and honouring the entitlements of content creators in the face of the double-edged implications of digitalization and open access resources. The concept of "*haq al-mal*" (right to property) is applicable to digital content and creative works. In this guise, Muslims should promote ethical practices by adhering to copyright laws, attributing, and acknowledging sources properly, and supporting fair compensation for creative endeavours (Abdillah et al., 2022). The ease of digital reproduction and distribution of creative works raises ethical issues related to intellectual property rights and copyright infringement (Asari et al., 2022). On the basis of fair play, balancing the interests of creators, users, and the public domain becomes a crucial consideration.

5.6. Data Privacy and Security

Data privacy and security present pivotal ethical concerns in the digital age. Islamic ethics emphasize the protection of personal information and prohibit unauthorized intrusion into individuals' affairs. Instrumental in this regard, is the Qur'anic verse where Allah (SWT) says in Surah Al-Hujurat (49:11): *"O you who believe! Let not a group scoff at another group, it may be that the latter are better than the former; nor let (some) women scoff at other women, it may be that the latter are better than the former, nor defame one another, nor insult one another by nicknames. How bad is it, to insult one's brother after having Faith [i.e. to call your Muslim brother (a faithful believer) as: "O sinner", or "O wicked", etc.]. And whosoever does not repent, then such are indeed Zâlimûn (wrong-doers, etc.)."*

By reflecting on this verse, Muslims are obliged to advocate for ethical data practices, including informed consent, transparency in data collection and usage, and the implementation of robust security measures. Islamic ethics guide individuals to handle personal data with integrity and respect, safeguarding the dignity and privacy of individuals. Similarly, it is imperative for relevant government agencies to implement robust cybersecurity measures to effectively combat the rising tide of cyber robbery and address the prevalent issue of digital financial insecurities.

Taking into cognizance the ethical challenges of technology in the digital age through the lens of Islamic ethics, Muslims can navigate these challenges while upholding their religious values. Islamic ethical principles, such as justice, responsibility, accountability, and compassion, provide a solid foundation for addressing the ethical implications of technological advancements (Astra et al., 2024). Furthermore, scholars and religious leaders should continue to play a vital role in providing guidance and engaging in ethical discourse surrounding technology, ensuring that the Muslim community remains ethically grounded in an ever-evolving digital terrain. To explore the ethical challenges arising from technological developments in the digital age, it is essential to critically analyse the implications, consequences, and potential solutions within the framework of Islamic ethics. By examining these challenges through an Islamic ethical lens, we can

evaluate the compatibility of technology with Islamic values and principles and develop guidelines for responsible and ethical engagement with technology in the digital age. Consequently, this move allows for a holistic approach that ensures the ethical use of technology while fostering personal and societal well-being.

The proliferation of surveillance technology raises ethical questions regarding the balance between security measures and the preservation of privacy rights. Therefore, the urgent imperative to examine cybersecurity measures in order to tackle issues of banditry, kidnapping, and insurgency in Nigeria becomes evident (Onuche & Martins, 2024). Similarly, it is a significant moral obligation to refrain from surreptitiously recording telephone conversations between individuals without their explicit consent. Likewise, leveraging spyware to monitor individuals' phone data without a valid justification is unethical and should be avoided. To this effect, the Qur'ān emphasizes the sanctity of privacy and warns against spying on others. In Surah Al-Hujurat (49:12), Allah (SWT) says: "And do not spy or backbite each other. Would one of you like to eat the flesh of his brother when dead? You would detest it. And fear Allah; indeed, Allah is accepting of repentance and Merciful." This verse emphasizes the prohibition of unauthorized surveillance and encourages Muslims to respect the privacy of others.

Furthermore, the Prophet Muhammad (peace be upon him) highlighted the importance of preserving the dignity and honour of individuals. He said, "… Allah has made your blood, your properties, and your honour sacred to one another (i.e., Muslims) like the sanctity of this day of yours in this month of yours, in this town of yours" (Sahih al-Bukhari, Hadith 69, Book 8). This Hadith underscores the importance of safeguarding individuals' privacy and protecting their personal information from unwarranted intrusion. In addressing the ethical challenges of surveillance technology, this paper advocates for a balance between security measures and the protection of privacy rights. Also, calls for responsible and transparent use of surveillance technology, ensuring that its deployment aligns with Islamic ethics, safeguards individual privacy, and avoids unnecessary invasion of personal space.

6. ISLAMIC ETHICAL FRAMEWORKS FOR NAVIGATING TECHNOLOGICAL CHALLENGES

In the era of digitalization, the ethical predicaments brought forth by technology have grown increasingly intricate and multifaceted. Amidst these challenges, Islamic ethical frameworks present invaluable insights and principles that can serve as a compass for individuals and societies in traversing the ethical implications of technological advancements. With a profound heritage rooted in moral values and teachings, Islam provides a comprehensive ethical framework that can aid Muslims in addressing the ethical dilemmas and responsibilities arising in the realm of technology. By scrutinizing the fundamental principles of Islamic ethics and their application to contemporary technological predicaments, we can acquire a deeper comprehension of how Islamic ethics can inform and shape ethical decision-making within an ever-evolving digital domain.

6.1. The Principle of Maqasid al-Shariah and its Application to Technological Advancements

Maqasid al-Shari'ah, the objectives of Islamic law, provide a comprehensive framework for addressing ethical challenges across various fields, including technology and artificial intelligence (AI). These objectives emphasize the preservation of five essential elements: religion, life, intellect, progeny, and wealth (Da'wah Institute, 2015). By applying these principles, Muslims can effectively navigate the ethical dilemmas posed by technological advancements. Ibn Qayyim eloquently stated: "*Al-Shari'ah* fundamentals are built on keeping the interests (*masalih*) of the people during this life and hereafter. These objectives are built on justice, mercy, wisdom and interest of the creatures. Therefore, any situation which perverts from justice to injustice, from mercy to cruelty, from wisdom and utility to chaos and futility is outside the scope of *Shari'ah*" (Albar & Chamsi-Pasha, 2015). In the realm of technology, the principles of *Maqasid al-Shari'ah* can guide ethical decision-making by ensuring that technological solutions and applications uphold the preservation of these five essential elements. This section highlights the application of the five *Maqasid al-Shari'ah* principles in the context of technological ethics:

i. **Preservation of Religion (*Hifz al-Din*)**: Technology should be harnessed to enhance religious practices and accessibility, such as through digital platforms for learning and worship. These tools can facilitate greater engagement with religious teachings and community activities. However, it is crucial to ensure that technology does not lead to distractions or misuse that could compromise religious values. The balance between embracing technological benefits and maintaining spiritual focus is essential.

ii. **Preservation of Life (*Hifz al-Nafs*)**: The principle of preserving life guides the ethical development and deployment of medical technologies, ensuring they prioritize human well-being and do not cause undue harm. In healthcare, AI can be leveraged to improve diagnostics and treatment, thereby enhancing the quality of life and saving lives. User-friendly mobile apps can facilitate patient-doctor communication, improve healthcare outcomes, streamline appointment scheduling, and enable seamless data sharing for better-informed treatment decisions. These apps can also support remote patient monitoring and serve as educational platforms, providing patients with accessible health information and resources. It is crucial to ensure that such technologies are used ethically and do not harm individuals.

iii. **Preservation of Intellect (*Hifz al-'Aql*)**: AI and technology should promote education and intellectual growth, providing tools for learning and innovation. At the same time, it is important to safeguard against misinformation and the erosion of critical thinking skills. The principle of preserving intellect can shape ethical guidelines for the use of AI and algorithms, safeguarding human agency and autonomy. This ensures that technology enhances, rather than diminishes, intellectual capacities.

iv. **Preservation of Progeny (*Hifz al-Nasl*)**: Technologies related to genetics and reproduction must be evaluated to ensure they align with ethical standards that protect family structures and future generations. This involves careful consideration of the implications of genetic engineering, reproductive technologies, and their impact on societal norms and values.

v. **Preservation of Wealth (*Hifz al-Mal*)**: Technology can enhance economic opportunities and efficiency. However, it is essential to ensure equitable access and prevent exploitation or harm to individuals' financial well-being. This includes addressing issues such as digital divide, data privacy, and the ethical use of financial technologies.

By integrating the principles of *Maqasid al-Shari'ah*, Muslims can embrace technological advancements that align with Islamic values, promoting ethical development and cautioning against potential harms. This approach ensures that technology serves humanity's best interests while adhering to the higher purposes of Islamic law, aligning technological progress with the overarching goals of justice, mercy, and wisdom as outlined in Islamic teachings.

6.2. Fiqh al-Mu'amalat and its Relevance to Contemporary Ethical Dilemmas

Fiqh al-Mu'amalat, the Islamic jurisprudential principle governing transactions and interpersonal relationships, provides a comprehensive legal and ethical framework for guiding interactions in various aspects of life, including contracts, commerce, and finance (Firdaus et al., 2023). In today's digital age, its principles are particularly pertinent in addressing ethical dilemmas arising from technological advancements. One of the key principles of *Fiqh al-Mu'amalat* is the prohibition of *riba* (interest or usury), which is considered a grave sin in Islam. This prohibition extends beyond the conventional understanding of interest; it encompasses any form of unjust enrichment or exploitation in financial transactions (Farooq, 2012). In the context of emerging financial technologies (fintech), this principle can guide the development and application of Islamic fintech (i-fintech) solutions that align with the Shari'ah objectives of promoting fairness, equity, and the equitable distribution of wealth.

Another foundational principle of *Fiqh al-Mu'amalat* is the emphasis on transparency, disclosure, and the avoidance of deception in transactions (Alsmadi et al., 2023). This principle is particularly relevant in the digital realm, where algorithms and automated systems have the potential to manipulate information or decision-making processes in ways that may be detrimental to users. Ethical Islamic fintech solutions must prioritize transparency, ensuring that users have a clear understanding of the processes involved and the implications of their actions. Additionally, *Fiqh al-Mu'amalat* promotes the concept of *maslahah*, or the consideration of public interest and the common good in decision-making (Nigeria & Trust, 2015). This principle can guide the development of technological solutions that prioritize societal well-being over individual or corporate interests. For instance, the utilization of Islamic fintech (i-fintech) can contribute to sustainable and inclusive growth, expanding financial access and supporting entrepreneurship and economic empowerment in underserved communities (Azman et al., 2020).

Moreover, central to *Fiqh al-Mu'amalat* is the principle of fairness, which mandates equitable treatment in all transactions (Azman et al., 2020). This principle can be applied to online commerce and digital financial transactions, ensuring that all parties are treated justly and that no party is disadvantaged. Transparency is crucial in digital interactions, where information asymmetry can lead to exploitation. *Fiqh al-Mu'amalat* emphasizes clear and honest communication, which is essential in e-commerce platforms and digital contracts to prevent misunderstandings and fraud (Muhammad, 2020). The requirement for mutual consent in transactions

ensures that all parties willingly agree to the terms. In the digital realm, this principle safeguards against coercive practices and ensures that users are fully informed before engaging in any transaction. Islamic ethics, as outlined in *Fiqh al-Mu'amalat*, demand adherence to ethical business practices, prohibiting fraudulent or exploitative behaviours. This is particularly relevant in digital marketing and online sales, where ethical standards must be maintained.

By applying the principles of *Fiqh al-Mu'amalat* to contemporary technological challenges, Muslims can navigate the digital scene with integrity, ensuring that their interactions and transactions align with Islamic ethical standards. This approach not only upholds the values of justice and transparency but also fosters trust and accountability in digital commerce.

6.3. The Concept of Ijtihad in Adapting Islamic Ethics to Technological Changes

Ijtihad, the process of independent reasoning in Islamic jurisprudence, plays a crucial role in adapting Islamic ethics to the rapidly changing technological terrain (Rahim & Ibrahim, 2018). This process involves interpreting Islamic sources to derive rulings that address new and complex ethical challenges. In the digital age, Ijtihad enables Muslims to confront ethical dilemmas arising from technological advancements. Scholars engage in thoughtful discourse, drawing from the Qur'an, Hadith, and scholarly interpretations, to provide guidance on contemporary issues. For instance, they can evaluate the ethical aspects of technologies like artificial intelligence, social media, and biotechnology, offering insights on their responsible use within an Islamic ethical framework. This underscores the importance of collaboration among Muslim scholars, experts, and professionals from various fields to develop effective strategies for addressing emerging issues and guiding the Muslim community. *Ijtihad* also empowers individuals to apply independent reasoning, guided by Islamic ethics, in navigating technological challenges. In this context, Muslims are encouraged to seek knowledge, reflect ethically, and consult scholars to make informed decisions about technology use.

The concept of *ijtihad* has been increasingly applied to various aspects of Information and Communication Technology (ICT) to address contemporary ethical and legal challenges, including software piracy, cybercrime, digital privacy, social media ethics, and artificial intelligence (AI). Islamic scholars and organizations have issued numerous fatwas (Islamic legal rulings) on these matters. For instance, the ethical and legal status of software piracy has been a subject of debate among scholars, particularly regarding whether it constitutes theft (sariqah) or falls under fair use. The prevailing opinion among Islamic jurists is that software piracy is prohibited, as it involves the unlawful consumption of another’s property. Notably, Sheikh Muhammad bin Salih al-Uthaymeen, a distinguished Saudi scholar, ruled that copying copyrighted material without permission is analogous to theft and is therefore impermissible in Islam (Al-Madina, 2015). Similarly, Sheikh Ahmad Kutty, a senior lecturer and Islamic scholar at the Islamic Institute of Toronto, emphasized that software piracy, as ruled by the World Council of Muslim Jurists, amounts to intellectual property theft, which no Muslim should consider engaging in (About Islam, 2025). Equally, cybercrimes such as hacking and unauthorized access to personal data have been deemed haram unless conducted for legitimate purposes, such as ethical hacking for cybersecurity. The Dar al-Ifta of Egypt, for example,

issued a fatwa categorizing hacking as a form of injustice (*zulm*), permissible only with the owner's consent (Komaruddin et al., 2023).

In the realm of digital privacy and social media ethics, Islamic scholars have strongly condemned acts such as unauthorized surveillance, spying on personal data, and sharing private messages without consent. The Grand Mufti of Saudi Arabia, Sheikh Abdulaziz Al-Sheikh, issued a fatwa explicitly stating that leaking private conversations or hacking social media accounts constitutes a sinful act (Saputra et al., 2022). Moreover, the integration of AI into financial practices, including automated zakat calculations and smart contracts in Islamic banking, has been examined by contemporary scholars. The International Islamic Fiqh Academy has ruled that AI-assisted financial decisions are permissible, provided they adhere to Islamic ethical principles (Komaruddin et al., 2023). Additionally, online gambling, including e-sports betting, has been unequivocally prohibited by Islamic scholars, as it falls under *maysir* (gambling), which is strictly forbidden in Islam. For instance, the Indonesian Ulema Council (MUI) has issued a fatwa declaring that online games containing gambling elements are haram (Rizky et al., 2023). These rulings illustrate the dynamic application of ijtihad in addressing the evolving ethical and legal concerns of the digital age within an Islamic framework.

By embracing Ijtihad, Muslim scholars and fatwa councils can help the ummah ensure their engagement with technology aligns with Islamic values, allowing them to navigate the digital world while fulfilling their religious duties. Islamic ethical frameworks, including *Maqasid al-Shariah*, *Fiqh al-Mu'amalat*, and Ijtihad, provide Muslims with essential tools for addressing the ethical challenges posed by technology. These frameworks help Muslims assess the compatibility of new technologies with Islamic values, ensure fairness in digital transactions, and adapt ethics to changing technological contexts. By incorporating these principles, Muslims can make responsible choices and contribute to building a virtuous and ethical digital society.

7. IMPLICATIONS FOR INDIVIDUALS, POLICYMAKERS, AND LARGE

The implications of this study are extensive and impact individuals, policymakers, and society at large. For individuals, it emphasizes the importance of being mindful and responsible in their use of technology. Muslims, in particular, are encouraged to align their digital interactions with Islamic ethics, promoting truthful speech, privacy rights, fairness, and accountability. Individuals should strive to foster positive online behaviour, cultivate a virtuous digital community, and make informed choices regarding their engagement with technology. On their part, policymakers have a crucial role in shaping the ethical dimensions of the digital age. They should consider the ethical implications of technology and develop policies that safeguard privacy, promote fairness and justice, and ensure accountability and overall security of persons and property. By incorporating Islamic ethical perspectives into policy frameworks, policymakers can create an environment that upholds Islamic values and fosters a virtuous digital society.

At the societal level, this discourse highlights the importance of promoting ethical awareness and education regarding technology. Muslim organizations, educational institutions, and community leaders can play a vital role in raising

awareness about the ethical challenges of the digital age and providing guidance on responsible and ethical technology use. Building a culture of ethical digital engagement requires collective efforts to foster a virtuous and ethical society.

8. FUTURE CONSIDERATIONS AND RECOMMENDATIONS

As technology continues to evolve at a rapid pace, it is essential for Muslims to stay informed and engaged in ongoing discussions regarding the ethical challenges of the digital age. Continuous education and awareness are crucial; Muslims should actively seek knowledge and remain updated on technological advancements and their ethical implications. This includes understanding the potential risks and benefits associated with emerging technologies, as well as staying informed about current ethical debates and discussions. Likewise, promoting interdisciplinary collaboration is vital for the development of ethical codes and guidelines. Muslim organizations, scholars, and professionals should collaborate to create ethical codes tailored to the digital age, focusing on privacy, online conduct, and responsible utilization of AI. This interdisciplinary approach will consider both Islamic ethical principles and the pragmatic realities of the digital world, ensuring a harmonious integration of these two realms.

As a matter of imperative, ethical design and responsible innovation should be encouraged among developers, engineers, and designers. They should adopt ethical design principles, prioritize user privacy, data protection, and minimize potential harm. Responsible innovation involves proactive measures to anticipate and address ethical concerns from the early stages of technological development. Ethical leadership and role models are essential in Muslim communities. Leaders, whether religious, educational, or social, should demonstrate ethical behaviour in their digital engagement. They should serve as role models by promoting ethical conduct, responsible use of technology, and fostering a positive online environment. Ethical dialogue and discourse should be actively pursued within communities, mosques, educational institutions, and online platforms. Muslims should explore the ethical dimensions of emerging technologies and seek guidance from scholars and experts who can provide Islamic perspectives on contemporary issues.

9. CONCLUSION

Islamic ethics offer Muslims a solid basis for navigating the ethical issues of technology in the digital era. Individuals, policymakers, and society can acquire insights and direction on responsible and ethical technology usage by referring to the Qur'ān, Hadith, and scholarly interpretations. The principles of truth, fairness, privacy, and responsibility in Islamic ethics serve as helpful guides for confronting modern ethical dilemmas. Based on the discussion above and the proposed considerations and recommendations, it is appropriate to conclude that creating a virtuous and ethical digital society requires individuals to apply Islamic ethics in their digital interactions, policymakers to develop ethical policies, and society to foster an environment that promotes ethical awareness and education.

Ultimately, by emphasizing the ethical dimensions of technology and encouraging further research and the development of ethical guidelines in the Islamic context, we can collectively address the ethical challenges of the digital age

and strive for a harmonious integration of technology and Islamic values. Finally, while this paper provides a comprehensive understanding of Islamic ethics in the digital age, there is a need for further research and the development of specific ethical guidelines in the Islamic context. Future research should explore emerging technologies, their ethical implications, and their compatibility with Islamic principles. This research can contribute to the development of comprehensive ethical guidelines tailored to the digital age, providing practical recommendations for Muslims in navigating the ethical challenges posed by technology.

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DEVELOPMENT OF E-COMMERCE PLATFORM FOR POSTNATAL CONFINEMENT SERVICES: BRIDGING MATERNAL HEALTH AND DIGITAL INNOVATION

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ABSTRACT: Accessing reliable postnatal confinement care remains a challenge for many expectant women due to the fragmented nature of available services. Currently, there is no centralized platform that allows expectant women to efficiently search for, compare, and evaluate service providers. Information about caregiver qualifications, experience, pricing, and service availability is scattered across multiple sources, making the process time-consuming and often frustrating. The lack of verified reviews and recommendations further contributes to concerns regarding safety and service quality. This paper introduces Pantang.com, a Business-to-Consumer (B2C) e-commerce platform developed to streamline access to postnatal confinement services. Employing the Agile development methodology, the platform was iteratively designed based on continuous user feedback to ensure responsiveness to user needs. Key components of the development process include user requirement gathering through surveys, intuitive interface design, and the implementation of features to enhance usability and trust. Pantang.com offers comprehensive caregiver profiles, user ratings, and verified reviews to promote transparency and informed decision-making. Filtering tools allow users to search by location, price, and service type, while integrated booking and secure payment functionalities improve convenience and transactional safety. To ensure platform effectiveness, ongoing testing and iterative updates are conducted based on user engagement and feedback. By addressing existing market inefficiencies and leveraging digital innovation, Pantang.com provides a centralized, user-centric solution for postnatal care. The platform aims to empower mothers with accessible, trustworthy, and efficient support during the critical postnatal period.

KEY WORDS: *Postnatal care, E-Commerce, Online marketplace, Confinement services, Maternal health*

1. INTRODUCTION

Accessing reliable postnatal confinement services is a significant challenge for many new mothers, particularly due to the absence of centralized platforms that facilitate the search, comparison, and evaluation of such services. This fragmentation often results in time-consuming and frustrating experiences, as mothers navigate multiple sources to gather information on caregiver qualifications, experiences, and service offerings. The lack of standardized reviews and recommendations further exacerbates concerns regarding safety and reliability in postnatal care.

The integration of e-commerce into healthcare services has shown promise in enhancing accessibility and convenience for patients. Digital health interventions have been effective in improving maternal and neonatal health outcomes by providing platforms for education, support, and service delivery. For instance, a systematic review and meta-analysis highlighted that technology-mediated interventions can be as effective, or even superior, to routine care in enhancing maternal health outcomes (Zhou et al., 2025). However, despite the proliferation of digital health applications, there remains a paucity of platforms specifically tailored to postnatal confinement services.

Addressing this gap, the development of a Business-to-Consumer (B2C) e-commerce platform dedicated to postnatal confinement services could significantly streamline the process for expectant women seeking quality confinement care. By consolidating various confinement service providers into a single, user-friendly interface, such a platform can offer comprehensive caregiver profiles, verified reviews, and secure booking systems. This approach not only enhances user convenience but also fosters trust and informed decision-making in selecting postnatal care services.

This paper introduces Pantang.com, an innovative business-to-consumer (B2C) e-commerce platform developed to consolidates a variety of postnatal care services—ranging from freelance nannies to certified confinement centers—into a centralized digital marketplace. The platform is designed to address prevailing challenges experienced by expectant mothers in searching for postnatal care services, particularly the fragmented and inconsistent access to reliable information, service availability, and caregiver quality. Leveraging the Agile software development methodology, Pantang.com offers a dynamic and user-centric solution aimed at enhancing accessibility, transparency, and trust in the selection and delivery of confinement services. The key features of the platform would include comprehensive confinement agency or caregiver profiles, user-generated ratings and reviews, customizable confinement service packages, and a secure, integrated payment system. These functionalities are intended to improved and streamline the decision-making process for new and expectant mothers, empowering them to make informed choices that best suit their individual needs, cultural preferences, and budget considerations.

The objectives of this study are twofold. First, it seeks to identify the key problems and challenges faced by expectant women when searching for postnatal confinement care services through digital means. Second, it aims to design and develop a centralized B2C e-commerce platform that integrates various types of confinement services, features, and packages into a single, cohesive ecosystem.

By addressing these objectives, this study aims to contributes to both the e-commerce and maternal health domains, proposing a scalable digital solution for a traditionally informal and localized service sector.

2. LITERATURE REVIEW

The postpartum period is a critical phase for maternal recovery and infant care, during which new mothers often seek specialized support services. Traditional postnatal confinement practices, deeply rooted in various cultures, aim to provide such support. A qualitative meta-synthesis by Xin et al. (2024) explored the experiences of postpartum Chinese women undergoing confinement practices, revealing a complex interplay of cultural adherence, personal comfort, and the need for professional care . However, accessing reliable postnatal care services remains a challenge, particularly in low- and middle-income countries (LMICs), where significant inequities have been documented. A systematic review and meta-analysis by Langlois et al. (2015) highlighted disparities in postnatal care utilization, with urban, higher-income women more likely to receive adequate services compared to their rural, lower-income counterparts.

The advent of digital health technologies has transformed healthcare delivery, offering innovative solutions to bridge gaps in maternal care. Digital health interventions have been increasingly integrated into antenatal and postnatal care, enhancing service delivery and patient engagement. A scoping review by Khatri et al. (2024) mapped the role of digital health solutions in improving the quality of antenatal care services, emphasizing their potential to enhance effective coverage. Similarly, a systematic scoping review by Hausvater et al. (2024) examined digital health interventions aimed at optimizing postpartum cardiovascular health, underscoring the efficacy of these technologies in managing postnatal health concerns.

Despite these advancements, the application of digital health technologies specifically tailored to postnatal confinement services remains limited. The integration of e-commerce platforms into healthcare has shown promise in improving accessibility and convenience for patients. However, there is a notable gap in the development of platforms dedicated to postnatal confinement care. Addressing this gap could significantly enhance the accessibility and quality of postnatal care services, providing new mothers with reliable, user-friendly platforms to connect with qualified caregivers.

2.1. Reviews on Existing Online Postnatal Care Services

This section presents a critical analysis of three currently available postnatal care service platforms. Each application is evaluated based on its core features, usability, accessibility, and the extent to which it meets the needs of postpartum mothers. The strengths and limitations of these platforms are examined to inform strategic decisions in the design and development of the proposed system. This comparative review serves as a foundation for determining which elements should be adapted, improved, or innovated in the creation of a more effective and user-centric e-commerce platform for postnatal confinement services.

2.1.1. Case Study 1: Nejlika

Nejlika is a confinement service centre based in Kuala Lumpur, Malaysia, that offers postnatal care by integrating both Western medical practices and traditional Chinese confinement methods. The centre aims to provide holistic postnatal care tailored to the needs of Malaysian women, with a focus on specialized confinement diets, lifestyle guidance, and therapeutic practices. Nejlika promotes its services primarily through its official website, which serves as an informational portal for the offerings available at the Nejlika Mother & Baby Centre. These services include postnatal rejuvenation therapies, parenting education courses, customized confinement meals, and breastfeeding support (Nejlika, n.d) .

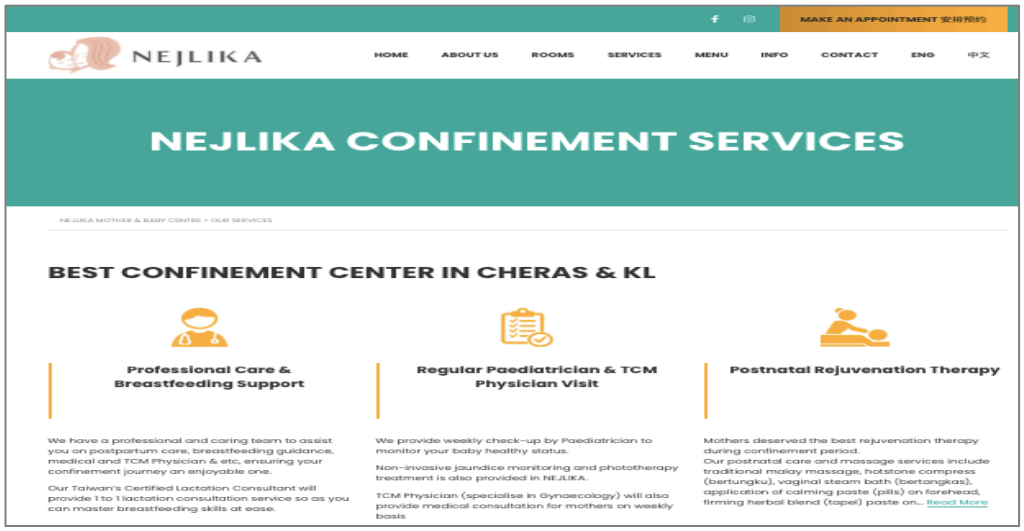


Fig. 1. Nejlika website

A notable feature of the Nejlika website is its provision of an exclusive appointment system, allowing prospective clients or expectant mothers to schedule site visits and participate in meal tasting sessions. This feature enhances client engagement by offering an immersive, firsthand experience of the centre's facilities and services. Additionally, the website's professional and visually appealing user interface contributes positively to its credibility and brand image.However, the platform presents certain limitations from an e-commerce perspective. The website does not display pricing information, nor does it support online bookings or transactions for its confinement services. Instead, users are directed to contact the centre via WhatsApp for further inquiries or reservations. This suggests that the platform functions more as a content management system rather than a fully developed e-commerce site. Its primary role is promotional rather than transactional, lacking the core features of digital marketplaces such as online payment integration, real-time availability tracking, or package comparison. Consequently, while the Nejlika website effectively markets the brand and its services, it does not fully utilize the potential of e-commerce technologies in streamlining the service procurement process.

2.1.2. Case Study 2: MummyNanny

MummyNanny is a digital platform that specializes in offering postnatal confinement services across various regions. It connects new mothers with service providers, including freelance confinement nannies and confinement centres,

through job advertisements posted either by mothers, confinement centres, or third-party agents. To support informed decision-making and ensure a level of trust in hiring, the platform incorporates filtering features that allow users to refine search results based on factors such as budget, type of cuisine, preferred language, sleeping arrangements, and specific caregiver qualities.

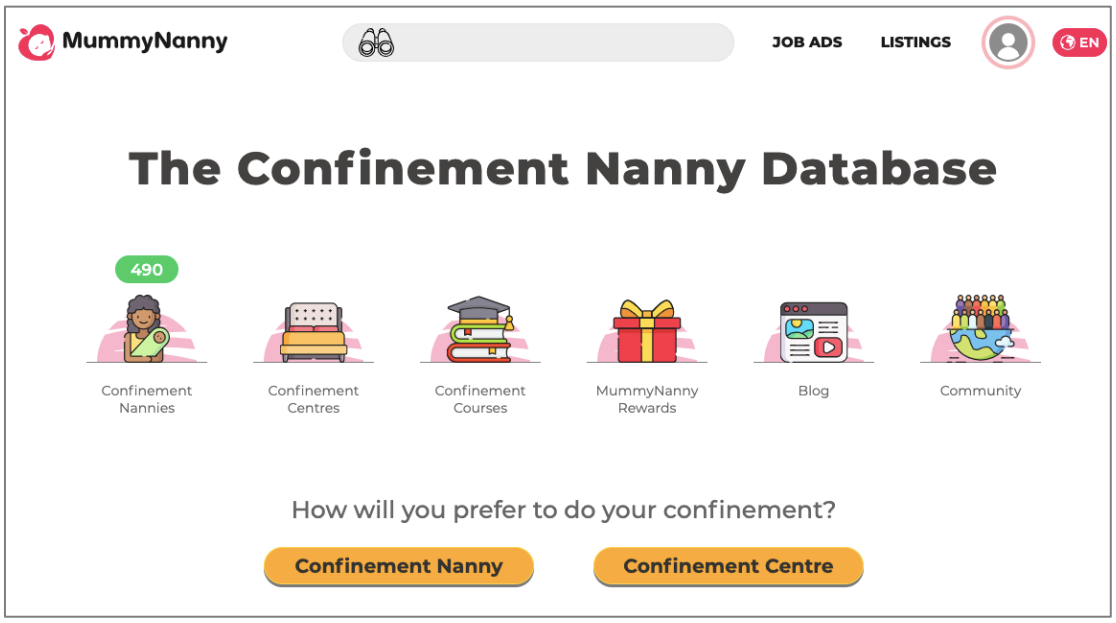


Fig. 2. MummyNanny website enable user to search for freelance confinement nanny or confinement centre.

The platform is designed to provide personalized care plans tailored to the unique needs of mothers and their newborns. In addition to listing freelance nannies, MummyNanny includes a searchable database of confinement centers, allowing users to browse based on geographical location and dietary options offered at each center. This dual approach broadens access and accommodates varying preferences for in-home or center-based care.

One of the platform's notable strengths lies in its support infrastructure and transparency. Customer service is readily available to address user inquiries, and the platform enables users to filter nanny availability according to preferred dates. Mothers can also leave public reviews and complaints, thereby contributing to a collective evaluation system that promotes accountability. A unique feature includes the visualization of complaints in graphical format, providing insights into the frequency and nature of grievances linked to specific service providers. Furthermore, MummyNanny emphasizes transparency by clearly displaying nanny ratings and background details, aiding users in making more informed selections.

Despite these advantages, the platform has several limitations. Pricing information for individual nannies is not readily available, and there is a lack of clarity regarding the packages or service bundles offered. Moreover, users are not able to compare prices or offerings across different confinement agencies within the platform. This lack of standardization may contribute to trust issues, particularly when dealing with freelance nannies whose qualifications are not consistently verified or clearly documented. These shortcomings may affect the decision-making

confidence of new mothers, especially those seeking professional assurance and quality assurance in postnatal care services (MummyNanny, n.d.)

2.1.3. Case Study 3: NannyStreet

NannyStreet is recognized as Singapore's first e-commerce marketplace dedicated specifically to postnatal confinement services. The platform functions as a centralized hub where various confinement agencies and freelance nannies can advertise their services, providing users with streamlined access to a wide array of confinement care options within a single digital ecosystem. Available as a mobile application on both the Google Play Store and Apple App Store, NannyStreet addresses the common issue of service fragmentation, whereby users previously had to visit multiple individual websites to compare and book confinement care providers.

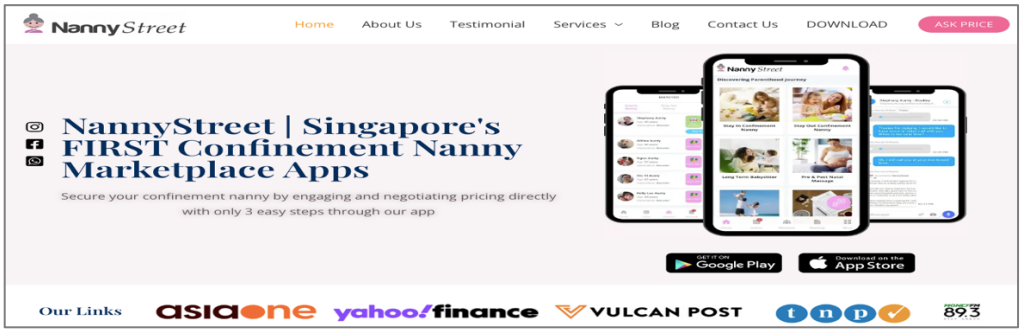


Fig. 3. The NannyStreet website

One of the platform's notable features is its ability to showcase various confinement packages and services, allowing users to explore offerings based on their individual needs and preferences. It enhances user engagement through integrated customer support and also facilitates preliminary interviews with prospective nannies. This not only adds a layer of personalization but also helps in fostering trust between the client and the caregiver. Furthermore, the platform supports negotiation of both the job scope and service fees prior to any deposit being made. This flexibility empowers users to customize their confinement care arrangements, including the creation of personalized service quotations that reflect specific household needs, cultural practices, or dietary requirements.

While the platform offers substantial user-centric features and simplifies the process of securing confinement services, its current availability is geographically limited to Singapore. This restriction poses a limitation in terms of scalability and regional applicability, especially for users outside of the country seeking similar solutions. Nonetheless, within its local context, NannyStreet represents a significant innovation in the digitalization of postnatal care services, aligning with broader trends in platform-based service delivery in the healthcare and wellness sectors. (NannyStreet, n.d.).

The comparative analysis of the three case studies – Nejlika, MummyNanny, and NannyStreet reveals distinct approaches to the digital delivery of postnatal confinement services, each with its own strengths and limitations. Nejlika operates

as a traditional service centre with a professionally designed website that serves primarily as a promotional tool, lacking e-commerce functionalities such as online booking and payment. MummyNanny, while offering a wider range of freelance and agency-based service providers, also falls short in terms of pricing transparency, service package comparison, and verified caregiver qualifications. NannyStreet, the most advanced in terms of marketplace features, facilitates service negotiation, caregiver interviews, and customized quotations through a dedicated mobile app; however, its services are geographically limited to Singapore. These limitations across the platforms point to a clear gap in the market for a centralized, scalable, and fully transactional e-commerce solution tailored specifically for the Malaysian context.

Pantang.com has the potential to address these gaps by serving as a comprehensive B2C marketplace that consolidates confinement service providers—including freelance nannies, certified agencies, and wellness centres—into a single digital platform. By integrating features such as verified caregiver profiles, transparent pricing, real-time booking, package comparison, user reviews, and secure payment systems, Pantang.com could streamline the decision-making process for expectant mothers while enhancing accessibility, trust, and convenience in Malaysia's postnatal care landscape.

The following Table 1 summarized the comparison between Nejlika, MummyNanny, NannyStreet and Pantang.com.

Table 1: Comparison of Existing Confinement Service Platforms and Pantang.com

Feature	Nejlika	MummyNanny	NannyStreet	Pantang.com (Proposed)
Platform Type	Informational website	Freelance platform	Freelance platform	Centralized B2C E-Commerce marketplace
Geographical Coverage	Malaysia (Kuala Lumpur only)	Multiple regions (including Malaysia)	Singapore only	Malaysia (nationwide)
Service Providers	In-house confinement centre only	Freelance nannies and confinement centre	Freelance nannies	Certified nannies, registered confinement agencies
Booking & Payment method	Manual via WhatsApp	No direct booking or payment on site	Customer pay deposits via app	Real-time booking with secure online payment
Pricing Transparency	Not available	Limited (only estimate), actual price not shown	Partial; user can negotiate fee with the nanny	Full transparency with price comparison
Service Customization	Limited to in-centre service options	Filter options (budget, cuisine, language, etc.)	Custom quotes based on user preferences	High customization based on user preferences

User Reviews & Ratings	Not supported	Only rating for nannies are visible, rating for confinement centre not shown	Limited, only selected reviews shown	User reviews and rating are transparent
Caregiver Verification	Internal staff only	Self-verified by user	Self-verified by user	Verified caregiver certification

3. METHODOLOGY

For the development of the Pantang.com e-commerce platform, the Agile methodology has been selected as the primary development approach. Agile is widely recognized for its emphasis on collaborative communication and customer feedback throughout the development process, ensuring that the product aligns closely with user needs and expectations (Batra, Xia, & Zhang, 2017; Dingsøyr, Falessi, & Power, 2019). This iterative process fosters continuous improvement, enabling flexibility and rapid adjustments based on feedback from stakeholders.

The first phase of the Agile process involves the requirements definition stage, during which the project's goals, scope, and budget are established. Developers work closely with clients to analyze the platform's concept and identify key features for integration. This collaborative effort ensures that the features selected align with the intended business objectives and are feasible within the project's constraints (Teffo, Sigama, & Kanobe, 2023). The iterative design and development phase involves continuous user feedback throughout each development cycle, known as an "iteration." This approach allows for frequent testing of features, helping to identify issues early and ensuring that the product evolves according to customer feedback. Each iteration culminates in the release of a functional product version, which is then tested for usability, functionality, and performance (Batra et al., 2017).

Once the product is released and tested, user training is provided to ensure effective platform use. If errors are detected during this phase, they are promptly addressed through further iterations to enhance the product's performance. Upon successful testing and resolution of issues, the platform is deployed and made available to users. The final deployment marks the transition of the product from development to live use, but the work does not stop there. The final phase involves monitoring and reviewing the system to ensure its continued effectiveness and smooth operation post-launch. Agile emphasizes the importance of post-deployment support and continuous evaluation to meet user needs and expectations (Dingsøyr et al., 2019). This ongoing monitoring also allows for future iterations based on user feedback, supporting the platform's long-term success and adaptability.

3.1. Requirements Specification

In order to inform the development of the Pantang.com e-commerce platform, a survey was conducted with the objective of gathering insights from potential users, particularly expectant women. The purpose of the survey was to understand the challenges that expectant mothers face when searching for postnatal care services and to identify their preferences for the features and functionalities that should be integrated into the platform. Additionally, the survey sought to explore the usability and accessibility expectations for the platform, ensuring that the final product would

meet the needs of users with varying levels of technical expertise. This user-centered approach is intended to guide the design and development of a digital solution that effectively addresses the pain points of the target audience and improves their experience in accessing confinement services.

The survey had several specific objectives. First, it aimed to identify the key pain points and challenges that expectant mothers face when searching for confinement services, such as difficulties in finding reliable information, evaluating service quality, or accessing affordable options. Second, the survey sought to gather feedback on the key features that users would like to see in the Pantang.com platform, including caregiver profiles, ratings and reviews, booking functionality, and secure payment options. Finally, the survey was designed to assess the usability and accessibility expectations of users, with a focus on their preferences for ease of use, intuitive navigation, and mobile compatibility.

3.1.1. Study Design

The survey employed an online questionnaire methodology, which was distributed to a targeted group of respondents specifically expectant mothers who had experience searching for confinement services online. The online format allowed for efficient and wide-reaching data collection, ensuring that a diverse group of respondents was included in the survey. The questionnaire was structured into three main sections to capture comprehensive insights; i) Part A focused on gathering demographic information about the respondents, including age, and previous experiences with confinement services; ii) Part B aimed to identify the specific problems or challenges users face when searching for postnatal care services, with questions designed to capture common difficulties in service discovery, trust issues, and availability and iii) Part C gathered user requirements for the online marketplace, focusing on essential platform features such as search functionalities, service provider profiles, user reviews, booking options, and payment mechanisms. The target respondents for the survey were primarily expectant mothers who had experience searching for postnatal care services online. These respondents were selected based on their relevant experience in the context of confinement services, ensuring that the data collected was both relevant and representative of the platform's user base. The convenience sampling method was employed to gather responses from readily accessible individuals who were willing to participate in the survey.

3.1.2. Participant Demographics

In total, the survey received 35 responses, which were analysed to gain a deeper understanding of the users' needs and preferences. The following Table 2 summarizes the demographic characteristics of the survey participants, which include age, gender distribution, and platform used to search for confinement services.

Table 2: Participant demographics

Item	Options	*N*	*%*
Age range	Below 20 years old	0	0
	21 – 30 years old	23	65.7
	31 – 40 years old	9	25.7
	41 – 50 years old	1	2.9

	Above 50 years old	2	5.7
Gender	Male	9	25.7
	Female	26	74.3
Platform used to search for confinement services *(may choose more than one)*	Search engine (e.g. Google Bing)	21	60
	Social media (e.g. Facebook, Instagram)	29	82.9
	Online forums or communities	5	14.3
	Dedicated websites / apps	10	28.6
	Recommendation from friends or family	21	60

Based on Table 2 above, substantial proportion of participants were aged between 21 and 30 years (65.7%), indicating that this age group is the primary demographic seeking online postnatal services. Studies have shown that younger women, particularly first-time mothers, are more likely to engage with digital platforms for health-related information (Wallwiener et al. 2016). A smaller percentage (25.7%) of participants were between 31 and 40 years old, suggesting that women in their 30s are also actively seeking online confinement services, though at a slightly lower rate. The underrepresentation of participants older than 40 years (8.6% combined in the 41-50 and 50+ age ranges) may reflect fewer older women seeking online postnatal care services (potentially for their daughter).

The gender distribution reflected the expected trends, with 74.3% of participants identifying as female. This is consistent with the broader literature, which suggests that women are the primary decision-makers when it comes to maternal healthcare (Murugesu et al. 2021) However, the inclusion of 25.7% male participants highlights the growing role of male partners in postnatal care decisions, potentially driven by increased awareness of paternal involvement in early childrearing (Firouzan et a. 2018).

Participants were also asked to select the platforms they used to search for confinement services, and the results reveal important trends regarding user engagement with different online channels. Social media emerged as the most frequently used platform, with 82.9% of participants indicating that they utilized platforms such as Facebook and Instagram to search for confinement services. The dominance of social media in this context is consistent with a study by Baker and Yang (2018) which demonstrate substantial role of social media as an additional source of both information and social support throughout the perinatal period in transitioning to the role of mother. Search engines were used by 60% of participants, suggesting that many users initiate their search for postnatal services through Google or Bing. This finding suggests that optimizing a website for search engines (through SEO strategies) is therefore critical for ensuring that postnatal services appear prominently in relevant search results.

Personal recommendations from friends or family were also cited by 60% of participants. Word-of-mouth has long been identified as a crucial factor in healthcare decision-making (Pauli et al. 2023). Trust in personal recommendations often supersedes online reviews, particularly in sensitive areas like postnatal care, where safety and reliability are paramount. This finding underscores the importance of integrating trust-building features, such as user testimonials and referral systems, into the design of an e-commerce marketplace for postnatal services.

Dedicated websites or apps for postnatal services were used by 28.6% of participants. While this percentage is lower than the usage of social media and search engines, it indicates an opportunity for growth in the market for specialized platforms. Meanwhile, only 14.3% of participants used online forums or communities. Although this represents a smaller proportion, it suggests that peer support and shared experiences remain an important source of information for some users. Thus, E-commerce platforms focusing on postnatal care might consider incorporating community features, such as discussion boards or user groups to engage this segment and provide personalized, peer-driven content.

3.1.3. Challenges of Searching for Confinement Services

Table 3 presents the challenges experienced by participants when searching for confinement services online.

Table 3: Challenges searching for confinement services online

Item	Options	*N*	*%*
What are the challenges of searching for confinement services online? *(may choose more than one)*	Concerns about the reliability and safety of the confinement lady/caretaker	30	85.7
	Difficulty accessing accurate and relevant information about the confinement agencies and services offered.	23	65.7
	Lack of transparency regarding the qualifications and experience of the confinement lady/caretaker	21	60.0
	Limited ability to compare prices, packages, and services across different confinement service providers	19	54.3
	Insufficient user reviews/ feedback / testimonials to assess the quality or performance of the confinement service provider.	18	51.4
	Difficulty customizing postnatal care packages to individual needs.	16	45.7
	Overwhelming or unclear information in promotional materials and advertisements.	8	22.9
How satisfied are you with the information you found online about confinement services?	Very dissatisfied	0	.0.0
	Dissatisfied	2	5.7
	Neutral	21	60.0
	Satisfied	9	25.7
	Very Satisfied	3	8.6
How would you rate your overall experience in finding confinement services online?	Very difficult	0	0.0
	Difficult	6	17.1
	Neutral	16	45.7
	Easy	10	28.6
	Very Easy	3	8.6

Based on Table 3 above, participants were asked to identify the issues they encountered during their search, with multiple responses allowed. The most significant challenge, cited by 85.7% of participants, was concerns about the

reliability and safety of the confinement lady or caretaker. Additionally, 60% of participants concerns about lack of transparency regarding the qualifications and experience of the confinement lady caretakers. This finding highlights a critical issue in the online postnatal service marketplace i.e. trust. Reliability and safety are paramount when selecting a caregiver for vulnerable individuals in a sensitive context. A lack of face-to-face interactions and the inability to conduct in-person interviews with potential caretakers exacerbate these concerns in an online environment. Thus, in order to ensure positive user experience in postnatal care, E-commerce platforms should strive for transparency in online environments by giving users access to necessary information to help them make an informed decisions (Wang et al. 2023).

Another common problem (65.7%) was difficulty accessing accurate and relevant information about the confinement agencies and the services offered. The lack of easily accessible, trustworthy information can hinder users from making informed decisions. Given that postnatal care involves critical health decisions, clear, concise, and accurate service information is essential for both user satisfaction and service quality. Besides, more than half of the respondents (54.3%) reported a limited ability to compare prices, packages, and services across different confinement service providers. This challenge underscores the need for comparison tools on e-commerce platforms. Consumers often rely on comparison features when purchasing services online, and the absence of such features can lead to frustration and suboptimal decision-making. Integrating a comparison tool into the platform could provide users with an easier way to evaluate and choose services that best meet their needs and budget (Hanna et al. 2019).

Additionally, the absence of user reviews or testimonials to assess the quality of service was a concern for 51.4% of participants. Reviews and feedback are critical in influencing consumer behavior, particularly in health-related sectors. The lack of social proof in the form of testimonials or reviews is a missed opportunity to build trust and provide validation for potential customers (Chen et al. 2022). Customization of postnatal care packages was also a challenge for 45.7% of participants. The inability to personalized confinement services to individual needs could lead to dissatisfaction and underutilization. A platform that offers customization options, such as flexible care packages and a variety of service options, would better meet the diverse needs of expectant mothers.

Our participants were asked to rate their satisfaction with the information they found online about confinement services. The results indicate that, majority of participants (60%) felt neutral about the information they found, with 25.7% expressing satisfaction. However, the fact that 5.7% were dissatisfied suggests that there is still room for improvement in terms of the quality and accessibility of information. The relatively high percentage of neutral responses could indicate that while users were able to find some information, it may not have been comprehensive or fully aligned with their expectations, This finding emphasizes the need for more detailed, user-friendly, and well-organized content on e-commerce platforms to improve user satisfaction.

When asked about their overall experience in finding confinement services online, participants reported the following, majority of our participants (45.7%) rated the experience as neutral, indicating that while they did not find the process overly

difficult, it was not entirely easy either. Only 28.6% found the process easy, and 8.6% found it very easy. These results may suggest that while some users had a relatively smooth experience, there are substantial barriers to ease of use that need to be addressed. Simplifying the online search process and providing clear, intuitive navigation could help improve the overall experience for future users.

3.1.4. User Needs and Preferences

The following Table 4 presents the user requirements for an E-commerce marketplace of online confinement services.

Table 4: User Requirements for Online Confinement Services

Item	Options	*N*	*%*
How likely would you use E-Commerce platform for confinement services?	Very unlikely	0	0.0
	Unlikely	1	2.9
	Neutral	2	5.7
	Likely	12	34.3
	Very likely	20	57.1
Relevant features in an E-Commerce platform for confinement services	Ability to search for postnatal services based on price range or personal budget.	30	85.7
	Access to customer reviews and star ratings for confinement service providers.	30	85.7
	Filter and display available confinement service agencies or packages based on user location or preferred area.	29	82.9
	Visibility of confinement lady/ caretaker credentials, including experience and qualifications.	29	82.9
	Categorization of confinement services by package type(e.g. stay-in, daily visits).	27	77.1
	Display comprehensive list of available postnatal care treatments (e.g. sauna, postnatal massage, body scrub etc.)	26	74.3
	Display confinement meals options with dietary details.	21	60.0
	Booking system for confinement service purchases and scheduling.	20	57.1

We first asked the likelihood of participants to use an e-commerce platform for confinement services. Based on Table 4 above, the survey results demonstrate a strong inclination toward using digital platforms for accessing postnatal care services. A significant 57.1% of participants indicated they were very likely to use an e-commerce platform for confinement services, and 34.3% were likely to do so. This represents a substantial 91.4% of respondents who are inclined to use such platforms, highlighting a positive reception to digital solutions in the confinement services sector. The findings align with broader trends in healthcare, where the adoption of online platforms especially in postnatal care, is on the rise (Sardi et al., 2020). However, a small portion (2.9%) of respondents were unlikely, and 5.7% felt neutral, suggesting that some concerns or barriers to full adoption remain, such as trust or technology accessibility.

Participants were also asked about the features they find most relevant in an e-commerce platform for confinement services. An overwhelming 85.7% of respondents indicated that the ability to search for services based on price range or personal budget is a crucial feature. Budget is often a key determinant in healthcare service decisions, and this preference underscores the importance of providing transparent pricing structures. Previous studies have highlighted that price is a significant factor in consumer decision-making. Offering price filters or budget-based searches could increase the platform's appeal and ensure it meets diverse financial needs (Hanna et al. 2019).

Equally important, with 85.7% of respondents selecting this feature, is the ability to access customer reviews and star ratings for service providers. Trust and social proof play a critical role in the decision-making process for healthcare services (Han et al., 2021). Reviews offer valuable insights into the quality of service, caregiver professionalism, and overall user experience. A platform with integrated review systems can enhance transparency and assist potential users in making more informed decisions.

Location-based filtering was considered relevant by 82.9% of participants. This feature allows users to easily find services available in their geographical area, ensuring convenience and reducing logistical barriers. The importance of localized services has been emphasized in health service delivery, particularly for maternal care, where proximity to care providers is often a critical factor (Hwang and Park, 2019). Incorporating location-based filters would optimize the search process and improve user satisfaction.

A substantial 82.9% of respondents also indicated that it is important for platforms to display the credentials of confinement ladies, including their qualifications and experience. As trust in caregivers is a central concern for many expectant mothers, transparency about qualifications can help address safety concerns and build confidence in the service provider. Previous research has underscored the importance of professional credentials in healthcare-related services, where perceived qualifications significantly impact consumer trust (Song et al., 2024).

The ability to categorize services based on package types (e.g., stay-in versus daily visits) was considered important by 77.1% of respondents. This feature allows users to more easily navigate the different types of services available and select those that best meet their needs. Categorization simplifies the decision-making process and can increase user engagement with the platform by making it easier to compare options. Besides, a comprehensive list of available postnatal treatments, such as sauna, postnatal massage, and body scrub, was considered relevant by 74.3% of participants. Offering detailed information about supplementary services is likely to enhance the appeal of a platform by providing users with a broader array of choices. Many new mothers seek diverse postnatal treatments to aid recovery, and a platform that integrates these options can better meet their needs.

The option to view confinement meals with dietary details was considered important by 60% of participants. Nutritional care is an essential aspect of postnatal recovery, and the inclusion of this feature highlights the increasing demand for comprehensive care. Dietary information also caters to individual preferences and restrictions, which can increase the attractiveness of a platform offering personalized postnatal care (Basir et al., 2018). Additionally, the ability to book services and schedule appointments directly through the platform was considered relevant by 57.1% of participants. A streamlined booking system is essential for enhancing user convenience and ensuring a smooth service experience. Simplifying the process of booking and managing services can contribute to higher user satisfaction and reduce barriers to service adoption.

In summary, to effectively meet user needs, e-commerce platforms for confinement services should integrate the relevant features identified in this survey, such as user-friendly search and comparison tools, clear service categorization, and robust trust-building mechanisms like reviews and caregiver credentials. Future research should investigate the specific barriers to adoption for the small portion of respondents who were neutral or unlikely to use online confinement services, to understand and address potential obstacles to wider acceptance of e-commerce platforms in this domain.

4. PROTOTYPE DEVELOPMENT

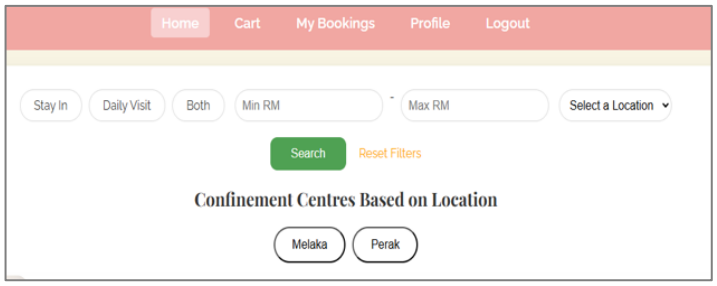
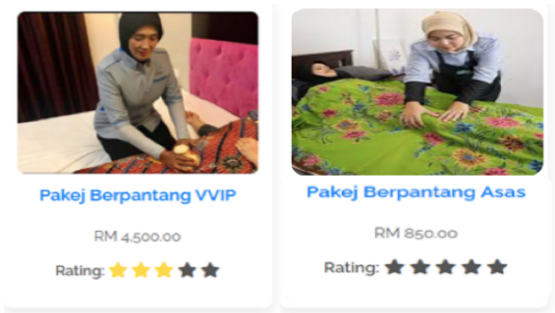
In this section, we would present development of the Pantang.com, an E-Commerce marketplace platform for confinement service. The system is built through a combination of a user-friendly frontend, developed using Visual Studio Code and a reliable backend, managed with phpMyAdmin. The integration of front-end and back-end systems offers seamless functionality, ensuring a smooth and efficient process for users to explore the website's features effortlessly. The following Figure x present the homepage of Pantang.com.

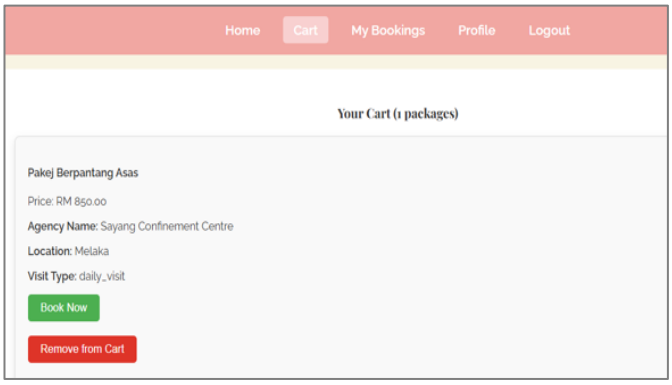
Fig. 4. Homepage of Pantang.com

Pantang.com's homepage was designed with a modern, user-friendly layout. At the top, it features a heart-warming image of a caregiver holding a baby, accompanied by a bold tagline stating "Expert Confinement Care Tailored for You" and a prominent gold-coloured call-to-action button labelled "Start Now" to encourage user engagement. Below, a section presents four visually distinct feature boxes with icons that are imported from AJAX library with titles written, "Trusted and Credible", "Budget Filtering", "Licensed Agencies", and "User-friendly", aims to convinced users that Pantang.com is a trusted E-commerce site as all the confinement agencies are registered and licensed.

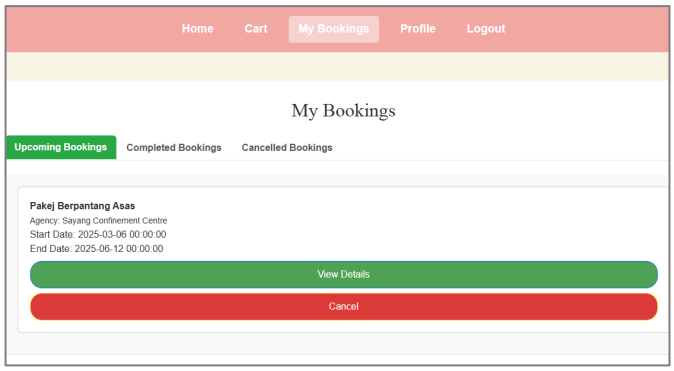
Additionally, the main page also presents a four-step 'quick start' for users, including signing in or signing up, setting preferences, booking a package, and being ready for nannies. The footer, designed with a dark contrasting background, provides essential contact information, including an email address, phone number, and physical office address, ensuring accessibility for inquiries. The entire page structure relies on HTML for content organization, CSS for the elegant color scheme and layout styling, and JavaScript for enhancing interactive elements such as the call-to-action button and step-by-step user guidance, making it both visually engaging and functional. Pantang.com has two different user access which are customers and admin. The following Table 5 presents different user interface for customer site.

Table 5: The user interface of customer site in Pantang.com

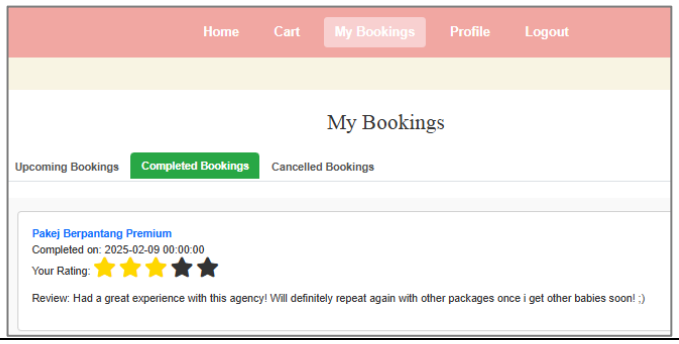
The User Interface	Description
	Customers can filter packages according to their preferences (e.g. based on location, budget or preferred package)
	Customers can see available packages and ratings



Customer can book / purchase their preferred confinement service package online.



Customer can cancel their booking online up until a specific date as agreed with the service provider.

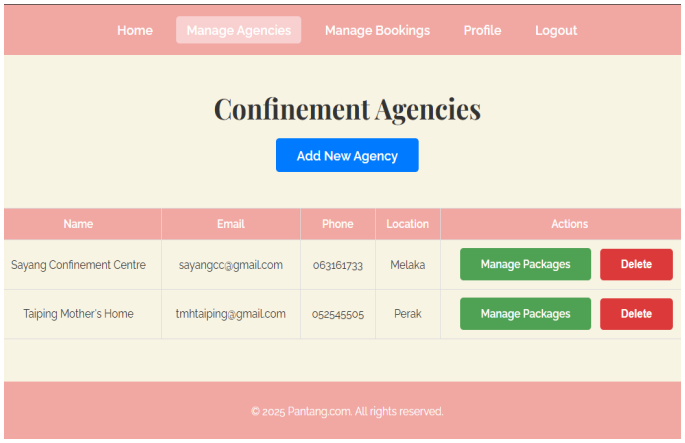


Once the confinement service had been completed, user may post a review evaluating their services.

The following Table 6 presents different user interface for admin.

Table 6: The user interface of admin site in Pantang.com

The User Interface	Description
	Admin can register a new confinement agency into the system. Prior to registration, verification are required to ensure the agency is indeed a registered business entity and certified postnatal care professionals).



Admin can edit and delete agency, and also manage confinement packages managed by the agency.

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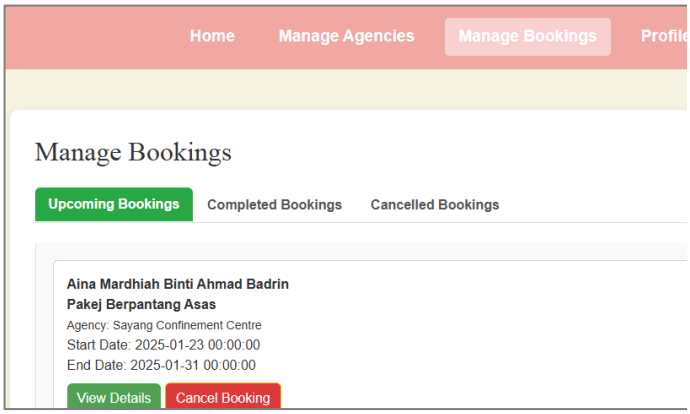
Admin can modify information related to confinement packages and services offered by confinement agencies.



Admin can track customer's order, monitor upcoming confinement service booking, completed booking, and approved cancelled booking as requested by the user.

5. USER TESTING

User testing was carried out to assess the functionality and usability of the e-commerce website for confinement care services. This testing phase aimed to ensure that key features, including user registration, package filtering, viewing shop pages, package reviews, and booking tracking, were fully operational and met the expectations of end-users. The primary goal of UAT was to validate that the system functions as intended and is user-friendly, ensuring readiness for deployment.

5.1. User Testing Procedures

The user testing was conducted on personal laptops using popular browsers like Chrome and Firefox, with a stable home Wi-Fi connection, simulating the typical conditions in which the system would be used by real customers. The scope of the testing focused on the most crucial functionalities, such as user registration, filtering available confinement packages, viewing confinement agency pages, reading package reviews, and tracking bookings. The testing was conducted in three (3) phases; i) pre-test phase, which involved asking participants on their demographic details and experience with similar systems, ii) intervention phase where participants were asked to follow a predefined test cases and scenarios to interact with Pantang.com. They were asked to carefully observed the system's behaviour, reported any issues encountered and iii) post-test phase, where the participants were asked about their experience interacting with Pantang.com, any problems and challenges they experience and if they had any suggestions to improve the functionalities of the system leading to a better user experience.

6. RESULTS AND DISCUSSION

A total of five participants involved in the session. The participants were selected to reflect a diverse range of backgrounds in terms of age, occupation, and level of technical experience, ensuring a well-rounded perspective on the platform's design and functionality. The following Table 7 presents the demographic details of the participants.

Table 7: Participant demographic for user testing

Participant ID	Age	Occupation	Level of technical experience
P1	30	Housewife	Moderate
P2	32	Professional	Moderate
P3	24	Professional	Moderate
P4	41	Professional	Expert
P5	45	Freelancer	Moderate

Based on the above table 7, participants ranged in age from 24 to 45 years, with an average age of 34.4 years. This range effectively represents the typical demographic of postnatal care service users and decision-makers. The group included a mix of professions, 60% were professionals (P2, P3, P4), one participant identified as a housewife (P1), and one was a freelancer (P5). The majority of participants (4 out of 5) rated themselves as having a moderate level of technical experience, while one participant (P4) had expert-level proficiency. This mix ensures the platform is tested for both average and advanced users, which is critical for an inclusive user experience design.

6.2. Usability of the System

The following Table 8 presents the result of post-test user evaluation.

Table 8: Results of user evaluation

No.	Questions	P1	P2	P3	P4	P5	Mean, M
1	Navigating through pages in Pantang.com was easy.	5	5	5	5	5	5.0
2	Filtering confinement services based on my preferences (e.g., location, budget) was effective and efficient.	5	5	5	5	5	5.0
3	The process of adding items to the cart and booking confinement services in Pantang.com was intuitive and user-friendly.	5	5	5	5	5	5.0
4	Tracking my bookings on Pantang.com was clear and straightforward.	5	5	5	5	5	5.0
5	Cancelling a booking and seeing the update reflected in the system was seamless.	5	5	5	5	5	5.0
6	The features provided in Pantang.com met my expectations for functionality and control.	5	5	5	5	5	5.0
7	The design and layout of Pantang.com is visually appealing and well-organized.	5	5	4	5	5	4.8
8	Overall, I was satisfied with my experience using Pantang.com	5	5	5	5	5	5.0
9	I would recommend Pantang.com to others seeking postnatal confinement services.	5	5	5	5	5	5.0

Based on Table 8 above, the findings revealed uniformly high scores across all evaluation items. Participants unanimously agreed (mean score = 5.0) that Pantang.com was easy to navigate, filtering of services based on user preferences (e.g., location and budget) was efficient, and the process of adding services to the cart and completing bookings was intuitive. Similarly, users rated the booking tracking system (including upcoming, completed, and cancelled services) and the cancellation process as seamless and straightforward. The platform's functionality also met or exceeded user expectation. Besides, our participants also expressed complete satisfaction with their overall experience (M = 5.0).

The only slight deviation from a perfect rating was in visual design, which received a mean score of 4.8. While this score remains within an excellent range, it suggests minor opportunities for improvement in terms of aesthetics and interface layout. Previous research has highlighted the influence of visual appeal on perceived credibility and user satisfaction in digital health platforms (Bandhari et al., 2019). Enhancing interface consistency, incorporating modern UI design trends, or offering personalization options (e.g., light/dark mode) could further improve user experience without disrupting the functional strengths of the system.

Based on the results, several design implications can be drawn. First, the current information architecture and booking workflow should be preserved as they provide a high degree of usability and user confidence. Second, minor refinements in the platform's aesthetic design could be explored through A/B testing or user-driven customization features. Finally, while the current proposed features of the E-commerce platform is well-received, any future additions should be approached cautiously to avoid overwhelming users, in line with usability principles that advocate for simplicity and minimal cognitive load.

In conclusion, the user testing confirms that Pantang.com offers an effective and easy to use platform for booking postnatal confinement services. These findings not only validate the platform's design approach but also provide actionable insights for iterative improvements and future scalability. The positive outcomes reinforce the growing body of evidence that supports digital platforms as viable and efficient tools for maternal health service delivery in the postnatal period (Zhou et al., 2025).

6.3. Suggestions for Improvement

In addition to the quantitative usability assessment, participants were invited to provide open-ended feedback regarding potential improvements to Pantang.com. The qualitative responses revealed valuable insights for enhancing both user experience and system efficiency. Several recurring themes emerged, including dynamic interaction design, visual appeal, mobile optimization, system notifications, and administrative efficiency.

One participant (P1) highlighted the filtering system's functionality but suggested that the platform would benefit from a more dynamic search experience, specifically by implementing real-time updating of results without requiring the user to click a search button.

'The filtering system is functional, but it would be better if the search results updated dynamically without needing to click the search button. It would make the experience smoother and faster. (P1)

This suggestion aligns with modern user interface design principles that emphasize immediate system feedback and reduced user effort (Harley, 2018). Research has shown that such interactive enhancements can significantly reduce cognitive load and improve the perceived responsiveness of web-based platforms.

Additionally, visual design and text readability were also another areas for improvement. P2 recommended the incorporation of more color and graphical elements to improve the attractiveness of UI design, as well as the optimization of text size for better readability on mobile devices.

'I found the booking process simple and clear, but the UI could use more color or graphics to make it look more modern and engaging. The text is (also) too small on mobile devices, making it a bit hard to read' (P2)

This feedback effectively highlights the significant role that visual aesthetics, readability, and screen size play in enhancing user experience and performance on mobile devices. As the study by Perrig et al. (2023) suggests, aesthetics contribute

not only to the subjective experience but also to the objective performance of users, which is critical for the success of mobile web applications. When users are presented with an aesthetically pleasing interface, they are more likely to engage positively and perform better, which can certainly provide a competitive edge to businesses or developers.

Moreover, the point about readability and legibility of text is crucial. The study by Al Ghamdi et al. (2016) underscores the importance of optimizing content for mobile screens, especially since smaller screens can negatively impact the ease of reading. Larger screen sizes tend to improve clarity and reduce reading time, which highlights the need for mobile-friendly design choices, including optimal font sizes. This can be particularly challenging on mobile devices with limited screen space, but addressing these concerns by adjusting font size and layout can drastically improve the user experience.

Another participant (P3) noted the absence of automatic notifications for key user events such as booking confirmations or cancellations.

'The system works well overall, but I think it would be more convenient if it sent notifications to alert customers about updates, like booking confirmations or cancellations. This way, I wouldn't need to check manually.' (P3)

Incorporating automated alerts either via email, SMS, or in-app messaging is essential for maintaining user engagement and reducing the mental workload required to manually track booking statuses. Prior studies emphasize that timely and relevant notifications improve the user experience and satisfaction (Gavilan & Martinez-Navarro, 2022). Implementing such features would also support continuity of care, an essential component in postnatal services.

On the administrative side, P5 recommended enhancing the dashboard with a visual summary section displaying key metrics, such as total bookings or revenue trends.

'Everything works fine for managing agencies and bookings, but the dashboard feels a bit cluttered. It would be better to have a summary section showing key stats, like total bookings or revenue trends' (P5).

Dashboards that highlight actionable data through visual summaries are known to improve decision-making and user satisfaction among administrators.

Overall, the qualitative feedback from participants reinforces the quantitative findings by affirming the platform's core usability, while offering actionable enhancements that align with established usability heuristics and contemporary e-commerce design trends. Implementing these user-driven suggestions can further refine the platform, making it more adaptive, engaging, and efficient for both end-users and administrative stakeholders.

7. CONCLUSION

This study propose a specialized e-commerce marketplace that addresses the growing demand for postnatal confinement services. The initiative responds to a notable gap in the formalization and accessibility of confinement care, which remains largely fragmented and difficult to navigate for new mothers. By integrating e-commerce features into this culturally grounded domain, the proposed platform offers a structured, scalable, and user-centred approach to delivering confinement care services.

The developed system demonstrates key features including search and filtering based on user preferences, confinement service customization, confinement agency and caretaker profiles and credentials, user feedback and reviews and online booking mechanisms. These features were designed in alignment with user needs and usability standards, with the aim of improving both maternal care outcomes and service provider visibility. The platform not only simplifies the process of discovering and booking confinement services but also enhances trust and transparency – two critical factors in maternal health decision-making.

However, this study is not without limitations. As a conceptual and developmental initiative, the platform has yet to undergo large-scale testing and user adoption studies. Additionally, the scope was limited to prototype development and core functionality, without integration into broader healthcare systems or engagement with regulatory stakeholders. These constraints suggest the need for cautious interpretation of the platform's potential until further empirical validation is conducted.

Future research should conduct more user testing sessions with end-users i.e. both mothers and service providers, to assess usability, satisfaction, and health outcomes. Besides, there is opportunities to refine the platform through mobile app development and data-driven personalization. Longitudinal studies could also explore how digital platforms influence maternal care behaviors and postpartum recovery. Overall, this study lays the groundwork for a culturally aware, digitally enabled postnatal care solution, indicating a promising direction for e-commerce applications to support maternal health.

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EMPOWERING THE B40 COMMUNITY IN ACEH THROUGH PRIVATE ONLINE TUTORING SOLUTION: A SUSTAINABLE EDUCATIONAL BUSINESS MODEL

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ABSTRACT: The purpose of this paper is to introduce an innovative and sustainable e-learning conceptual business model that comprises an application tailored for school students, complemented by a sustainable digital platform, all aligned with the Sustainable Development Goals (SDGs) 4, 8, and 9. This ground breaking application seeks to transform education delivery by providing a comprehensive suite of resources for our Costumer Segment (CS) including online lectures, video tutorials, entrepreneurship for teacher, interactive exercises, coaching for student, and feedback learning accessible through both free and premium versions. A special focus is placed on the B40 community in Aceh, identified by the Upah Minimum Regional (UMR), ensuring that financial limitations do not impede their access to quality education. Additionally, this initiative offers from the B40 community (B40 priority student and Teachers) opportunities to take on mentoring roles, promoting inclusivity, and free access to premium account. In the business domain, a robust strategy is employed, leveraging tools such as the Business Model Canvas (BMC) and Value Proposition Canvas (VPC) to meticulously plan and execute the venture. The BMC aids in visualizing critical elements including customer segments, value propositions, channels, revenue streams, and cost structures, providing a clear blueprint for sustainable growth. Embracing SDGs 4 (Quality Education), 8 (Decent Work and Economic Growth), and 9 (Industry, Innovation, and Infrastructure), this e-learning application aspires to foster a holistic and sustainable approach to education, benefiting both students and the broader community. With a comprehensive vision encompassing education, economic empowerment, and technological innovation, this endeavour strives to leave a lasting positive impact on the educational landscape in Aceh and beyond.

KEY WORDS: *E-learning application, Sustainable business model, Sustainable Development Goals (SDGs), B40 community, Education delivery*

1. INTRODUCTION

In the wake of the COVID-19 pandemic, Aceh, like many regions, has faced a surge in economic challenges, particularly for its workforce. According to Jurnal Ilmiah Mahasiswa (JIM) Pertanian (2022) over 4,000 labourers in Aceh have experienced job terminations or layoffs since the onset of the pandemic. The Chairman of the Aceh Labor Alliance reported that the total number of individuals

affected by these layoffs surpassed 4,000, spanning various districts within Aceh. These affected individuals worked in diverse sectors ranging from hospitality and mining to various other service-oriented industries.

This alarming statistic underscores the pressing need for innovative solutions to address the employment crisis exacerbated by the pandemic. As individuals grapple with sudden job losses and economic uncertainty, it becomes imperative to identify their specific pain points, needs, and aspirations. The key challenges faced by the community, or Customer Segments (CS), include not only securing immediate employment but also accessing opportunities for upskilling and reskilling for teacher and student by coaching. Moreover, low-income individuals, notably those identified as B40, find themselves in a precarious position, struggling to meet their basic needs amidst financial constraints.

Existing solutions in the marketplace attempt to alleviate some of these pains. Various programs and services have emerged to offer job placement and training services. Additionally, some organizations have initiated mentorship programs, aiming to guide individuals towards sustainable employment options. However, these current solutions often fall short in adequately addressing the holistic needs of the CS. The job-to-do, or the primary task that these individuals seek to accomplish, extends beyond mere job placement. They yearn for opportunities that provide not just economic stability, but also personal growth and skill development.

While some products and services in the market may temporarily alleviate the immediate pain of unemployment, they often lack the depth required to usher individuals towards long-term stability. Some examples of these pain relievers are flexible working hours and community support and networking. Moreover, the gaps in current solutions become glaringly evident as they struggle to adapt to the evolving landscape of work, exacerbated by the economic disruptions caused by the pandemic.

Considering these challenges and limitations, there arises an urgent call for new, innovative, and highly relevant solutions. These solutions must not only respond to the immediate job-to-do but also empower individuals to navigate the complexities of the contemporary job market. It is imperative that these innovations transcend traditional approaches, offering a more comprehensive, dynamic, and sustainable pathway to economic recovery and personal growth.

2. OBJECTIVES

The primary goal of this paper is to devise a forward-thinking business model with a digital platform and applications that effectively address pressing pain points and create tangible gains for specific customer segments. These segments include time-constrained professionals and parents seeking swift solutions, service providers lacking visibility, and the low-income B40 community in need of tailored skill development. The conceptual business model aims to streamline service delivery for time-constrained professionals and parents, reducing search and survey time while maximizing problem-solving efficiency. It also seeks to empower service providers who lack a robust platform to promote their offerings, enhancing their reach and impact in a competitive marketplace. Additionally, the model addresses the skill development gap among the B40 community, offering tailored

resources to enhance employability, collaboration from alumni as professionals for guiding the teacher and economic prospects.

3. METHODOLOGY

This study adopts the Design Thinking methodology, as pioneered by the Hasso-Plattner Institute of Design at Stanford (David M. Kelley, 2019). The initial phase focuses on cultivating an empathetic grasp of the identified problem, involving an online survey to gain deeper personal insights into the area of concern. This survey also serves as a foundation for Design Thinking (DT) methodology. The DT methodology is used to identify significant challenges and propose possible effective solutions. There are five steps to adapt: empathize to understand the customers; define a construct point of view (POV) based on CS real problems; ideate to come up with creative solutions; prototype to represent the solution; and test the prototype for feedback. The important phase in Design Thinking is empathy, where we try to understand the customers' needs to solve their problems. This paper consists of the following: conducting a literature review and benchmarking; and conducting an online survey based on the business modeling tools such as Business Model Canvas (BMC), Value Proposition Canvas (VPC), Strategy Canvas (SC), and Environmental Map (EM). We will conduct tests of our initial BMC and VPC using surveys, highlight the key findings, and will then refine and establish the validated Business Model Canvas and Value Proposition Canvas based on the findings. The BMC is a strategic management template used for developing new business models and documenting existing ones (Wikipedia Contributors, 2021). Following the survey analysis, it pinpoints the core problem, paving the way for the Ideation stage.

Building upon an improved understanding of user needs, this phase centres on generating multiple ideas to tackle the challenges at hand. The subsequent Prototype phase involves designing and testing several potential solutions, with only one ultimately chosen as the most effective (Han, Y, 2020). The final step, the Test phase, scrutinizes the prototype's ability to meet user expectations and solve their problems, allowing for further adjustments and refinements as necessary.

A. Business Model Canvas (BMC)

The BMC serves as a foundational tool for outlining essential aspects of the business or product. Comprising nine key components, including Customer Segment, Customer Relationship, Channels, Revenue Streams, Value Propositions, Key Activities, Key Resources, Key Partners, and Cost Structure. Deac (2022) adds that the Business Model Canvas is a method that companies use to see how they can “improve their model, cut on costs, increase efficiency, or get a better overall view of their organization.”

B. Value Proposition Canvas (VPC)

The VPC is employed to elaborate on the critical elements of the Business Model: Customer Segment and Value Map. It aids in enhancing customer understanding and facilitating alignment between the product and the market. According to Osterwalder (2014), the Value Proposition Canvas is a “strategic

management tool to design, test, build, and manage products and services. Fully integrated with the Business Model Canvas" (p. 79).

C. Strategy Canvas (SC)

The SC provides a snapshot of the business's current market presence, enabling comparison with similar competitive enterprises in the clothing industry. In accordance with Brigham Young University (n.d.), a Strategy Canvas is a graph that shows how companies compare to each other on the key customer buying criteria.

D. Environmental Map (EM)

The EM offers a comprehensive understanding of the organizational environment, contributing to the development of more competitive business models. The design space encompasses Market Forces, Industry Forces, Key Trends, and Macroeconomic Forces. Environmental Map is described by Amarsy (2015) as "a tool to map a clear picture of their environment and identify opportunities, constraints and threats."

4. LITERATURE REVIEW

4.1. 4IR in the Education Industry

The emergence of 4IR has led to several implications in the field of education. Industry 4.0-also called the Fourth Industrial Revolution or 4IR-is the next phase in the digitization of the manufacturing sector (McKinsey & Company, 2022). This includes the reinvention of education systems and a more strategic approach to increase creativity and innovation. In the context of our private online tutor business, it is imperative to understand what the implications of the 4IR is on our educational practices. With 4IR came technologies like AI and IoT, which drastically changed the way we conducted our education, allowing for a more personalized education suited for individual student needs. This is even more important as our target market are high school students from the B40 community, who can benefit greatly from a personalized educational support due to their economic constraints and different educational backgrounds.

Ruangguru is one of the educational companies that uses 4IR. Ruangguru's innovative use of 4IR technologies is demonstrating the transformative potential of these technologies in education. Their desire to keep children in Indonesia learning while stay-at-home orders were in place garnered them high praise and ten million users (Tech Collective, 2021). The company's personalized learning platform, adaptive learning modules, immersive language learning experiences, AR-enhanced science labs, big data-driven curriculum development, and IoT-powered classroom engagement exemplify the ways in which 4IR can revolutionize education. As 4IR technologies continue to evolve, their impact on education is expected to grow, further enhancing learning experiences, empowering learners, and preparing students for success in the 21st century. Recognizing the crucial role this period plays in shaping future trajectories, the need for effective support systems becomes paramount. In this context, coaching emerges as a promising tool, empowering students to navigate these complex transitions and unlock their full potential. This delves into the burgeoning field of coaching for middle and high

school students, examining existing research, identifying key themes, and highlighting potential avenues for future exploration.

4.2. Reskilling & Upskilling of B40 Community

The B40 community faces the challenges of limited access to quality education and job displacement. In this current educational landscape, it is important to reskill and upskill these students with skills that are not only academically focused but are also in line with the demands of the future job market. Upskilling involves learning new skills and enhancing competencies. (NCER Malaysia). Offering specialized courses and tutoring programs that also teaches critical thinking skills, enhanced digital literacy and problem-solving skills are essential when catering to the B40 community. Not only that, but these programs are needed to better equip the B40 community with the necessary skills to remain relevant and employable in a technology-driven economy. With our private online tutor business, we will be able to address the needs and challenges faced by the students from that community, offering skills required in the 4IR landscape, introducing them to emerging job markets and facilitating job placements.

4.3. Benchmarking of Business Models

The following Figure 1 shows the Udemy business model canvas, which we will use as one of the benchmarks for our business.

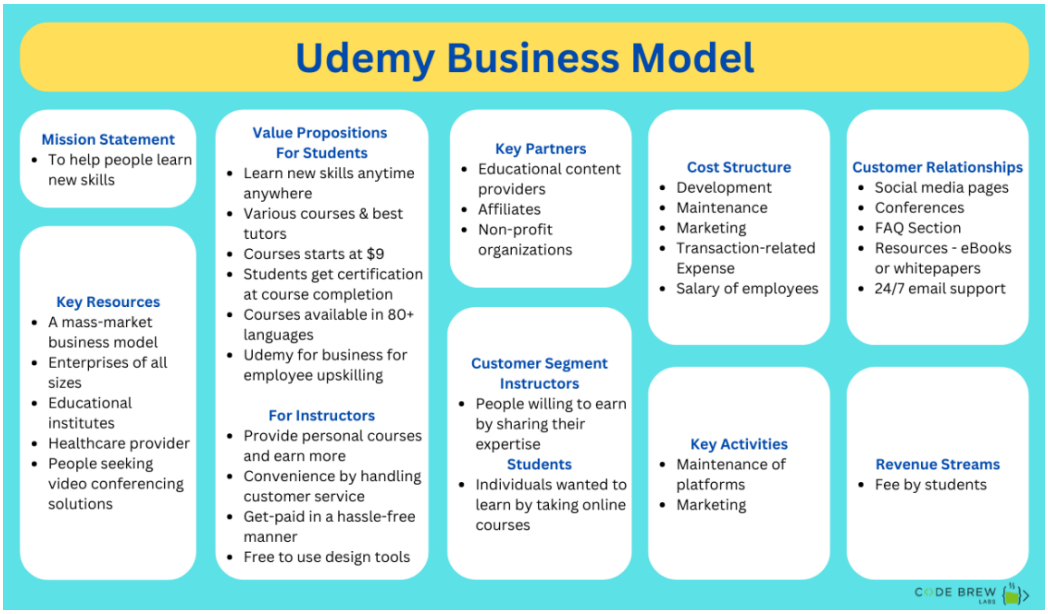

Fig.1. Udemy Business Model Canvas

The following Figure 2 shows the business model canvas for our competitor Ruangguru.

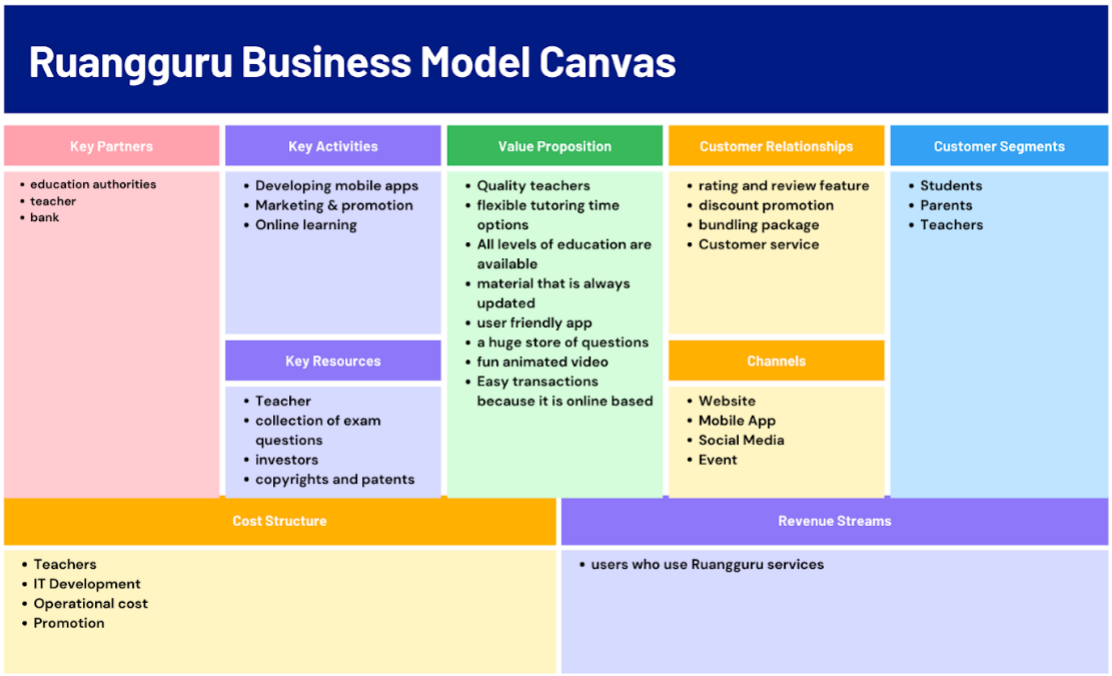

Fig. 2. Ruangguru Business Model Canvas

The following Figure 3 shows the Khan Academy business model canvas, their revenue streams are mainly made up of donations.

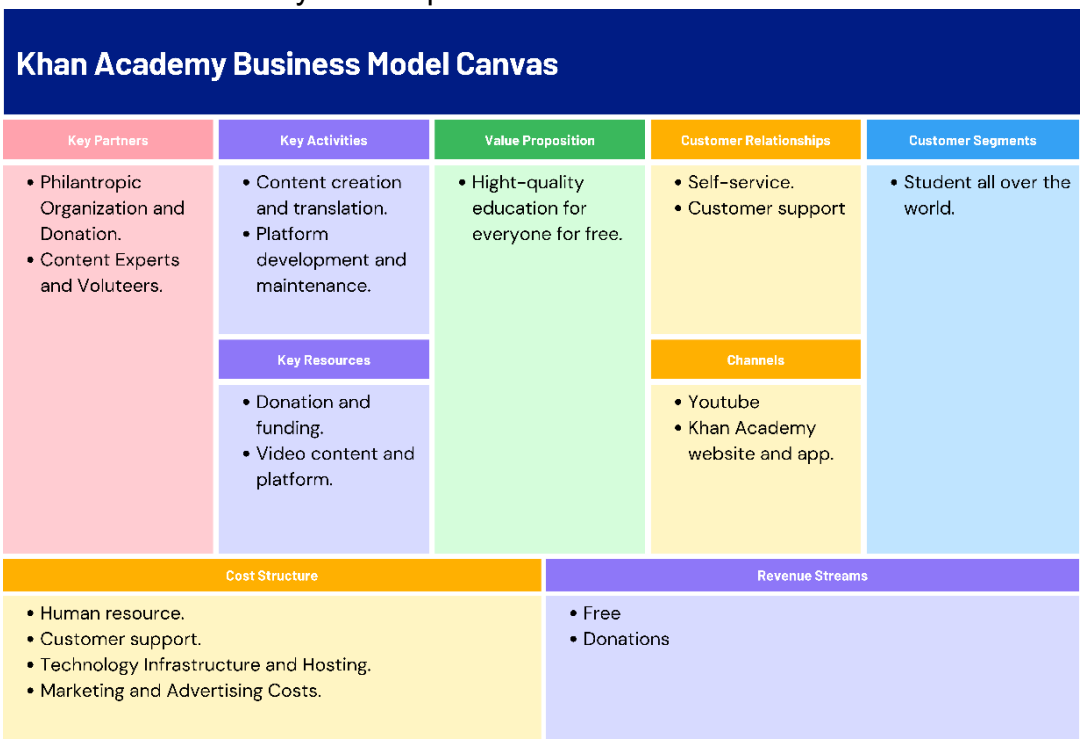

Fig. 3. Khan Academy Business Model Canvas

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

5.1. Initial Business Model Canvas (BMC)

The following Figure 4 shows the literature review conducted on the initial business model canvas of Khan Academy.

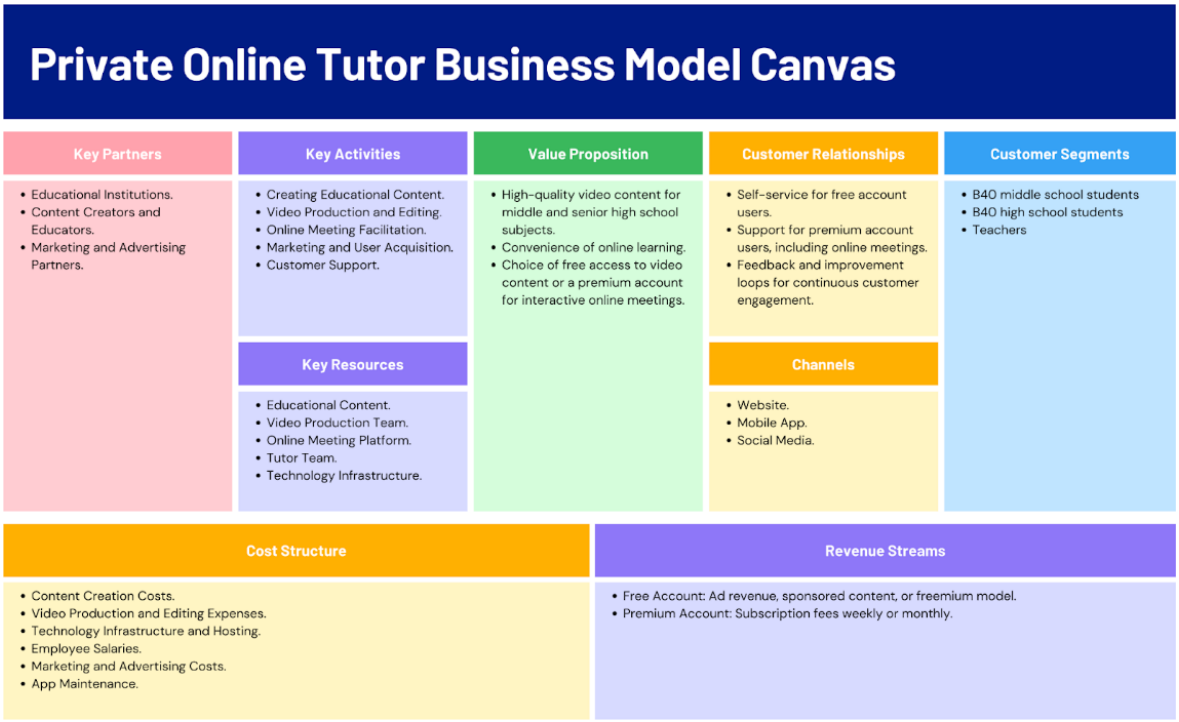

Fig.4. Initial Universe Academy Business Model Canvas

A key issue in validating Khan Academy's business model is the limited sample size. To address sustainability concerns, a selective pilot assessment should focus on key components from the business canvas:

1. Revenue Streams: Khan Academy relies on donations, grants, and partnerships to support its free education platform. For a sustainable future, it is crucial to assess how resilient these streams are against changes in the economic landscape.
2. Customer Segments: Evaluate market engagement and potential growth.
3. Value Proposition: The platform's promise of free, high-quality education is central to its model. The pilot assessment should measure the impact of this value proposition on long-term learning outcomes and user retention.
4. Cost Structure: Another important aspect of the pilot assessment should involve a detailed review of Khan Academy's operational costs, including content creation, technology infrastructure, and partnerships.

This focused approach will provide a foundation to test sustainability within the proposed new model.

5.2. Initial Value Proposition Canvas (VPC)

The following Figure 5 shows the initial value proposition canvas of our business. Since it is the initial model, we only developed one value proposition canvas.

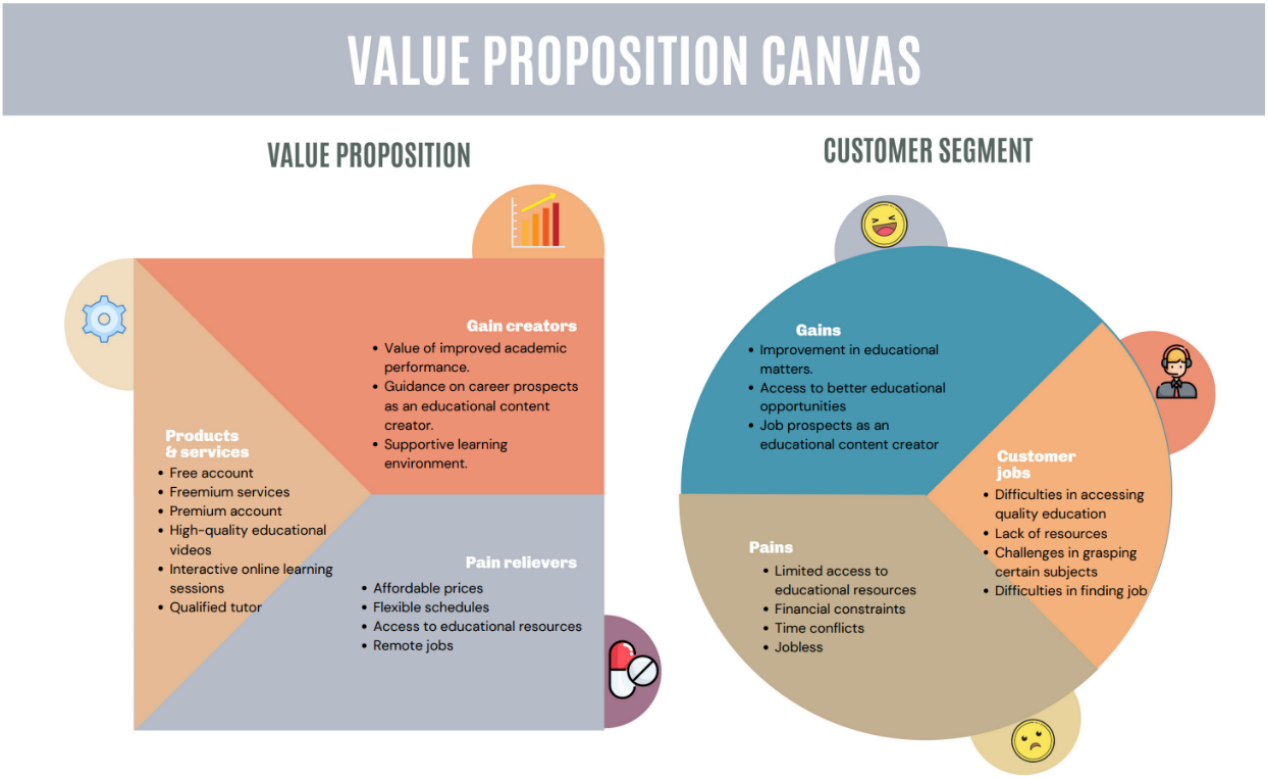

Fig.5. Initial Universe Academy Value Proposition Canvas

6. CONDUCT VALIDATION OF INITIAL BM & KEY FINDINGS

Universe Academy has conducted a survey of customer segments that summarizes 25 respondents among students, parents, and teachers to understand their pain and their ability to adapt to technology. A total of 7 short questions were asked through our online survey to validate our business model and its key findings. Based on the results below, we found that the largest number of respondents are students at 56%. The rest of the respondents consisted of honorary teachers, or teaching graduates, at 24% with the remaining 20% being the parents of students.

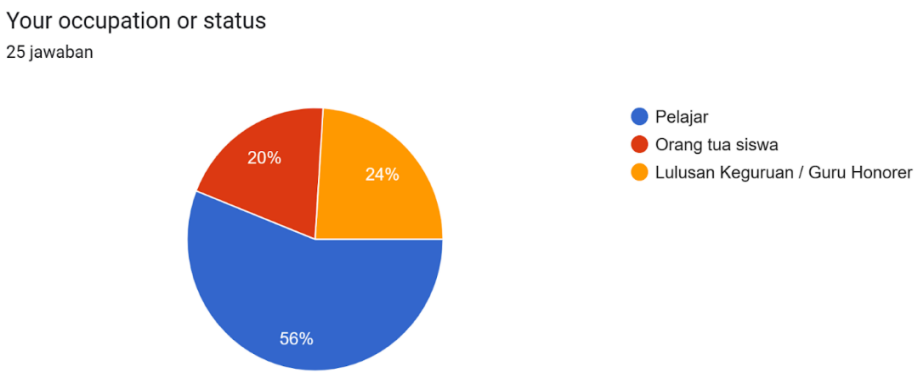

Fig. 6. Occupation Survey Result

Based on the following Figure 7, out of the 24 responses to the online course question, 70.8% said that they have tried taking an online course before, while only 29.2% said that they have not. There was no data about respondents who chose maybe to the above survey question.

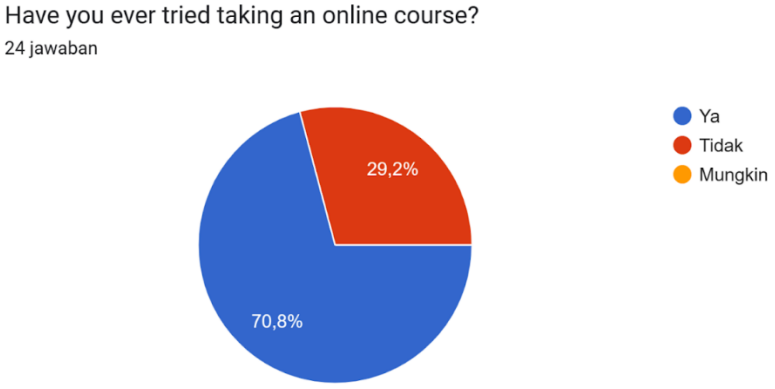

Fig. 7. Online Course Survey Result

When asked which type of learning they preferred, which was either synchronous or asynchronous, 72% of the 25 respondents said that they prefer to have asynchronous learning, while only 28% said that they prefer synchronous or real-time learning. The result is presented in the following Figure 8.

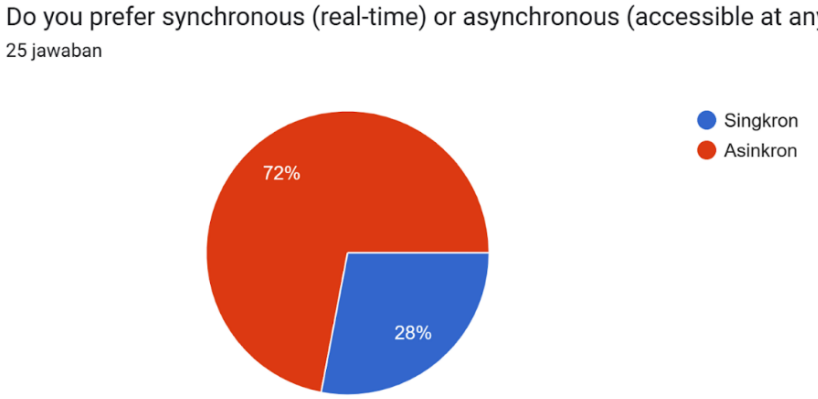

Fig. 8. Flexible Schedule Survey Result

Next, we asked participants about the impact that our free 3-month premium account program would have on easing the financial strain on our users' family. These are specific to students or families whose income is below the UMR (B40).

The result is presented in the following Figure 9. A total of 44% of respondents gave a 5 on a scale of 1 to 5, from very unlikely to very likely. This indicates that they are excited about and would welcome a commitment from Universe Academy. The fact that 36% of respondents gave a score of 4, and 20% gave a score of 3, shows that the free 3-month program will lessen the financial burden on their family. Users who answered, "very unlikely" and "unlikely" to the survey question did not have their data gathered. This implies that while not all agree this program will significantly lessen their family's financial burden, it will at least provide some assistance.

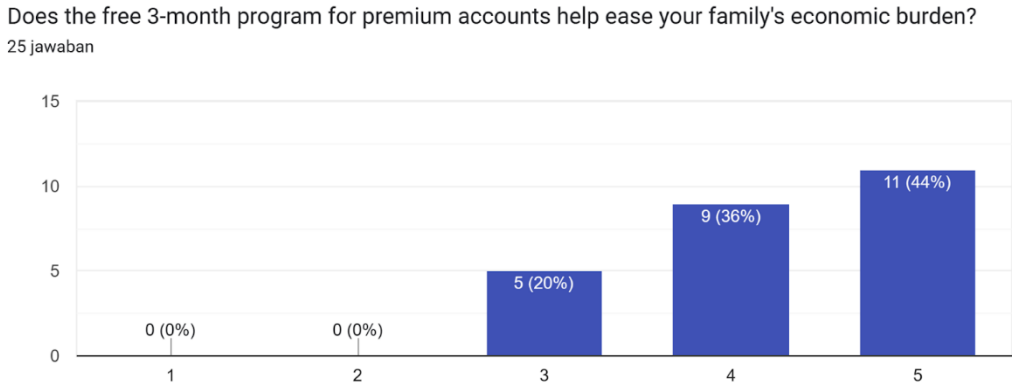

Fig. 9. Family Economic Survey Result

Our platform aims to help teachers or teaching graduates get a more decent income. The following Figure 10 presents result on a question asking if our respondents sees the potential of private online tutoring as a good job for honorary teachers. A total of 36% answered, respectively for the 4th and 5th scale, likely and very likely. The remaining 28% answered with a 3, neither likely nor unlikely. No data were collected for respondents who answered 1 or 2.

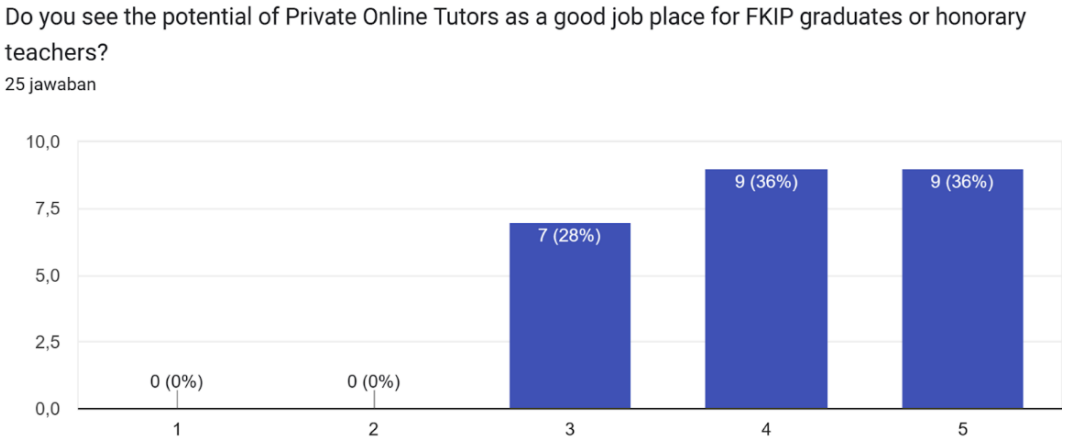

Fig. 10. Teacher for Online Tutor Survey Result

Based on the following Figure 11, in terms of effectiveness of the video for learning, 48% of respondents agreed that 4, on a scale of 1-5, learning videos were effective, and 24% answered 5, video learning is very effective. 24% of respondents answered 3, neither effective nor ineffective, and only 4% answered 2, ineffective. No data for those who answered 1, very ineffective. This is directly proportional to their readiness to adapt to technology in the world of education.

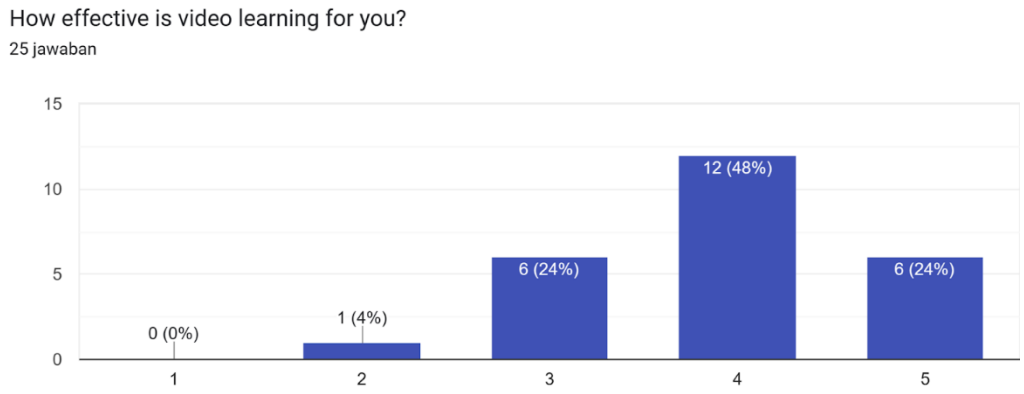

Fig. 11. Video Learning Survey Result

Additionally, when asked if they were ready for the adaptation of technology in the world of education, 44% of the participants choose scale 4 and 40% for scale 5 which clearly states that their readiness towards technology adaptation (see Figure 12) . Only a few participants felt a little bit unprepared for adopting technology in their online learning with 12% answered scale 3 and 4% answered scale 2. No data were collected for respondents who answered 1.

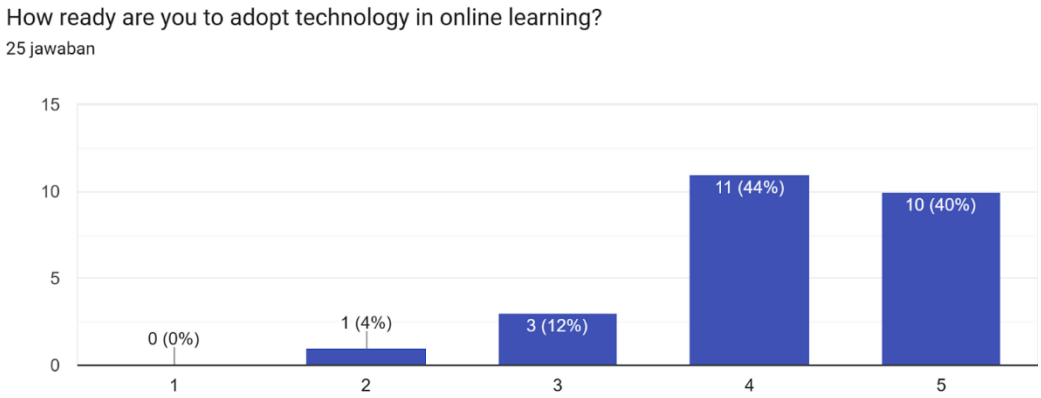

Fig. 12. Technology Adaption Survey Result

7. VALIDATED BM – BMC FRAMEWORK

7.1. Validated BMC

7.1.1. Customer Segment

Customer segment defines the type of customers that a company wants to address and attract by offering value propositions (Muhtaroglu et al., 2013). Our customer segments include middle and senior high school students seeking educational content or coaching for some certain speciality, parents looking for online support for their children's education, and teacher seeking job opportunities through our platform.

7.1.2. Value Proposition

Value propositions can be described as products and value-added services delivered by a company to fulfill customer needs and are of value to customers (Muhtaroglu et al., 2013). For our business model, the value proposition for learners includes high-quality video content for school subjects, the convenience of online learning, and the choice between free access to video content and a premium account with interactive online meetings. For the teacher, we focus by giving entrepreneurship and flexible schedule for the teacher, this allows the teacher work in flexible time and make this as their side-job. Furthermore, for parents we will providing feedback from what their children gain in this learning course. Sponsors will get social impact by helping education field.

7.1.3. Channels

How a company communicates with and reaches its Customer Segments to deliver a Value Proposition. Communication, distribution, and sales Channels comprise a company's interface with customers (Qastharin, 2016). In our case, it includes our website, where educational content is available, schools as a physical place where the learners and teachers can meet and social media platforms for marketing and outreach.

7.1.4. Customer Relationship

Customer relationships are established and maintained with each customer segment (O'Neill, 2015). It mentions the differentiation between self-service for free account users, and support, including online meetings, for premium account users. Additionally, coaching on certain speciality is rarely find in Aceh, to make significant differences we provide coaching, feedback and improvement loops are essential to maintain continuous customer engagement and satisfaction.

7.1.5. Revenue Streams

Revenue streams result from value propositions successfully offered to customers (O'Neill, 2015). For our platform, revenue streams come from both free and premium accounts. The free account can potentially earn revenue through advertising, sponsored content, or a freemium model. The premium account generates income through subscription fees, which can be charged weekly or monthly.

7.1.6. Key Resources

These are the essential assets and resources our business requires to operate successfully. This includes educational content, an online meeting platform, a tutor team, and the necessary technology infrastructure.

7.1.7. Key Activities

These are the crucial tasks and operations our business needs to perform to create and deliver value to our customers. The marketing activity of the site itself and the planning of promotional strategies undertaken by the marketing department (Erlyana, 2017). Our key activities involve content creation, video production, online meeting facilitation, marketing, user acquisition, coaching on certain speciality and customer support.

7.1.8. Key Partners

The network of suppliers and partners that make the business model work (Qastharin, 2016). In our case, key partners may include educational institutions for content validation, content creators and educators for content development, collaborating with our professional alumni who's graduated from education, and marketing and advertising partners for promotional activities.

7.1.9. Cost Structure

The influence of products that are affordable and suitable for customers significantly influences repurchase interests (Sari, 2016). These typically include content creation costs, expenses related to technology infrastructure and hosting, employee salaries, and marketing and advertising costs.The following Figure 13 presents validated Universe Academy Business Model Canvas.

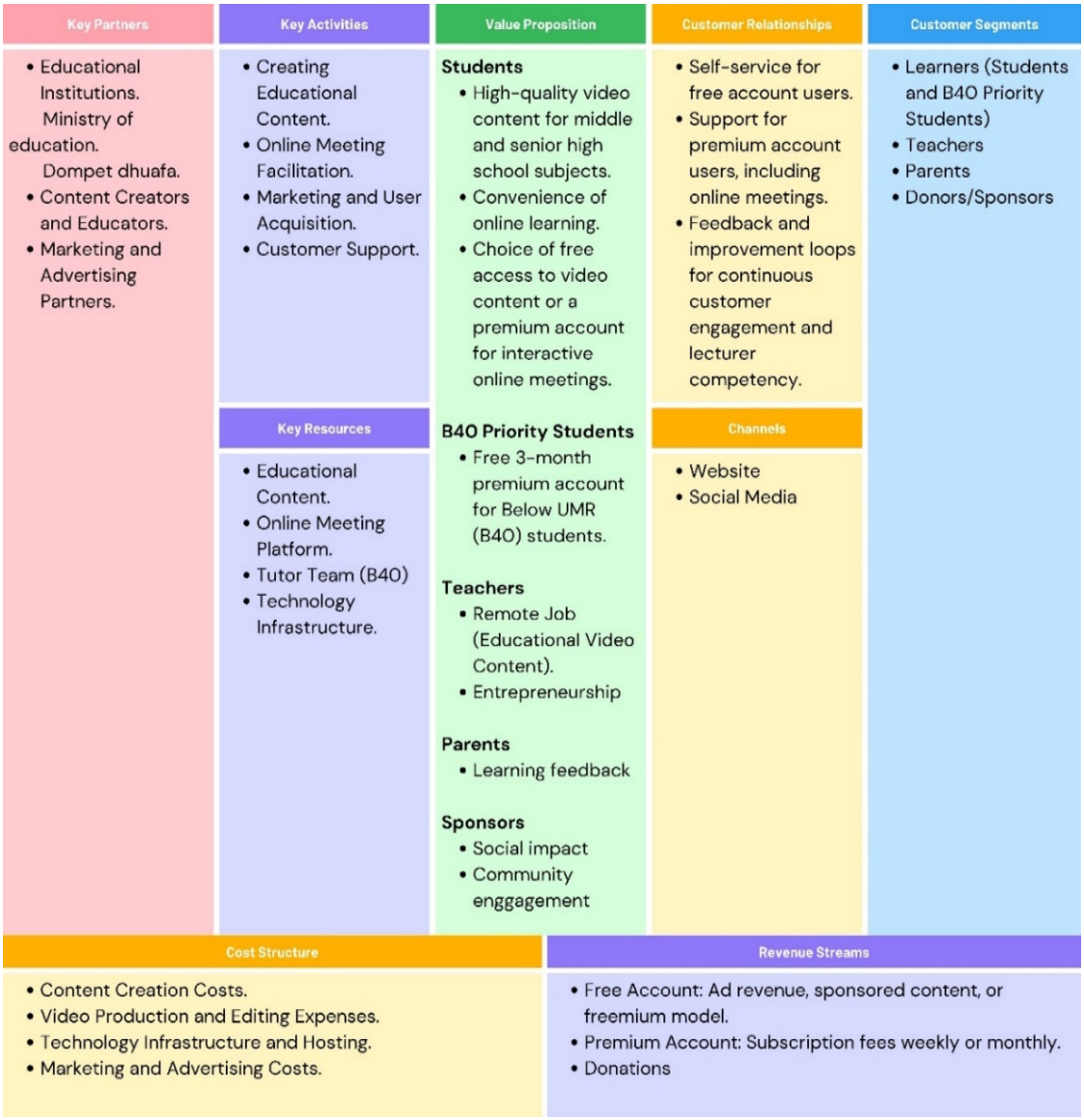

Fig. 13. Validated Universe Academy Business Model Canvas

The following Figure 14, Figure 15, Figure 16 and Figure 16 presents Value Proposition Canvas for students, B40 priority students, teachers and parents respectively.

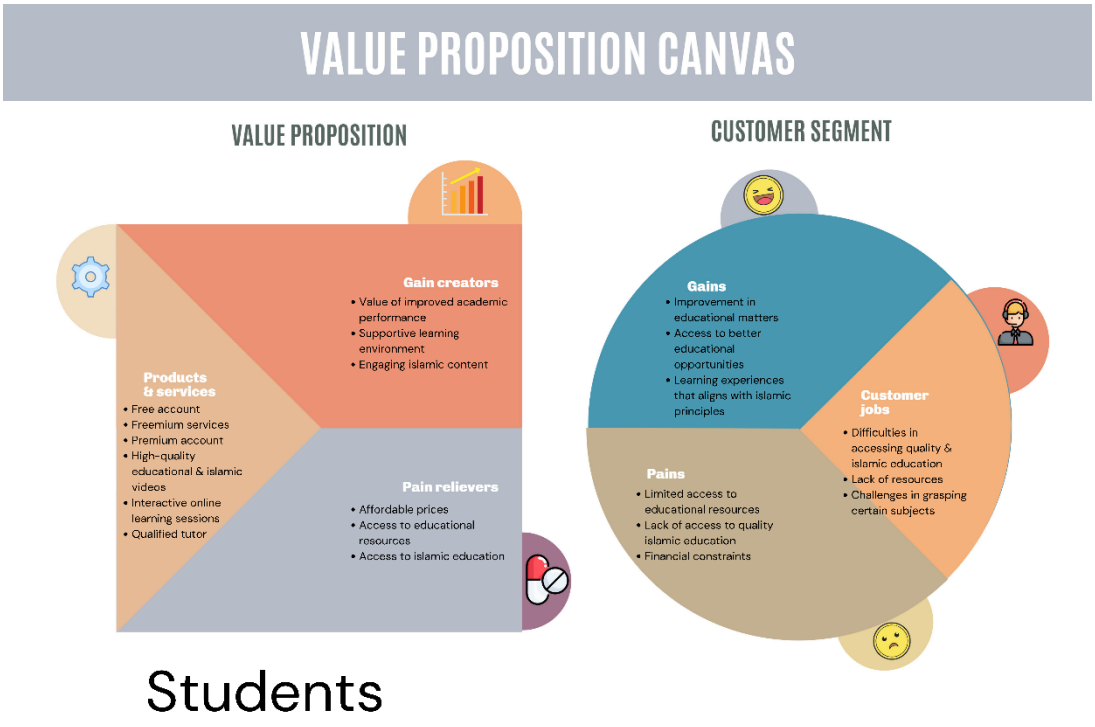

Fig. 14. Validated Universe Academy Value Proposition Canvas for Students

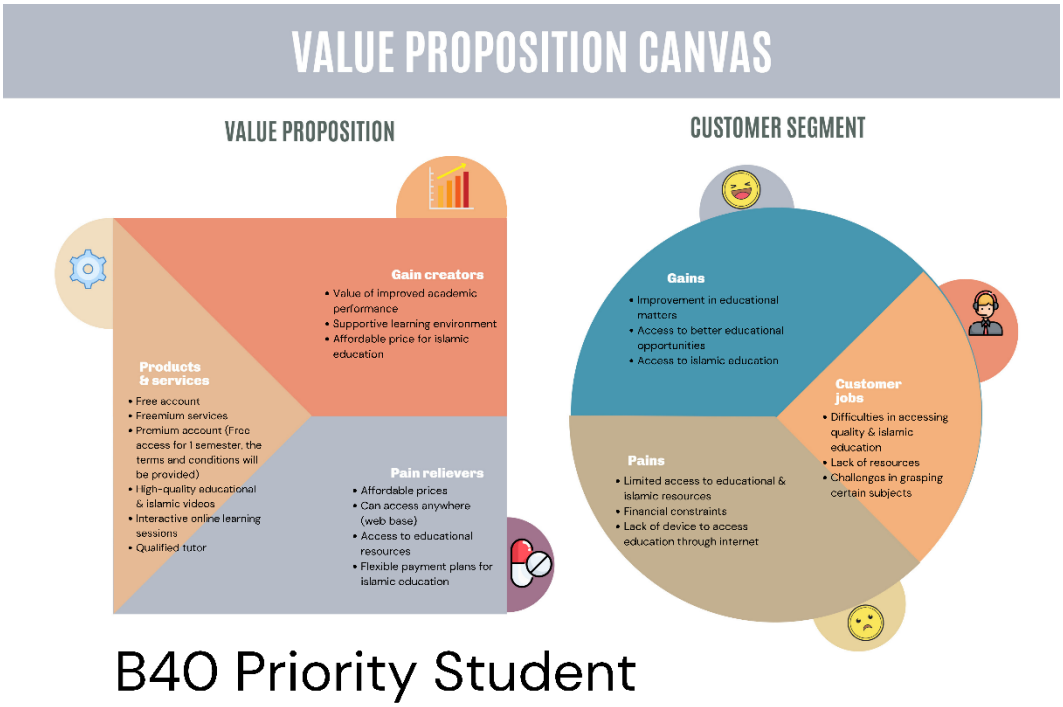

Fig. 15. Validated Universe Academy Value Proposition Canvas for B40 Priority Student

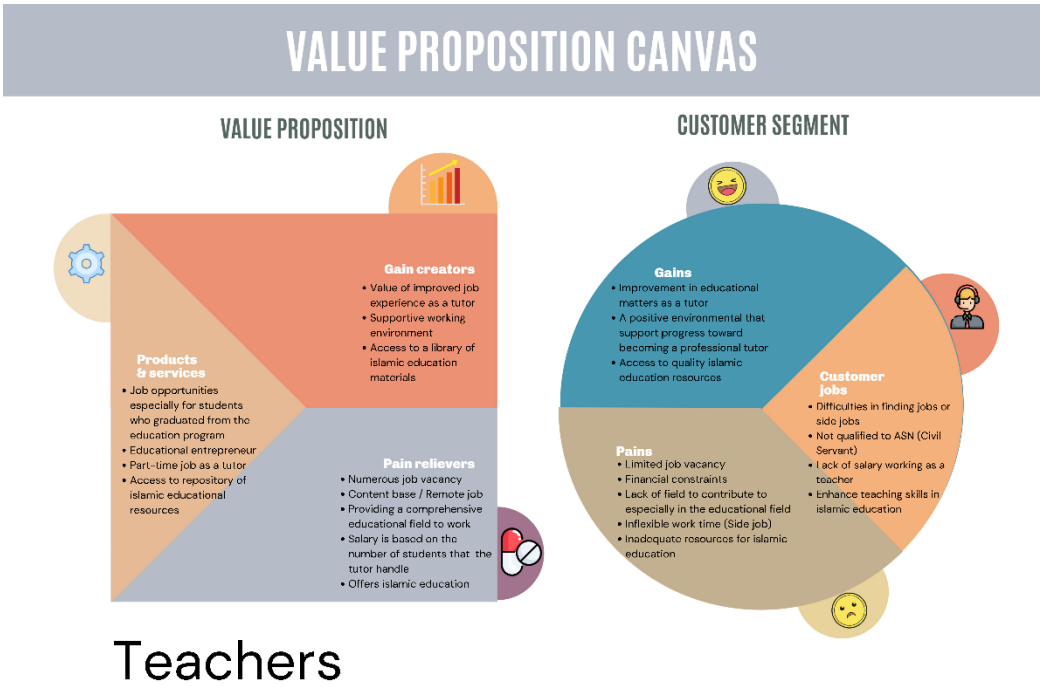

Fig. 16. Validated Universe Academy Value Proposition Canvas for Teachers

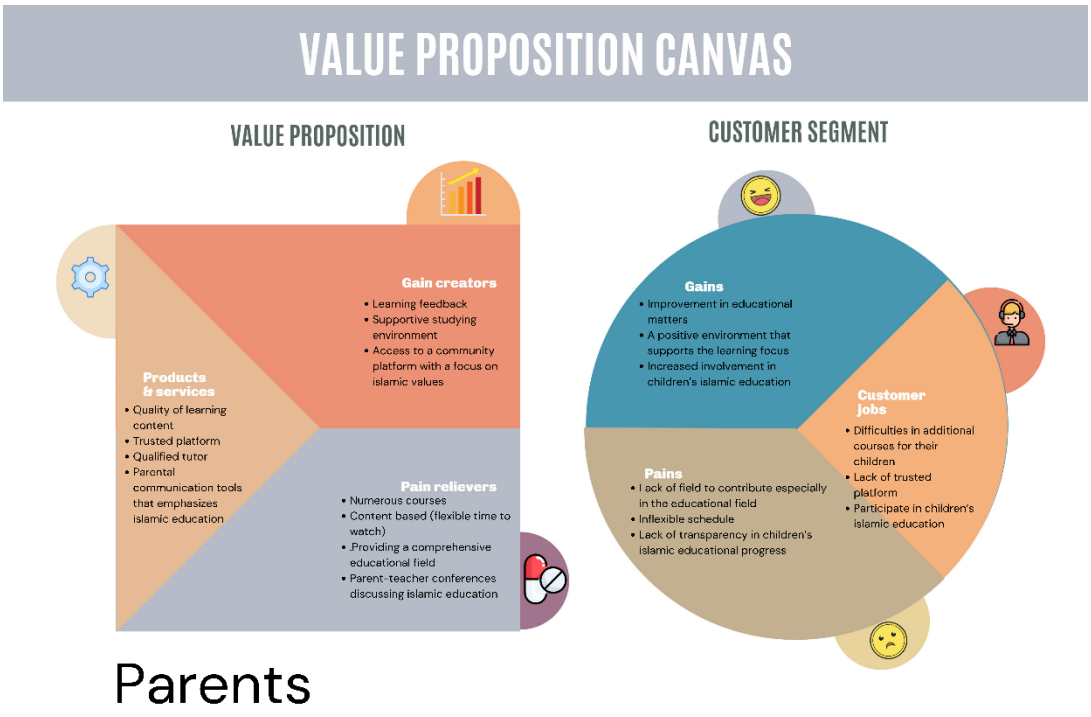

Fig. 17. Validated Universe Academy Value Proposition Canvas for Parents

7.2. Environmental Map

7.2.1. Market Forces

A. Customer Demand: The demand for online educational content and support is influenced by factors such as academic performance pressures, the need for convenience in learning, and the desire for interactive learning experiences.
B. Competitive Landscape: The presence of other online educational platforms and tutoring services can affect the market, leading to competition for customers and content quality.
C. Regulatory Environment: Therefore, organization of a company is shown in a dynamic perspective, which means that the resources are considered elements of an open system and cooperate with elements of environment by exchanging information and communication (Markiewicz, 2013). Changes in educational regulations, especially related to online learning and tutoring, can impact how our business operates.

7.2.2. Industry Forces

A. Technological Advancements: Ongoing advancements in technology and e-learning tools can enhance the quality and delivery of educational content. Finally, the human element needs to go along where the merging of IR4.0 in academia should benefit humanity in the long run. To achieve this, the process of teaching and learning and incorporating latest technology must be transformed (Dzulkifli, 2017).
B. Content Creators and Educators: Building strong relationships with content creators, educators, and educational institutions is crucial for access to quality content and a competitive edge.
C. Partnerships: Collaborations with educational institutions, tutors, and content providers can shape the dynamics of the industry.

7.2.3. Key Trends & Foresight

A. Online Learning Growth: The shift from face-to-face lectures to online classes is the only possible solution. Indeed, academic institutions would not be able to transform all their college curricula into and online resource overnight (Dhawan, 2020). A continued trend toward online learning due to its flexibility and accessibility, particularly in response to global events that disrupt traditional education.
B. Personalized Learning: In these environments, students can be anywhere (independent) to learn and interact with instructors and other students (Singh & Thurman, 2019). A shift towards more personalized and adaptive learning experiences, catering to the specific needs and learning styles of students.
C. Educational Tech Innovation: Incorporating the latest technologies, it can raise the effectiveness of teaching and learning process (Vawn, 2018). Ongoing innovation in educational technology, including AI and virtual reality, can revolutionize how educational content is delivered and experienced.

7.2.4. Macroeconomics

A. Economic Conditions: Economic stability and growth can influence parents' willingness to invest in premium educational services, impacting our subscription-based revenue model.
B. Government Policies: Government funding and policies related to education can impact the availability and affordability of educational services.
C. Global Events: Events like the COVID-19 pandemic have demonstrated the significance of online education and its resilience in the face of global disruptions. During this tough time, the concern is not about whether online teaching–learning methods can provide quality education, it is rather how academic institutions will be able to adopt online learning in such a massive manner (Carey, 2020).

7.3. Strategy Canvas

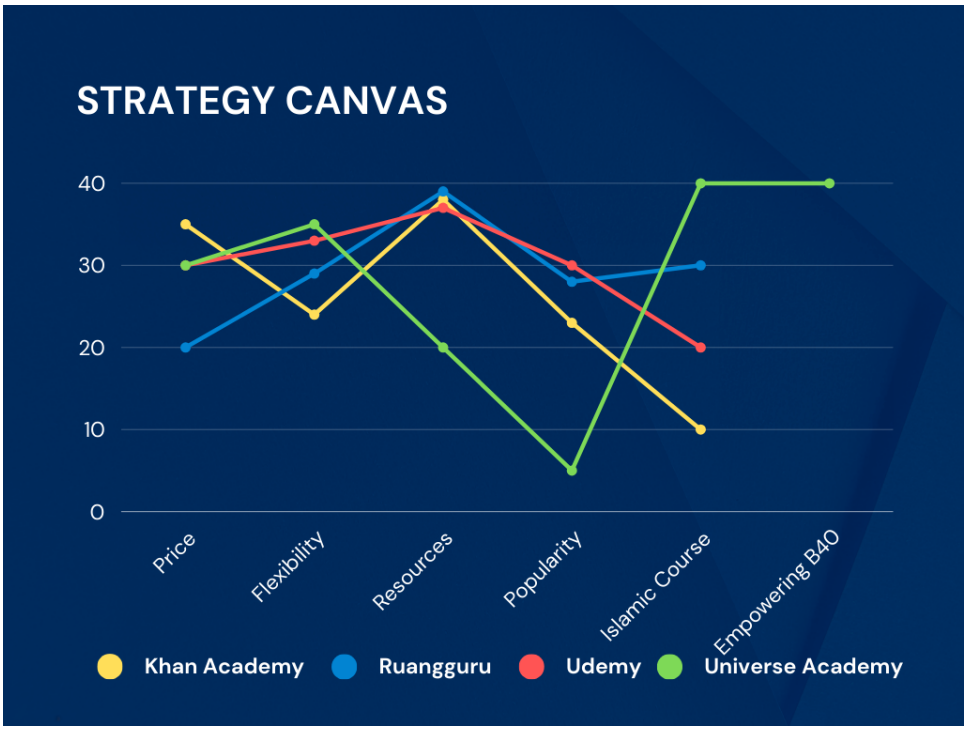

Fig. 18. Strategy Canvas for comparing our business to other companies for benchmarking.

Inside our strategy canvas we have our blue ocean strategy, which focuses on empowering the B40 which creates new job opportunities either for side-job or primary-job, new innovations and opens a new market space for our business.

7.3.1. Key Differentiators

A. **High-Quality Content**: Good online instructors are those who possess the knowledge and skills on how to use and adapt updated technologies, who are always available online, who frequently check for emails and text messages, who promptly reply to questions and concerns, and who grade and return assignments with feedback on a timely manner (Bailey et al, 2009). Our focus on delivering top-notch educational content

differentiates our platform. The quality of the content surpasses that of many competitors, ensuring students receive a comprehensive learning experience.

B. **Interactive Learning**: Offering the choice of a premium account with interactive online meetings distinguishes our platform. This live interaction component provides a more engaging and personalized learning experience, setting you apart from platforms that offer static content only.

C. **Pricing Flexibility**: Cost savings and convenience emerge as the strongest drivers for corporate uptake of e-learning (Forrester Research, 2000). The availability of free access alongside premium accounts with flexible pricing options is a unique selling point. This flexibility caters to a wider range of students and parents, making education more accessible.

7.4. Low Fidelity Prototype Apps

The following Figure 19, figure 20, and figure 21 shows the landing display, course video, and instructor page in sequence. With a simple and modern appearance, it makes it easier for users to quickly understand the navigation of the Universe Academy website.

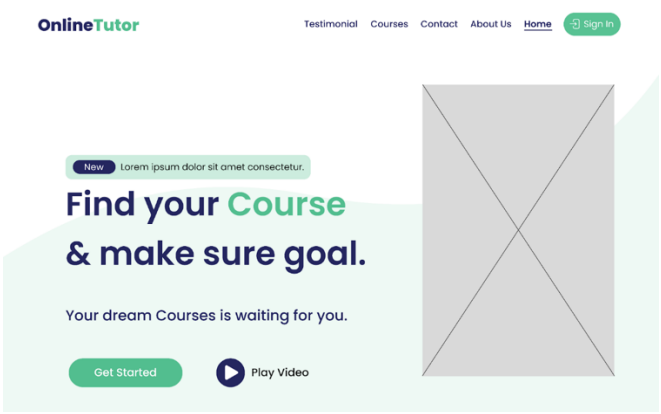

Fig. 19. Landing Page of the Universe Academy Website

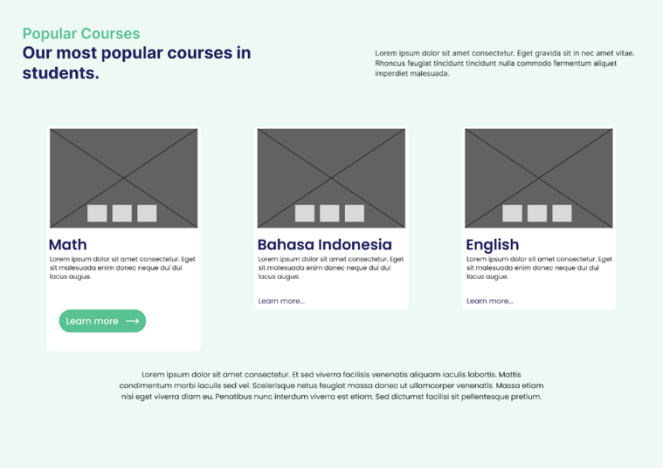

Fig.20. Course Video Page of the Universe Academy Website

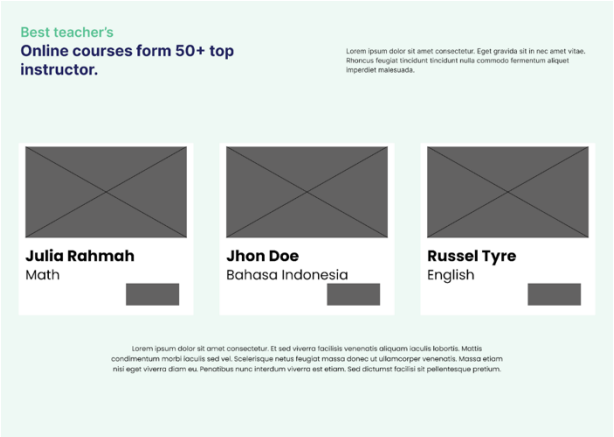

Fig. 21. Instructor Page of the Universe Academy Website

8. CONCLUSION AND FUTURE WORKS

The conceptual Universe Academy business model for digital platform/apps addresses critical challenges and aspirations of various customer segment. Aspiring learners (students and B40 priority students), teachers, parents, and sponsors. Learners seek the ability to effortlessly access premium educational content from any location while being free to pose questions that propel their academic progress. This venture aims to provide significant gains to the Costumer Segment (CS), offering the convenience of a private tutor experience that does not consume excessive time, the potential for remarkable academic improvement, and the flexibility to watch educational videos at their own pace. However, our Customer Segment (CS) encounter notable hurdles, such as acclimating to the platform's layout, grappling with limited device availability, or with premium pricing constraints.

To address these challenges and fulfil the job to be done, the Universe Academy business model solution is committed to a distinctive approach. Based on figure 13, we show the validated Business Model Canvas and based on that we can develop the innovative business model, tailored to the needs of learners, teachers, parents, and sponsors simultaneously serves as a gain creator and pain

reliever. Implement an adaptive learning system that analyses each student's progress and tailors' subsequent lessons to address specific areas of difficulty. This personalization ensures that learners receive content at an optimal pace, promoting a deeper understanding of the subject matter as a gain creator.

For pain relievers, we address the challenge of limited device availability by developing a lightweight mobile application that is compatible with a wide range of devices. This app should be designed to provide a seamless learning experience, ensuring that students can access educational content even with basic smartphones or tablets. By offering an intuitive and user-friendly interface, the platform aims to alleviate the layout-related pains that users may face. Additionally, it recognizes the issue of limited access to devices and works towards providing accessible solutions. Moreover, the platform differentiates itself by offering flexible pricing options, ensuring that it accommodates a wide range of students, and addressing the pain point of premium pricing. In doing so, the Online Private Tutor platform presents a transformative solution that empowers both students and teachers, fostering an educational journey that is seamless and accessible to all, ultimately contributing to the enhancement of our society through improved learning opportunities.

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A CONCEPTUAL EDU4YOUTH BUSINESS MODEL: EMPOWERING UNDERSERVED YOUTHS THROUGH TVET AND DIGITAL PLATFORM

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ABSTRACT: This paper aims to develop a conceptual business model (BM) for Edu4Youth, complete with its digital platform that align with the Sustainable Development Goals (SDG) by promoting equitable education (SDG 4), fostering economic growth (SDG 8), and encouraging partnerships for collaboration (SDG 17). A digital project is designed to address key challenges, extreme pains and create essential gains for various customer segments (CS) - underserved youths, professional tutors, and organisations including educational institutions and community organizations. Many youths face extreme pains such as high course fees, limited access to personalized guidance and insufficient opportunities for real-world application. Educational institutions and community organisations have challenges in reaching underserved youths, measuring impacts and managing resources. Professional tutors struggle with limited tools for interactive teaching, balancing administrative responsibilities and providing personalized feedback. The methodology utilize design thinking (DT) by conducting a literature review (LR) and benchmarking, supplemented by interviews and surveys to understand and define the key challenges, pains, gains, and important jobs-to-do of various customer segments (CS). An initial Business Model (BM) is ideated and developed using business modelling tools such as Business Model Canvas (BMC) and Value Proposition Canvas (VPC). The initial Business Model (BM) together with the digital platform/app prototype is tested and validated by the various customer segments (CS) to establish the validated Edu4Youth Business Model (BM). A Strategy Canvas (SC) is created to compare the validated Business Model (BM) with other market players to identify Edu4Youth's "purple cow" features. This paper offers validated conceptual Edu4Youth Business Model (BM) with digital platform/ app as pain reliever and gain creator. A comprehensive Project Management Plan (PMP) will be developed in the future for Edu4Youth's development and implementation; and improve its impact on marginalised areas while fostering sustainable economic growth.

KEY WORDS: *Youth Empowerment, Entrepreneurship, Digital Platform Business Model, TVET, SDG*

1. INTRODUCTION

Education is a fundamental right that should be accessible to all, regardless of background, financial means, or geographical location. However, access to affordable, quality education, particularly in digital entrepreneurship and skills, and Technical and Vocational Education and Training (TVET), remains limited, with many youth and learners lacking the resources and support needed to pursue their career and professional development aspirations (UNESCO, 2020). Innovative platforms that offer tailored learning pathways and one-on-one support can address these barriers, creating a more inclusive and sustainable learning environment that fosters skill-building, up-&re-skilling, personal growth, and long-term success.

This aligns with several key Sustainable Development Goals (SDGs). SDG4: Quality Education highlights the importance of accessible, quality learning opportunities, where these platforms aim to advance by offering free resources, tutoring and coaching in digital enterpreneurship and TVET. Additionally, it supports SDG8: Decent Work and Economic Growth by equipping youths with practical skills that contribute to employability and entrepreneurship, fostering sustainable economic development. Through SDG17: Partnership for the Goals, the platform encourages collaboration by connecting professional tutors, youths, and partner organizations, creating a supportive network that enhances learning opportunities and strengthens community ties. These initiatives aim not only to democratize access to entrepreneurship, business, and technical education but also to empower youths to pursue their professional and career goals, enhance their economic stability and well-being, and contribute to a skilled and adaptable workforce (UNESCO, 2020).

In today's competitive landscape, many youths seeking to develop entrepreneurship face barriers such as high course fees, limited access to personalized guidance, and insufficient real-world application opportunities. Organizations such as training institutions like IIUM and Jabatan Tenaga Manusia (JTM), community organizations, and non-profit initiatives like Teach for Malaysia play a pivotal role in overcoming these challenges through re-skilling and up-skilling efforts. By offering accessible educational programs, resources, and personalized support, they equip learners with the skills needed to thrive in evolving industries. These initiatives address skill gaps, particularly in underserved communities, empowering individuals to adapt to changing job market demands, enhance employability, and pursue meaningful career opportunities. Through their combined efforts, these organizations ensure that education remains inclusive, practical, and aligned with the needs of the labor market

Moreover, professional tutors are responsible for providing youths with relevant and useful content, relying on the well-organized resources that system admin give. They also need to provide timely feedback and support to youths while adapting their teaching strategies based on the progress of each learner. The ability to offer personalized attention to each youth can be impeded by limited tools for interactive and remote teaching. This challenge is compounded by the need to balance teaching responsibilities with administrative duties. Nonetheless, when professional tutors are equipped with enhanced tools for remote and interactive teaching, it streamlines their administrative processes, allowing them to focus more on

delivering quality education and expanding their reach to youths in need (Duncan et al., 2020).

The proposed platform aligns with the goal of providing equitable educational opportunities to underserved youths. By leveraging technology to deliver personalized and interactive learning experiences, Edu4Youth addresses the shortcomings of current solutions. The platform's focus on connecting youths with professional tutors for real-time support enhances the overall learning experience. Hence, innovative IT/Digital projects like Edu4Youth are essential to meet the educational needs of underserved youths, fostering a more inclusive and equitable education system. Through its focus on accessible, affordable, and practical entrepreneurship and business education, Edu4Youth empowers youths to pursue their career and professional goals, gain financial independence, and contribute to sustainable economic growth.

2. OBJECTIVES

The primary goal of this paper is to propose a conceptual business model for Edu4Youth that addresses the educational challenges faced by youth as learners, professional tutors and organisations nowadays.The objectives include:

a. To empower youth through financial management including budgeting, saving, and debt management and support professional tutors with digital tools by sharing resources, skills, and experiences.
b. To provide accessible entrepreneurship, business training and TVET for underserved youth with tailored tools and technologies while promoting equitable access to learning materials for all.
c. To enable youth with disabilities in upskilling them in using adaptive technologies for running e-commerce businesses from home, connecting them with customers beyond physical limitations.

3. LITERATURE REVIEW

3.1. Digital platforms as support mechanisms for Youth Entrepreneurship

In Malaysia, youth entrepreneurship is greatly aided by internet platforms, particularly for those struggling financially, academically, or physically. Edu4Youth addresses problems faced by underserved youth, such as unemployment or underemployment, by providing resources, business tools, and networks that connect them to professional tutors, investors, and clients.Digital platforms help financially underserved youth make educated financial decisions by developing critical money management skills like cash flow, debt management, saving, and budgeting (Khan et al., 2016). Digital entrepreneurial education on these platforms increases self-efficacy and confidence, extend market reach, promoting persistence during economic challenges (Selvadurai & Hamid, 2017). Access to digital technology training enhances business operations, optimise operating costs, thus making youth more competitive in the digital economy (MyDigital, 2021).

For underserved youth, especially those unemployed or underemployed, digital platforms offer job-matching services, skill-building courses, and micro-lending options, enabling entrepreneurship as a viable path to financial security (MyDigital, 2021). AI and big data analytics improve these platforms by providing tailored suggestions, forecasting market trends, and understanding consumer behavior,

helping young entrepreneurs make informed decisions (4IR, 2021). These technologies identify deficiencies in entrepreneurial ecosystems and customize solutions for community needs.By offering low-cost entry into micro-entrepreneurship, tools for small enterprise management, and virtual markets for customer outreach, digital platforms support youth with limited resources (Sahrah et al., 2023). Adaptive technologies like speech recognition and screen readers enable entrepreneurs with disabilities to manage online enterprises (Zaremohzzabieh et al., 2016). One-stop online platforms ensure access to essential resources for development (MyDigital, 2021).

The Fourth Industrial Revolution (4IR) emphasizes how digitalization drives economic growth. Malaysia's National 4IR Policy promotes technological advancement and creative business strategies, providing opportunities for young entrepreneurs to prosper (4IR, 2021). However, MSMEs' unpreparedness underscores the need for supportive environments to encourage innovation and technology adoption. Budding entrepreneurs benefit from mentoring, coaching, and networking gatherings to foster collaboration and knowledge exchange (MyDigital, 2021). Government programs also support youth entrepreneurship by reviewing regulations and promoting cross-sector cooperation (MyDigital, 2021).

3.2. Benchmark of Business Models.

3.2.1. Malaysia Digital Economy Corporation (MDEC)

In order to promote digital adoption and increase opportunities within the digital economy, Malaysia Digital is the engine propelling the expansion of our ecosystem across nine (9) important industries. Initiatives like the Malaysia Digital Catalytic Programmes (PeMangkinMD) and other competitive offerings help achieve this. Among the nine sectors given priority are:

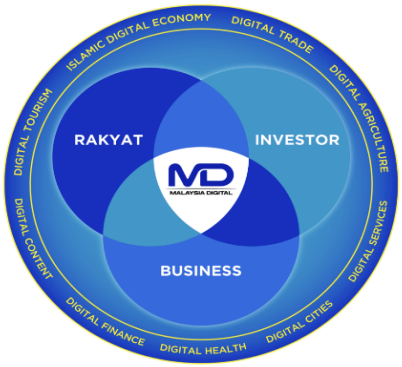


Fig. 1. Malaysia Digital Important Industries

3.2.1.1. Digital Skill Training (https://mdec.my/training directory)

MDEC provides an extensive training directory aimed at improving digital skills among the Malaysian population (see Fig. 1). The training programs encompass a variety of digital competencies essential for the workforce, such as coding, digital marketing, and data analytics. This initiative seeks to prepare individuals with skills that are pertinent to the rapidly changing digital environment.

3.2.1.2. eUsahawan (https://mdec.my/eusahawan)

This program by MDEC is specifically designed for micro-entrepreneurs and young individuals, equipping them with the knowledge and skills necessary to utilize digital tools effectively in their businesses. The initiative focuses on practical skills in e-commerce, digital marketing, and online branding, with the goal of empowering individuals from underserved communities to start and expand their enterprises.

3.2.2. Skim Latihan 1Malaysia(https:///skim-latihan-1malaysia-sl1m/)

SL1M is a government initiative aimed at improving the employability of Malaysian graduates through training and internship opportunities. It concentrates on providing skill development that aligns with corporate requirements and enhancing the job readiness of young individuals. While SL1M focuses on employability within conventional corporate frameworks.

3.2.3. Coursera

Coursera collaborates with universities and organizations around the globe to offer a variety of online courses, such as those in business and entrepreneurship (see Fig. 2). It provides specializations and professional certificates tailored to different learner requirements. While Coursera offers top-notch educational materials, it usually demands a substantial time commitment and may not target youth or marginalized communities specifically. On the other hand, Edu4Youth presents a learning model that is more adaptable and easily accessible, tailored for young entrepreneurs in training who may need varied learning methods and guidance.

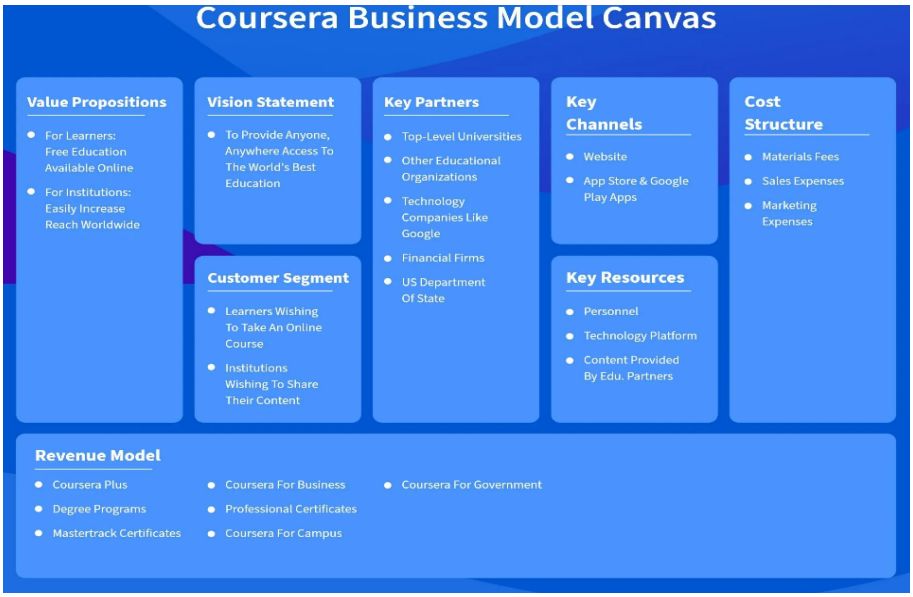


Fig. 2. Coursera Business Model Canvas

3.2.4. Skillshare

Skillshare is an online learning platform offering short, project-based courses in a number of subjects, such as marketing, entrepreneurship, business, and creative skills. It is a desirable option for prospective business owners due to its emphasis on experiential learning and community engagement (see Fig. 3). The platform's adaptable learning options and accessibility appeal to a wide range of learners, including youth who looking for real-world experience to launch or expand their

businesses. Furthermore, access to Skillshare is reasonably priced, making it a cost-effective choice for people wishing to learn new skills without having to make a big financial commitment. Skillshare is a well-liked option for people looking to improve their entrepreneurial skills on a budget because of its cost and dynamic learning environment.

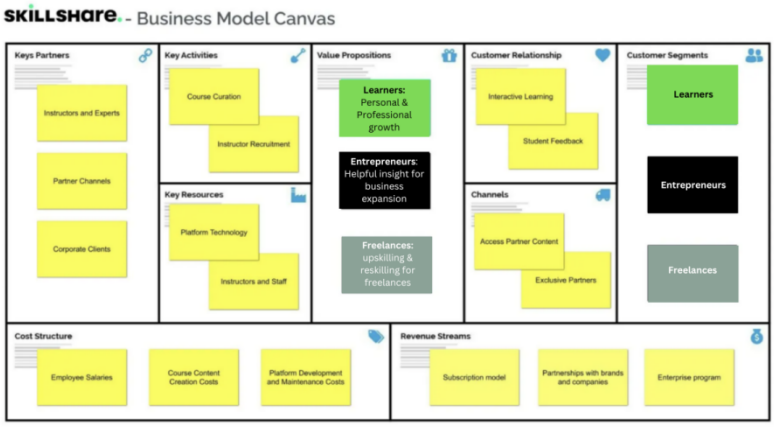


Fig. 3. Skillshare Business Model Canvas

3.3. Socio-Cultural Factors Influencing Youth Entrepreneurship

Socio-cultural factors significantly influence youth entrepreneurship by shaping attitudes, behaviors, and opportunities. Cultural norms impact how entrepreneurship is perceived, with collectivist cultures prioritizing social harmony and individualistic cultures viewing it as a path to personal success (DeScioli, 2024). In communities emphasizing traditional careers, youth may avoid entrepreneurship due to societal judgment or family disapproval. Educational systems promoting entrepreneurial thinking foster cultures where entrepreneurship is seen as a viable career path (Kadir & Merican, 2017).

Social networks and community participation provide essential resources, mentorship, and collaboration opportunities, enabling young entrepreneurs to succeed. Financial support and entrepreneurship education encourage an entrepreneurial mindset, while programs, competitions, and mentorships build confidence and skills (Hassan, Sade, & Rahman, 2020). Family background also plays a role, as entrepreneurial parents pass on values and support, while social media and community networks aid in promotion and networking (Gómez-Araujo & Bayon, 2017b).

Entrepreneurial activities are also influenced by gender dynamics. In certain societies, established gender norms can restrict young women's chances to engage in entrepreneurship. It is crucial to tackle these socio-cultural obstacles with specific programs and policies to guarantee equal opportunities for every young person. For example, advancing female entrepreneurship has been shown to contribute to economic development and social empowerment, fostering greater inclusivity in entrepreneurial ecosystems (Acs, Szerb, & Lloyd, 2017). Moreover, factors like capital access, market prospects, and economic stability significantly impact youth entrepreneurship. Young people in economically vibrant regions with available resources and market access are more inclined to participate in entrepreneurial endeavors (Stephan & Uhlaner, 2010).

Supportive institutional and governmental frameworks are essential for young entrepreneurs, offering resources, training, and incentives. Grants, tax breaks, and entrepreneurship education encourage entrepreneurship, while policies promoting a supportive business climate significantly impact young people's motivation to establish and expand businesses (Global Entrepreneurship Monitor, 2019). Addressing these socio-cultural factors is crucial for fostering a generation of successful young entrepreneurs.

3.4. Role of The Fourth Industrial Revolution (4IR) in Transforming Youth Entrepreneurship

The fourth industrial revolution, known as 4IR, integrates advanced analytics, IoT, AI, and cyber-physical systems into traditional industries. Economic growth, job creation, and development are all significantly impacted by youth entrepreneurship (Boris & Parakhina, 2022). By automating repetitive tasks, 4IR technologies boost efficiency while allowing up young entrepreneurs to concentrate on important areas. Decision-making is improved by AI-driven analytics, which offer insights into consumer behaviour and market trends (Durrie & Gahlot, 2020). Young entrepreneurs may promote their products internationally at low prices by overcoming entry barriers with the help of digital platforms and e-commerce solutions.

Digital literacy and new skills like data analytics, coding, and cyber-physical systems are required by 4IR. These days, educational institutions include these skills into their curricula to get students prepared for the evolving work environments. Upskilling initiatives ensure that youth can utilise modern technology efficiently (Bonekamp & Sure, 2020). Hackathons and other innovation programs offer experiential learning that promotes problem-solving and entrepreneurial thinking (Gonzalez et al., 2020). Furthermore, cybersecurity measures are necessary to protect customers and businesses (Sung, 2020). Reskilling and comprehensive labour policies with social safety nets are essential as 4IR changes society in order to support the growth of local talent ("National Fourth Industrial Revolution (4IR) Policy," 2021).

AI and IoT are currently used in smart manufacturing by young entrepreneurs to optimise production. Platforms like Siemens drive innovation in manufacturing (Siemens, 2022). E-commerce tools like Shopify simplify business expansion and market access (Shopify, 2021). By increasing innovation and productivity, 4IR technologies provide business owners access to global marketplaces. This creates a new generation of tech-savvy, resilient businesses. The National Fourth Industrial Revolution (4IR) Policy emphasises a significant value on helping entrepreneurs and MSMEs implement 4IR technology. Initiative 26 concentrates on real-time matching and scaling, whereas initiatives like S13 facilitate integrated support to facilitate the adoption of technology ("National Fourth Industrial Revolution (4IR) Policy," 2021). Recognising these prospects guarantees that entrepreneurship succeeds in a quickly changing economic environment.

4. METHODOLOGY

The goal of this paper is to create a platform that helps underserved youths grow their skills especially in TVET and entrepreneurship. This paper has adopted Hasso Platner's Design Thinking Process in order to accomplish these goals.

Design thinking is important because it is focused on users, concentrating on the needs of individuals and coming up with solutions to satisfy them. Empathize, define, ideate, prototype, and test are the first five stages of design thinking, according to Platner (n.d.). The first phase is empathy, which entails reading articles to understand human behavior and trends. So as to create a more valuable platform, this stage additionally relies on surveys and interviews to gather more information and gain a deeper understanding of human thought processes. Based on the information gathered from earlier stages, the next step, define, establish the actual issues encounter by youths, professional tutors and organisations. The ideation process is utilized to come up with solutions to this problem. Different kinds of solutions are created in an effort to identify the most effective one for the issues. Once the answers to issues faced by individuals have been identified, the prototype is created. This prototype has been implemented multiple times to guarantee that the best one is created that meets people's expectations for this platform. The Testing phase, which involves real user feedback and validation of the prototype, has not yet been conducted. Typically, this step would include usability testing, gathering feedback from potential users, and making necessary adjustments based on their experiences. Future work will focus on implementing user testing to assess the platform's effectiveness and usability. Additionally, benchmarking is carried out by searching for comparable business patterns that have already been present in the market. By modifying the current business model, this guarantees that our platform is innovative and relevance, satisfies the high standards and is comparable to other companies that are currently in operation.

a. Literature Review (LR) & Benchmarking

Conduct a systematic literature review to evaluate existing digital education platforms, identify the challenges underserved communities faced, and gather insights on best practices. Using academic databases like Google Scholar, search for scholarly articles, research papers, and conference proceedings that discuss barriers to education, especially for the underserved youths (Osterwalder & Pigneur, 2010). Focus on factors such as access to resources, digital infrastructure limitations, and the role of personalized tutoring/coaching in bridging learning gaps.

b. Business Model Canvas (BMC)

The Business Model Canvas (BMC) framework is used to define and visualize our platform strategy. Key components such as customer segments, customer relationship, channels, revenue stream, value propositions, cost structure, key activities, key resources and key partners are identified to align the platform's offerings with user needs (Osterwalder & Pigneur, 2010).

c. Value Proposition Canvas (VPC)

The Value Proposition Canvas (VPC) is used to align our offerings with the specific needs of the youths, professional tutors and organisations (Osterwalder et al., 2014). VPC consists of two components: the customer profile and the value map. The customer profile includes job-to-do, extreme gain, and pain, while the value map includes products and services, the gain creators, and pain relievers. VPC makes it possible for us to comprehend customer needs more thoroughly and offer suitable solutions.

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

5.1. BMC

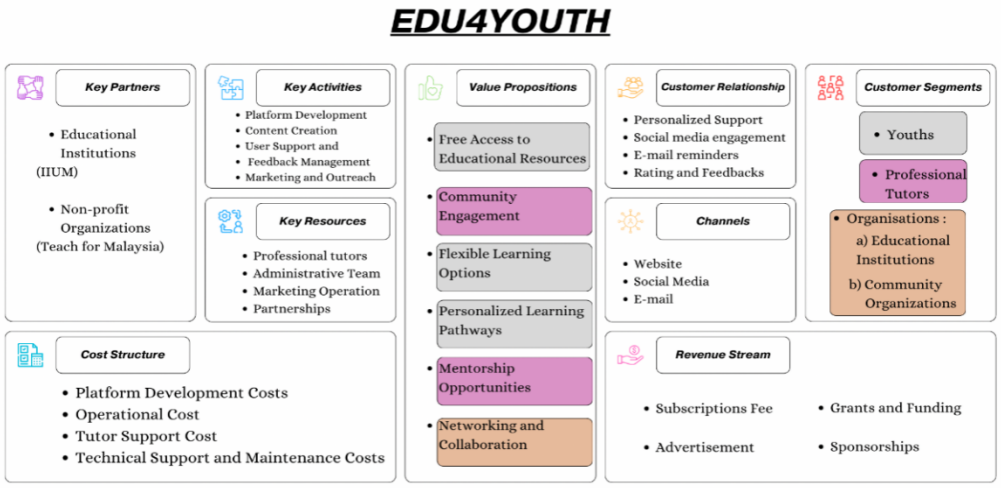


Fig. 4. Initial Edu4Youth Business Model Canvas

5.2. VPC

Fig. 5. Youth Value Proposition Canvas (VPC)

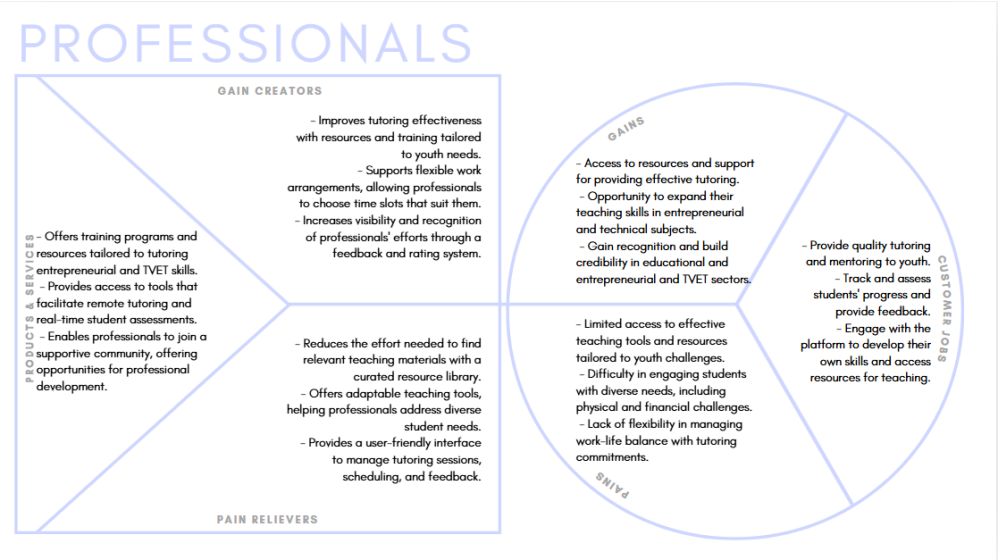


Fig. 6. Professionals Tutors Value Proposition Canvas (VPC)

Fig. 7. Organizations Value Proposition Canvas (VPC)

6. CONDUCT VALIDATION OF INITIAL BM & KEY FINDINGS

An online survey was created using Google Forms in order to validate Edu4Youth's initial business model. A total of 11 structured questions was created in order validate the business model canvas and identify areas that needed improvement. The survey specifically targeted Edu4Youth's customer segments, which including youths. The survey was completed by 20 respondents in total. Based on Fig. 8 & 9, 50% identified as students, 30% as unemployed, 15% as self-employed, and 5% as employed.

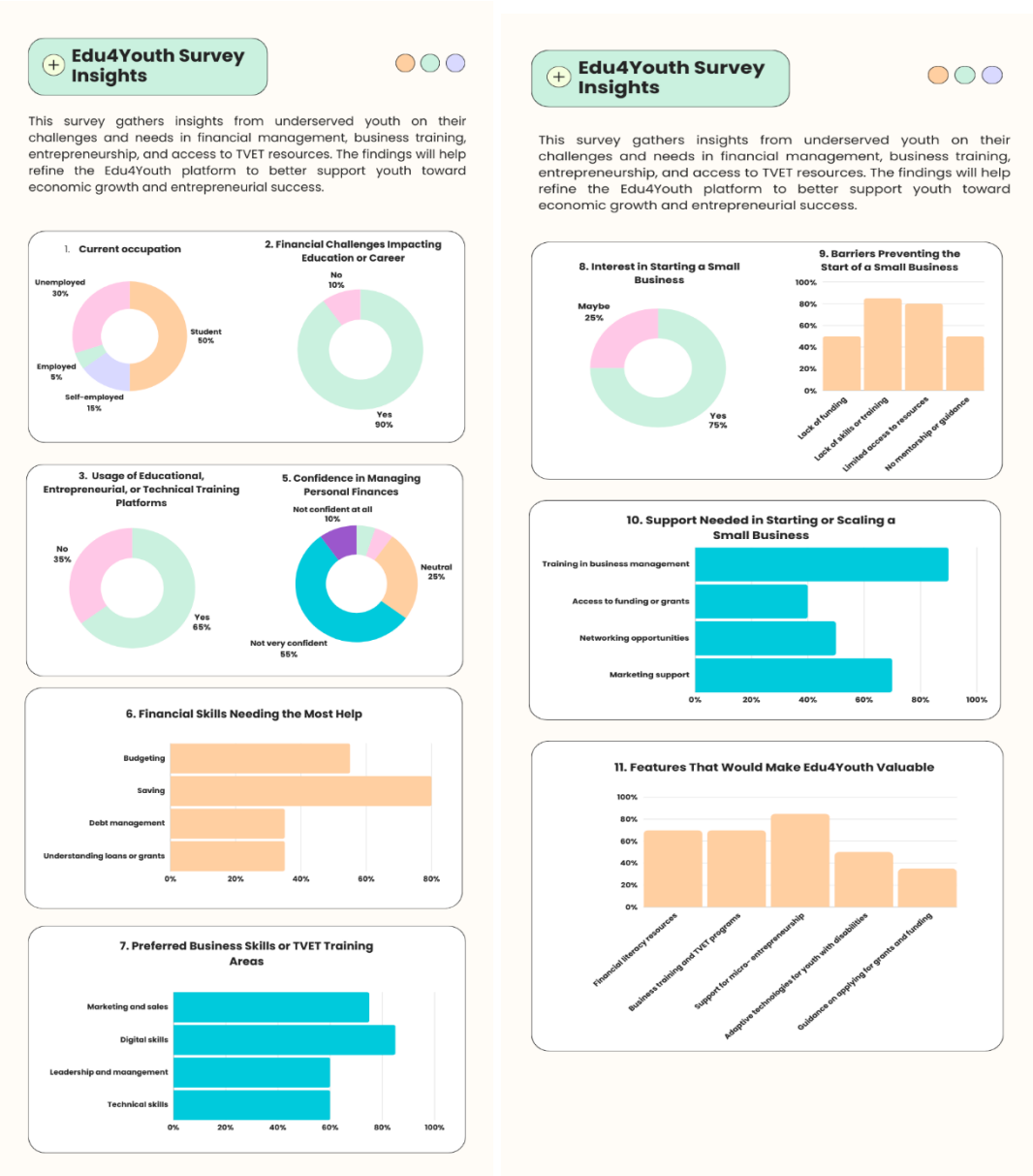


Fig. 8. Infographic Survey Insights

Significantly, 90% of participants have financial challenges which impact their ability to focus on their studies or careers. 35% had not used educational or technical training platforms, despite 65% having done thus, showing accessibility issues. The fact that 55% of respondents are not very confident and 10% are not confident at all in their ability to manage personal finances raises serious concerns about financial literacy. Youth require support in several important areas, such as saving which shows 80% votes from the respondent following with budgeting which 75%, understanding loans or grants and managing debt.

The survey also emphasises the significance of developing business skills, with 85% of respondents seeing sales and marketing as crucial, followed by technical, leadership, and digital skills. The majority of respondents which are 75% said they are interested in starting a small business, but they encounter several barriers, including a lack of funding, a lack of training or skills, limited access to resources,

and a lack of mentoring. In order to overcome these barriers, youths noticed the need for marketing support, networking opportunities, funding and grant access, and business management training. In order to enhance its impact, the Edu4Youth platform should focus on offering important resources including training in financial literacy, business and TVET programs, and help for micro-entrepreneurship. Other aims include providing guidance on obtaining grants and funding and creating adapted technology for youths with disabilities.

Interviews with professional tutors provided a number of valuable recommendations for enhancing the Edu4Youth platform. They recommended that the platform has the ability to differentiate itself from JobStreet and other websites, guaranteeing that youths could use it for free. Furthermore, the platform need to focus on carefully reviewing and promoting professionals who join the initiative. The instructors emphasised that offering job-related volunteering opportunities, like LinkedIn-style job marketing, would be appealing than just giving motivational talks. In order to increase their exposure and reputation, they also advised job seekers to create detailed profiles. The professional tutors offered recognition approaches like certificates, profile-building opportunities, and tracking achievements such the number of talks a professional has given as a way to encourage professionals to contribute. This feature would distinguish Edu4Youth from platforms like LinkedIn, which do not offer this kind of capability, and help speakers establish their reputations. Instead of depending on typical social influencers, the primary focus should be on knowledge-sharing experts who can offer significant expertise.

In order to get sponsorships, it is crucial to match Edu4Youth's purpose with their goals, such as skill development and youth empowerment, according to interviews with educational institutions which is IIUM and NGOs such as Teach for Malaysia. They emphasised that in order get sponsors, measurable results, such as the number of youths trained or employed were required. They also recommended developing partnership structures that highlight sponsor contributions, funding specific programs or providing training materials, and collaborating with groups that have expertise with TVET and entrepreneurship to maximise the impact. These findings highlight the importance that direct interaction and effective partnerships are to the platform's long-term sustainability.

7. VALIDATED BUSINESS MODEL – USING BMC FRAMEWORK

7.1. Validated IT/Digital Project BM

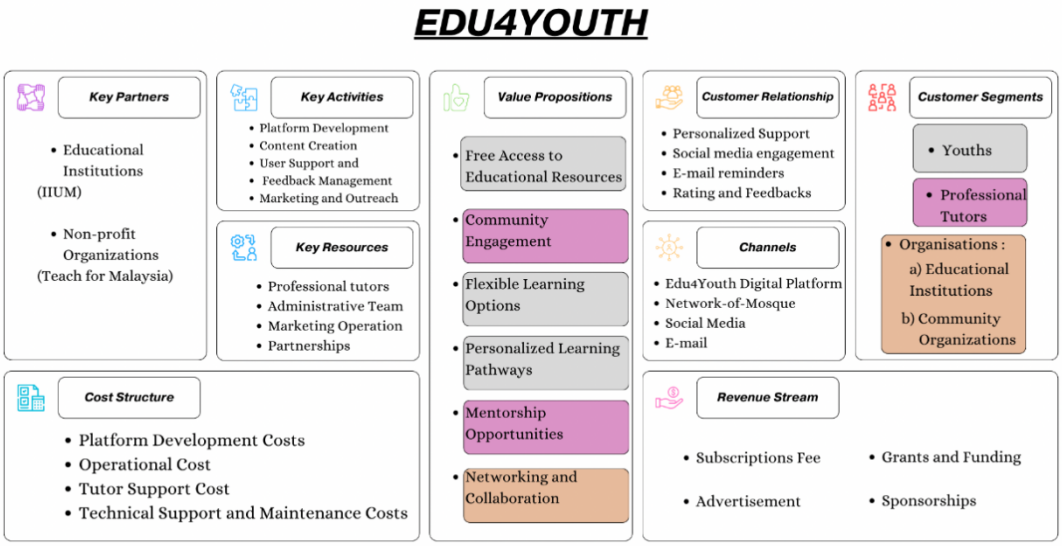


Fig. 9. Validated Edu4Youth Business Model Canvas

Edu4Youth, a platform designed to bridge the gap in access to digital entreprenership, business and TVET education; operates with the aim of empowering underserved youths by providing them with essential resources, skills and opportunities (see Fig. 10). The platform's foundation is built on a robust Business Model (BM), which ensures sustainability while delivering impactful educational solutions. The BM consists of nine interconnected blocks that highlight the operational strategies, partnerships, and value propositions of Edu4Youth, all of which are designed to address the challenges faced by its target audience. Below is an in-depth explanation of these nine components, tailored to the needs of Edu4Youth.

7.1.1. Customer Segments (CS)

Edu4Youth is an inclusive educational platform serving diverse customer segments, primarily focusing on youths from underserved communities who face barriers to quality education. The platform equips these youths with essential business skills, entrepreneurial knowledge, and financial literacy through free educational tools, while also offering opportunities in Technical and Vocational Education and Training (TVET) to enhance their employability. Through individualized mentoring and flexible learning options, youths can overcome obstacles and build confidence. Professional tutors contribute by providing guidance, mentoring, and high-quality instructional materials, while also offering valuable career and entrepreneurship insights. Additionally, organizations like IIUM, JTM, and Teach For Malaysia play a key role by driving re-skilling and up-skilling efforts, securing funding, and addressing both operational and strategic needs to ensure the platform's sustainability and growth, ultimately supporting Edu4Youth's mission of delivering inclusive, sustainable, and high-quality education for all.

7.1.2. Value Proposition (VP)

Edu4Youth's value proposition begins with its commitment to free access to educational resources, making quality education accessible to underserved communities. By removing financial barriers, the platform empowers youths to acquire essential skills in business, entrepreneurship, and TVET (Technical and Vocational Education and Training) without the burden of high costs. Additionally, Edu4Youth fosters community engagement by connecting learners, professional tutors, and organisations, creating a supportive and collaborative. This engagement ensures that learners receive not only academic resources but also emotional and motivational support, which is crucial for their personal and professional development.The platform also emphasizes flexible learning options and personalized learning pathways, catering to the unique needs of each individual. Learners can access resources and mentorship opportunities at their own pace, ensuring that education is adaptable to their schedules and learning styles. Furthermore, Edu4Youth promotes mentorship opportunities and networking and collaboration by connecting youths with experienced professional tutors and organizations. These connections enable learners to gain insights and explore real-world applications of their knowledge, ultimately preparing them for future careers and fostering a sense of community.

7.1.3. Channels (CH)

To successfully reach and engage its audience, Edu4Youth uses a variety of channels, such as our own Edu4Youth digital platform, social media platforms, and email. The digital platform acts as the main center, giving youths ,professional tutors and organisations access to mentorship programs, instructional resources, and platform updates. Social media platforms are used to communicate success stories, encourage community involvement, and reach a broader audience, particularly the younger demographic who are active on these platforms. Additionally, email communication ensures personalized interactions by sending reminders, updates, and feedback directly to users, fostering a strong connection between the platform and its stakeholders. When combined, these channels give users a smooth and convenient experience, increasing the platform's influence and audience.Moreover, this digital platform also uses the comcept of Network of Mosque (Dahlan et. al, 2016; Burhan et. Al, 2013) which allows all people to visit website without specific gender or ages.Thus, these platform channels use to communicate with customers segments to deliver value proposition.

7.1.4. Customer Relationship (CR)

Edu4Youth builds strong customer relationships through personalized support, offering one-on-one guidance from tutors and responsive administrative assistance to address challenges promptly. This personalized approach enhances user experience, fostering long-term engagement and trust. The platform also engages users through social media, email reminders, and a rating and feedback system, ensuring consistent interaction. Social media helps build a community and share updates, while email reminders keep learners on track and informed. The feedback system gathers user insights to improve the platform's services. These strategies together create a supportive, dynamic relationship between Edu4Youth and its users.

7.1.5. Revenue Stream (RS)

Edu4Youth generates revenue through multiple streams to ensure sustainability while keeping education accessible. Primary sources include subscription fees for premium features, advertisements that do not disrupt user experience, and grants from government agencies, educational foundations, and non-profits. Then ,sponsorships from organizations further support the platform, enabling expansion and improved services. These diverse revenue streams ensure Edu4Youth remains financially viable, continuing to empower underserved youths with essential skills for a better future.

7.1.6. Key Resources (KR)

Edu4Youth's key resources include professionals database, such as professional tutors and industry experts, who provide essential knowledge and mentorship to learners, ensuring the platform offers high-quality educational content. The administrative team plays a crucial role in managing daily operations, ensuring the smooth functioning of the platform, coordinating between users and tutors, and handling logistical tasks. Marketing operations are vital for promoting the platform, attracting new users, and maintaining visibility in the competitive educational landscape. Additionally, partnerships with educational institutions, JTM, community organizations, and non-profits strengthen Edu4Youth's network, enhance resource sharing, and broaden its reach, enabling the platform to offer a wider range of services and support to underserved communities.

7.1.7. Key Activities (KA)

The key activities of Edu4Youth are centered on ensuring the platform's effectiveness and sustainability in delivering accessible education to underserved youths. These include platform development, which involves designing, maintaining, and improving the mobile app and website to meet user needs, incorporating features like personalized learning pathways, mentor connections, and resource libraries. Content creation is essential, with Edu4Youth producing high-quality educational materials in business skills, entrepreneurship, and TVET, tailored to the target audience. Additionally, user support and feedback management ensure a seamless experience, addressing user challenges and refining the platform based on feedback. Marketing and outreach activities help attract new users, raise awareness, and foster community engagement, using digital marketing tools and partnerships to expand the platform's reach and maintain accessibility. Collectively, these activities contribute to Edu4Youth's mission of providing equitable, high-quality education.

7.1.8. Key Partners (KP)

Edu4Youth relies on key partnerships with educational institutions like IIUM and non-profit organizations such as Teach for Malaysia to strengthen its platform and expand its reach. IIUM and JTM provide academic expertise, curricula, and credibility, ensuring that the educational materials offered on the platform meet high standards and are relevant to the needs of underserved youths. Teach for Malaysia, a non-profit organization dedicated to improving education in marginalized communities, plays a crucial role by offering volunteer educators and mentorship opportunities. Additionally, the Network of Mosques serves as a vital partner

providing a broad and inclusive platform for engagement.These partnerships allow Edu4Youth to access valuable resources, enhance its content, and engage a wider network of volunteers and professionals, ultimately contributing to the platform's mission of providing equitable education and empowering youths.

7.1.9. Cost Structures (CS)

Edu4Youth incurs several key expenses to ensure the platform's smooth operation and continued growth.Firstly , platform development costs are significant, covering the design, maintenance, and continuous improvement of the website and mobile app, ensuring they remain user-friendly, efficient, and responsive to the needs of learners. Next, operational costs include administrative expenses such as managing day-to-day operations, coordinating with partners, and overseeing user support services. Furthermore ,tutor support costs cover expenses related to recruiting, training, and retaining professional tutors, ensuring they are equipped to provide high-quality mentorship. Additionally, technical support and maintenance costs are essential to address any technical issues that may arise, ensuring the platform remains operational without disruptions. Together, these costs ensure that Edu4Youth can continue delivering accessible, high-quality educational services while expanding its reach and impact.

7.2. Business Envrionmental Map (EM)

7.2.1. Market Forces

According to Technavio (2024), the global e-learning market is expected to grow by USD 192.79 billion from 2022 to 2027, at a compound annual growth rate (CAGR) of 15.87%. This growth is driven by increased demand for flexible education solutions, technological advancements, and the rising popularity of online certification and skill development. In regions like Asia-Pacific, the expanding digital infrastructure is a key factor contributing to the increasing adoption of e-learning platforms, making this a prime market for Edu4Youths to meet the educational needs of underserved communities.

7.2.2. Industry Forces

The e-learning market is highly competitive, with several major players offering courses across various fields. In order to stand out, Edu4Youths can offer unique value propositions, such as integrating Technical and Vocational Education and Training (TVET) with business education, providing a more comprehensive skill-building experience. This differentiation allows Edu4Youth to cater not only to general business education but also to practical vocational skills, setting it apart from platforms that focus only on theoretical knowledge.

7.2.3. Key Trends

Digital technologies have been essential in making education more accessible and adaptable to the needs of modern learners. As highlighted by Dabbous et al. (2023), the transition to digital learning is a key factor in fostering more competitive and inclusive economies. Edu4Youth takes advantage of this trend by offering a web-based platform that allow users to access learning content and mentorship remotely.Thus, Edu4Youths addresses this demand by offering tailored learning pathways that meet individual needs.

7.2.4. Macroeconomic Forces

Edu4Youth has strong growth potential due to the increasing demand for flexible and accessible education, supported by global trends in digital learning and workforce development. The e-learning market is forecasted to grow by USD 309 million from 2023 to 2028, at a CAGR of 20.24%, driven by the rise of mobile learning technologies, online education adoption, and cost-effective content development (Technavio, 2024). Furthermore, the platform can provide job training for underserved youths, enhancing their economic stability through business and TVET skills. However, macroeconomic factors like inflation, which remains at 3.8% in 2023, may affect operational costs, particularly in technology and resources, making cost-effective strategies essential to maintain growth and service quality (Technavio, 2024).

7.3. Strategy Canvas (SC)

Based on a blue ocean strategy, the strategy canvas identifies Edu4Youth's unique advantages over sites such as MDEC, SL1M, Coursera, and Skillshare. By filling important gaps in relevance, pricing, and accessibility, Edu4Youth gives Malaysian youth entrepreneurs a distinct and uncontested place in the market. In contrast to international platforms that give expensive, generic courses, Edu4Youth offers free or reasonably cost, locally relevant content that is suited to the requirements of Malaysian business owners. Unlike SL1M, Edu4Youth also hosts special networking events and tutoring programs that promote collaboration, industry connections, and mentoring. In order to assist young people in implementing digital strategies,a crucial area that rivals frequently ignore. It integrates reasonably priced technology tools, content, and tutorials. Edu4Youth provides useful digital entrepreneurship and business tools for marketing, operations management, and financial control in addition to skill development, allowing relevant knowledge and know-how to be applied right away. Edu4Youth provides the eco-system, resources and case studies that are specifically tailored to Malaysia's socioeconomic setting, in contrast to Coursera and Skillshare, which concentrate on worldwide content. Edu4Youth is the go-to platform for entrepreneurship education because of its localised approach, which guarantees that its re-skilling & up-skilling training is useful, relevant, sustainable, and effective for Malaysian entrepreneurs.

By connecting youth entrepreneurs with professional tutors and encouraging teamwork through discussion boards and forums, group learning, and peer-driven projects, Edu4Youth creates a strong feeling of community. This nurturing atmosphere promotes innovation, problem-solving, and collective achievement, setting Edu4Youth apart from sites like Skillshare and SL1M that do not place as much emphasis on the underserved and B40 community.The strategy canvas graphically illustrates how Edu4Youth is compared to industry players in key value areas by adapting a blue ocean strategy, making it relevant and pertinent option for young Malaysian entrepreneurs and business owners.

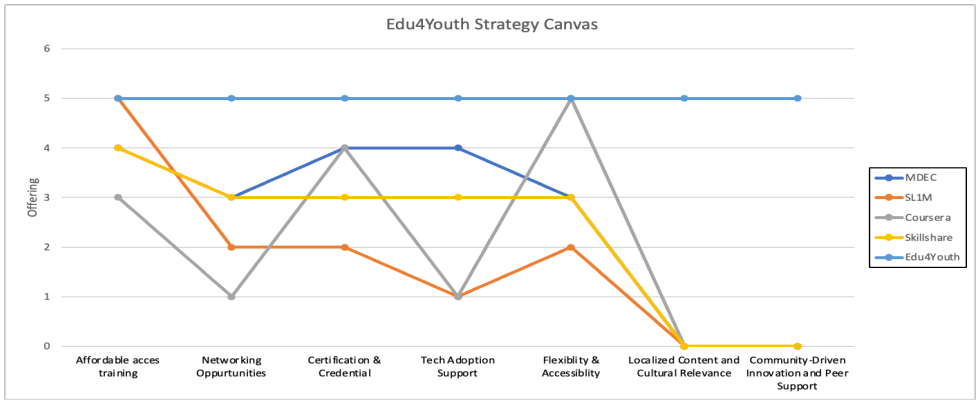
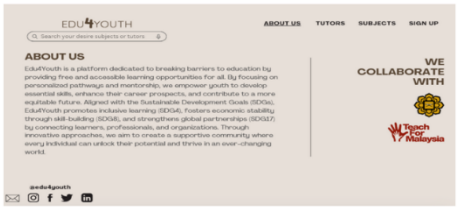


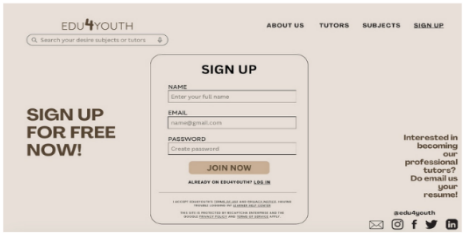
Fig. 10. Edu4Youth Strategy Canvas

7.4. High Fidelity/mock-up prototype apps

(a) Edu4Youth website Home Page



(b) Edu4Youth website About Us Page

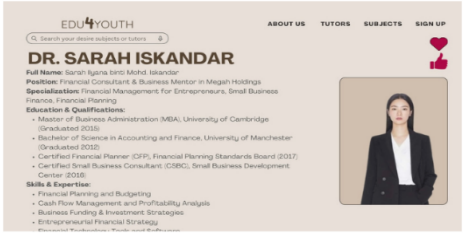


(c) Edu4Youth website Sign Up Page

(d) Edu4Youth website Subjects Page

(e) Edu4Youth website Class Page

(f) Edu4Youth website Professional Tutor List Page



(g) Edu4Youth website Professional Tutor Profile Page

Fig. 11. Edu4Youth Website Prototype

This project also includes the implementation of BDA (Big Data Analytics), AI (Artificial Intelligence) and Blockchain. For instance:

- BDA: We could get insights into learning trends, class popularity, tutor popularity, and engagement patterns by collecting and analyzing user data through our database using Big Data Analytics. Both the user experience and the creation of educational materials can be enhanced by this realization. This data-driven approach can direct platform improvements and future content updates.
- AI: A highly adaptable learning environment can be established by using AI to examine user behavior and preferences. In order to offer courses that are specific to each learner's needs, AI algorithms can monitor their progress, interests, and previous interactions. AI makes it possible for users to locate the most appropriate classes that fit their learning preferences and habits in real time by offering data-driven recommendations.
- Blockchain: Blockchain technology can be used to track student progress, safely validate certificates, and keep an open record of achievements. It guarantees that learning outcomes and academic certificates are easily verifiable and impenetrable.

8. CONCLUSION AND FUTURE WORKS

The Edu4Youth project is addressing major issues and stresses brought on by stakeholders and their customers including the needy youths, professional tutors and managements of educational bodies and other community organizations. Educations regarding youths, in particular, do emphasize high course costs accompanied by low rates of individualized assistance or tangible applications. Equally, it is the case that administrators have noted deficits in resource allocation, impact assessment and outreach to the under-resourced areas while professional tutors have challenges in relations with educating the youth in an engaging manner and in a one-on-one interaction because of lack of resources.

Edu4Youth stands out with distinctive traits that act as successful pain relievers and value enhancers in its business model. The project aims to overcome financial obstacles to education by providing a free digital platform with professional tutors, allowing personalized learning on subjects such as entrepreneurship, finance, digital and TVET skills.Organisations gain tools for measuring impact and allocating resources, while professional tutors access interactive teaching tools that improve learner engagement. These characteristics are in line with the strategic objectives of both the organization and IT, guaranteeing that the platform plays a role in achieving larger aims such as promoting fair education, economic expansion, fostering partnerships, and enhancing societal well-being. The idea of the business model is designed to meet the needs of everyone involved, making it a groundbreaking effort in the fields of education and entrepreneurship.

The focus of emerging activities will be on formulation of a detailed Project Management Plan (PMP) plan to address the detailed implementation of Edu4Youth project. This entails defining major areas of focus, site resources and put in place impactful monitoring mechanisms. Other activities will also seek to incorporate 4IR technologies like AI and Big Data Analytics in enabling personalized

learning and analytics to improve engagement and feedback loops. In addition, pilot programs in low-income regions will evaluate the ease with which the platform broadly operates and is implemented for optimization of the model across regions. Collaboration with federal and state authorities, education institutions, NGO's, and private sector will also be further developed to enhance funding and outreach with a view of help Edu4Youth to achieve desired economic and education growth in its strategic goals.

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A CONCEPTUAL FRAMEWORK: EVENT-BASED CYBERSECURITY RISK ASSESSMENT FOR ORGANISATIONS

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ABSTRACT: The current phenomenon of the interconnected digital world has heightened exposure to cyber risks, emphasising the critical need for robust cybersecurity risk management within organisations. Cybersecurity risk management encompasses identifying, assessing, and mitigating threats to protect individuals, organisations, and nations from cyber risks. Central to this process is the cybersecurity risk assessment, a fundamental exercise aimed at understanding and mitigating potential cyber threats. There are two primary risk assessment approaches: event-based and asset-based approaches. While current literatures are mostly focused on an asset-based approach, this study delves into the event-based approach by exploring potential cyber-attacks that could compromise the confidentiality, integrity, and availability of digital data, posing significant cybersecurity risks to organisations. Despite technological advancements and the increasing complexity of cyber threats, organisations' predominant reliance on an asset-based approach to cybersecurity risk assessment may not adequately address the evolving nature of cyber risks. Furthermore, there is a lack of harmonisation between scholarly and established cybersecurity frameworks based on international standards, such as those by the National Institute of Standards and Technology (NIST) and the International Organisation for Standardization (ISO). This paper synthesises existing frameworks from ISO, NIST and academic research and proposes recommendations to guide organisations in implementing an event-based approach to cybersecurity risk assessment.

KEY WORDS: *Cybersecurity, Information security, Risk management, Risk assessment, Event-based, Framework*

1. INTRODUCTION

In the contemporary digital landscape, the reliance of organisations on technology for operational efficiency, enhanced service delivery, and client engagement has significantly increased. However, this digital transformation has also increased the organisation's exposure to cyber risks (Krishtanosov & Brovko, 2023). As organisations become more reliant on digital infrastructure, the potential for cyber-attacks that could disrupt services, compromise sensitive information, and undermine client trust becomes an urgent concern (National Cybersecurity Agency,

2020). This phenomenon underscores the critical need for robust cybersecurity risk management within organisations.

Cybersecurity risk management encompasses a comprehensive process of identifying, assessing, and mitigating threats to protect individuals, organisations, and nations from cyber risks (Chen et al., 2021; Lau et al., 2021; Sukumar et al., 2023). At the heart of this process lies the cybersecurity risk assessment, a fundamental exercise aimed at identifying and assessing potential cyber threats (ISO/IEC 27005, 2022; NIST SP 800-30, 2012). A robust risk assessment process is essential for devising effective strategies to protect against cyber-attacks and ensure the resilience of public sector operations. There are two primary approaches to risk assessment: the event-based approach and the asset-based approach (ISO/IEC 27005, 2022).

In this context, an "event" refers to any occurrence or change in circumstances that might impact security (ISO/IEC 27005, 2022). The event-based approach to cybersecurity risk assessment focuses on analyzing potential cyber events or incidents that could compromise the confidentiality, integrity, and availability of digital data (ISO/IEC 27005, 2022). This approach involves identifying specific threats, understanding their potential impact, and developing strategies to mitigate those threats (ISO/IEC 27005, 2022). By concentrating on events, this method aims to provide a more dynamic and responsive framework for managing cyber risks, which is particularly important given the rapidly evolving nature of cyber threats.

On the other hand, the underlying concept of an asset-based approach is that risks can be identified and assessed through an inspection of assets, threats and vulnerabilities. The inherently dynamic nature of cybersecurity threats may not be sufficiently addressed by organisations that primarily rely on an asset-based approach to risk assessment. In recent times, cyber-attackers have upskilled their skills through AI techniques to automate attacks, augment their strategies, launch more sophisticated attacks and by implication increase their success (Ukwandu et al., 2020; Zhang et al., 2022). The asset-based approach typically focuses on identifying and protecting critical assets, such as information systems and data repositories. While this method is valuable and more popular than event-based approach, it may fall short in addressing the dynamic and multifaceted nature of modern cyber threats (Bagheri et al., 2023). The asset-based approach tends to emphasize static protection measures, which might not be sufficient in the face of sophisticated and adaptive cyber-attacks (Jung et al., 2023).

The scholarly focus on cybersecurity risk assessment has similarly leaned towards asset-based methods, potentially weakening strategies against emerging cyber threats. For instance, the studies on cybersecurity risk assessment by previous scholars such as (Akbarzadeh & Katsikas, 2023), (Kalinin et al., 2021), (Rea-Guaman et al., 2020), (Mathias Ekstedt et al., 2023) and others are more inclined toward an asset-based approach while less previous scholars focused on the event-based approach.

Moreover, there is insufficient alignment between academic research and established cybersecurity frameworks grounded in international standards, such as those from the NIST and the ISO (Melaku, 2023). These standards provide comprehensive guidelines for managing cybersecurity risks and offer valuable insights into best practices.

This study addresses this gap by proposing an event-based cybersecurity risk assessment framework. The propose framework is developed through a synthesis of the two international standards, ISO/IEC 27005 and NIST SP 800-30, as well as a study by Elmarady & Rahouma This approach seeks to integrate the strengths of these established frameworks with insights from recent scholarly research, creating a comprehensive and practical framework for managing cyber risks in organisations.

2. OVERVIEW OF CYBERSECURITY RISK ASSESSMENT

This section presents the reviews of academic literature and existing standards to understand cybersecurity risk assessment including the definitions, key elements and approaches.

2.1. Definitions of Cybersecurity Risk Assessment

Cybersecurity risk management is defined as the systematic application of management policies, procedures, and practices to the activities of communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring, and reviewing risk (ISO/IEC 27005, 2022). Cybersecurity risk assessment is an important process in the field of cybersecurity risk management, essential for the protection of an organisation's digital information. There are various definitions of cybersecurity risk assessment, although from different sources, share the same objective: to identify, estimate and prioritize information security risks.

According to NIST SP 800-37, cybersecurity risk assessment is central to organisational risk management, emphasizing the protection of operations, missions, reputation, and assets, as well as broader impacts on other organisations and national security (NIST SP 800-37, 2018). This underscores the broad implications of cybersecurity risks and the need for a comprehensive approach. ISO/IEC 27005 defines cybersecurity risk assessment as a process of identifying, analyzing, and assessing risks to make informed decisions that ensure organisational objectives are met (ISO/IEC 27005, 2022). This highlights the strategic role of cybersecurity risk assessment in decision-making and goal alignment.

Meanwhile, NIST SP 800-30 defines it as identifying, estimating, and prioritizing cybersecurity risks by analyzing threats and vulnerabilities, focusing on the analytical aspect of assessing the likelihood and impact of adverse events (NIST SP 800-30, 2012). Whitman et al. describe cybersecurity risk assessment as an integrated approach combining risk identification, analysis, and assessment into a cohesive strategy, simplifying the management of cybersecurity risks (Whitman & Mattord, 2018).

All definitions stress the importance of understanding threats and vulnerabilities to protect digital information. The emphasis varies: NIST SP 800-37 on the broad scope of impacts; ISO/IEC 27005 on aligning risk management with objectives; NIST SP 800-30 on the analytical process; and Whitman et al. on an integrated strategy.

2.2. Key Elements in Cybersecurity Risk Assessment

The key elements in cybersecurity risk assessment encompass three (3) primary processes as presented in Fig. 1.

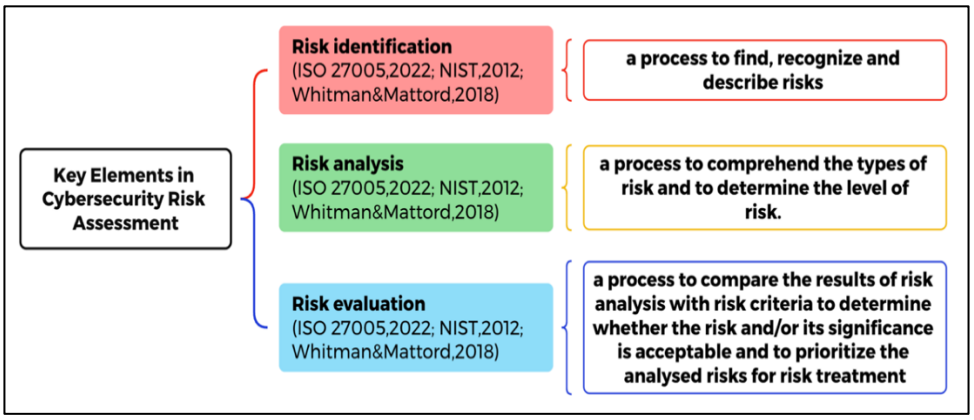

Fig. 1. Key elements in cybersecurity risk assessment

Risk identification is the stage where risks are discovered, acknowledged, and described. It's about spotting potential threats that could negatively impact an organisation's assets and operations (ISO/IEC 27005, 2022; NIST SP 800-30, 2012; Whitman & Mattord, 2018).

During the risk analysis phase, the nature of identified risks is understood, and the level of risk is determined. It involves assessing the likelihood and potential consequences of each risk (ISO/IEC 27005, 2022; NIST SP 800-30, 2012; Whitman & Mattord, 2018).

Risk evaluation involves comparing the risk analysis results against established criteria to determinethe acceptability of the risk. It also prioritizes the risks identified to inform the risk treatment process, which involves deciding on the measures to mitigate, accept, or transfer the identified risks (ISO/IEC 27005, 2022; NIST SP 800-30, 2012; Whitman & Mattord, 2018).

2.3. Approaches in Cybersecurity Risk Assessment

There are two main approaches for assessment: an event-based approach and an asset-based approach (ISO/IEC 27005, 2022).

In an event-based approach, the underlying concept is that risks can be identified and assessed through an evaluation of events and consequences (ISO/IEC 27005, 2022). Events and consequences can often be determined by a discovery of the concerns of top management, risk owners and the requirements identified in determining the context of the organisation (ISO/IEC 27005, 2022).

In an asset-based approach, the underlying concept is that risks can be identified and assessed through an inspection of assets, threats and vulnerabilities (ISO/IEC 27005, 2022). An asset is anything that has value to the organisation and therefore requires protection. Assets should be identified, taking into account that an information system consists of activities, processes and information to be protected (ISO/IEC 27005, 2022).

The event-based approach is contrasted with the asset-based approach to risk identification (ISO/IEC 27005, 2022). In principle, the two approaches differ only regarding the level at which identification is initiated. This study focuses on the event-based approach to cybersecurity risk assessment because it offers a more dynamic and context-specific understanding of risks. This approach aligns with the

necessity for a more adaptive and responsive risk management strategy that addresses not only the technical aspects of cybersecurity but also the broader organizational context and stakeholder concerns (Ganin et al., 2020). Additionally, the event-based approach facilitates a more comprehensive assessment by considering the interplay between different events and their cumulative impact on the organization (Liu et al., 2021). Therefore, developing a framework for event-based cybersecurity risk assessment will provide organizations with a robust framework to assess risks in an increasingly complex digital environment.

3. REVIEW OF EXISTING CYBERSECURITY RISK ASSESSMENT FRAMEWORKS

In the dynamic landscape of information technology, cybersecurity risk management and assessment frameworks serve as essential frameworks for safeguarding digital information. This section presents the reviews of existing cybersecurity risk management and assessment frameworks including the relevant standards and previous studies.

3.1. Comparison of ISO, NIST and ITSRM Cybersecurity Risk Management and Assessment Frameworks

Information security controls, methods and techniques can be applied to manage cybersecurity risks (ISO/IEC TS 27100, 2020). The ISO/IEC 27005 and NIST SP 800-37 stand out as global beacons, widely adopted for their robust approach to managing risk in cybersecurity (Efe A, 2023; ENISA, 2022; Melaku, 2023). Complementing these is the NIST SP 800-30, a risk assessment framework for its event-based approach, which takes into account specific incidents that could potentially disrupt cybersecurity (ENISA, 2022). Additionally, the European Union's IT Security Risk Management Methodology (ITSRM) is known for its process-oriented framework, which meticulously outlines the inputs and outputs associated with each risk management process (ENISA, 2022). A review of these frameworks is presented in Table 1.

Table 1: Comparison of ISO, NIST and ITSRM cybersecurity risk management and assessment frameworks

Parameters	ISO/IEC 27005 (2022)	NIST SP 800-30 (2012)	NIST SP 800-37 (2018)	EU ITSRM2 (2020)
Context Establishment	Yes	No	Yes	Yes
Asset-based / Event-based	• Asset-based • Event-based	Event-based	Asset-based	Asset-based
Risk Treatment	Yes	No	Yes	Yes
Author	ISO	NIST	NIST	EU DIGIT
Compatibility	Any type and size of the organization	Any type and size of the organization	Any type and size of the organization	Any type and size of the organization
Focus Area	Holistic RM	Risk Assessment	Tactical-level RM	Holistic RM
Risk Management Team	Yes	Yes	Yes	Yes
Communication and Consultation	Yes	Yes	Yes	Yes
Monitoring And Review	Yes	Yes	Yes	Yes
Challenges	• Higher costs (Paid access) • Difficulties in implementation for users who are not familiar with ISO/IEC standards	• Focus on Risk Assessment only • Primarily for U.S. federal government entities	Primarily for U.S. federal government entities	Mainly adapted for European organisations

ISO/IEC 27005 provides a comprehensive approach, allowing both asset-based and event-based risk assessments and including context establishment and risk treatment (ISO/IEC 27005, 2022). It is designed for organisations of any type and size, promotes a holistic risk management view, and includes a risk management team, communication, consultation, and monitoring and review processes. However, it can be costly due to paid access and challenging for those unfamiliar with ISO/IEC standards (Melaku, 2023).

NIST SP 800-30 focuses solely on event-based risk assessment (ENISA, 2022) and is specifically tailored for U.S. federal government entities (Efe A, 2023; Melaku, 2023). It lacks context establishment and risk treatment components but includes a risk management team, communication, consultation, and monitoring and review.

NIST SP 800-37 is asset-based (ENISA, 2022) and includes context establishment, risk treatment, a risk management team, communication,

consultation, and monitoring and review. Its focus is on tactical-level risk management, and it is again primarily suited for U.S. federal government entities (Efe A, 2023; Melaku, 2023).

EU ITSRM2 is asset-based, including context establishment, risk treatment, and all the supporting processes, similar to ISO/IEC 27005 (ENISA, 2022). It is adaptable for any organisation size and type, with a holistic risk management focus, designed mainly for European organisations.

All frameworks are compatible with any type and size of the organisation and include a risk management team, communication, consultation, and monitoring and review processes. However, they differ in their approach to risk assessment, focus area, and specific regional applicability.

This study focuses on ISO/IEC 27005 and NIST SP 800-30 in developing an event-based cybersecurity risk assessment framework for organisations with several justifications. ISO and NIST's methodologies are globally recognized and respected (Efe A, 2023; ENISA, 2022; Melaku, 2023). ISO/IEC 27005 offers a comprehensive framework for managing information security risks, allowing both asset-based and event-based assessments. This flexibility is crucial for organizations needing to adapt their risk management approach to specific contexts (Putra & Soewito, 2023). On the other hand, NIST SP 800-30 focuses on event-based risk assessments (ENISA, 2022), which are particularly effective for identifying and evaluating the dynamic nature of cybersecurity threats. This methodology is suitable for organizations aiming to understand and mitigate specific events that could impact their systems (Putra & Soewito, 2023).

Combining ISO/IEC 27005 with NIST SP 800-30 allows leveraging the strengths of both standards. ISO/IEC 27005 offers a holistic view of risk management, while NIST SP 800-30 provides detailed guidance on conducting thorough event-based risk assessments, ensuring a robust and adaptable risk management strategy (Fikri et al., 2019). Therefore, the researchers can develop a robust event-based cybersecurity risk assessment framework that combines comprehensive risk management principles with detailed, context-specific risk assessment practices.

3.2. Comparison of Previous Studies on Cybersecurity Risk Assessment Frameworks

A comparative overview of various cybersecurity risk assessment studies, contrasting their findings, approaches, and scopes is presented in Table 2.

Table 2: Comparison of previous studies on cybersecurity risk assessment frameworks

Authors & Research Title	Research Finding	Risk Assessment Approach	Scope
Rea-Guaman et al. (2020) AVARCIBER: A Framework For Assessing Cybersecurity Risks	Proposed a framework to identify and assess cybersecurity risks to improve the decision-making process regarding the importance and criticality of the risks and countermeasures that must be applied (Rea-Guaman et al., 2020).	Asset-based	Organisations
Elmarady & Rahouma, (2021) Studying Cybersecurity in Civil Aviation, Including Developing and Applying Aviation Cybersecurity Risk Assessment	Identify potential cyber threats to aviation systems and to evaluate their likelihood and risk levels (Elmarady and Rahouma, 2021).	Event-based	Civil Aviation
Kalinin et al. (2021) Cybersecurity risk assessment in smart city infrastructures	Evaluated cybersecurity risks in the dynamic device-to-device networks characteristic of smart city infrastructures (Kalinin et al., 2021).	Asset-based	Smart city infrastructures
Akbarzadeh & Katsikas (2023) Dependency-Based Security Risk Assessment For Cyber-Physical Systems	Propose a dependency-based, domain-agnostic cybersecurity risk assessment method to identify possible attack paths against critical components (Akbarzadeh & Katsikas, 2023).	Asset-based	Cyber-Physical Systems
Ekstedt et. al (2023) Yet Another Cybersecurity Risk Assessment Framework	Introduces a metaframework-based approach named Yet Another Cybersecurity Risk Assessment Framework (Yacraf) which aims to enable comprehensive risk assessment for organizations with more decision support (Mathias Ekstedt et al., 2023).	Asset-based	Organisations
Researchers' Study Event-based Cybersecurity Risk Assessment for Organisations	Proposed an event-based cybersecurity risk assessment framework for organisations	Event-based	Organisations

The comparison reveals that most studies, such as those by Rea-Guaman et al., Kalinin et al., Akbarzadeh & Katsikas, and Ekstedt et al., employ an asset-based risk assessment approach. These studies focus on various scopes including organisations, smart city infrastructures, and cyber-physical systems. In contrast, Elmarady & Rahouma (2021) stand out by using an event-based approach specifically for the civil aviation sector, identifying and evaluating potential cyber threats to aviation systems. This highlights a gap and the potential need for more event-based risk assessment frameworks in organisations to address the evolving nature of cyber threats effectively.

This study focuses on the study by Elmarady & Rahouma on the development of an event-based cybersecurity risk assessment framework for organizations with several justifications. The study by Elmarady & Rahouma specifically utilizes an event-based risk assessment approach, tailored to evaluate potential cyber threats and their likelihood (Elmarady & Rahouma, 2021). This method is highly relevant for dynamic and evolving cyber threat environments, providing a more responsive and adaptive risk management strategy. Furthermore, their research is applied in the civil aviation sector, a high-stakes environment where cybersecurity threats can have severe consequences (Elmarady & Rahouma, 2021). The methodologies and insights gained from this study can be valuable when adapted to other sectors with critical cybersecurity needs, including various organizational contexts. By leveraging the insights and methodologies from Elmarady & Rahouma can significantly enhance the development of an event-based cybersecurity risk assessment framework for organizations, ensuring a comprehensive, dynamic, and adaptable approach to managing cybersecurity risks.

4. PROPOSED FRAMEWORK

This section presents the proposed Event-based Cybersecurity Risk Assessment Framework designed specifically for organizations, outlining its key components and methodologies.

4.1. Adapted Frameworks

The proposed framework of this study adapted three (3) frameworks: ISO/IEC 27005, NIST SP 800-30 and Elmarady & Rahouma to achieve the research objective. The justifications for adapting these frameworks were mentioned in sections 3.1 and 3.2 of this article.

Fig. 2 represents the cybersecurity risk management framework defined by ISO/IEC 27005 while Fig. 3 represents the cybersecurity risk assessment framework defined by NIST SP 800-30. Fig. 4 represents the cybersecurity risk assessment framework defined by Elmarady & Rahouma.

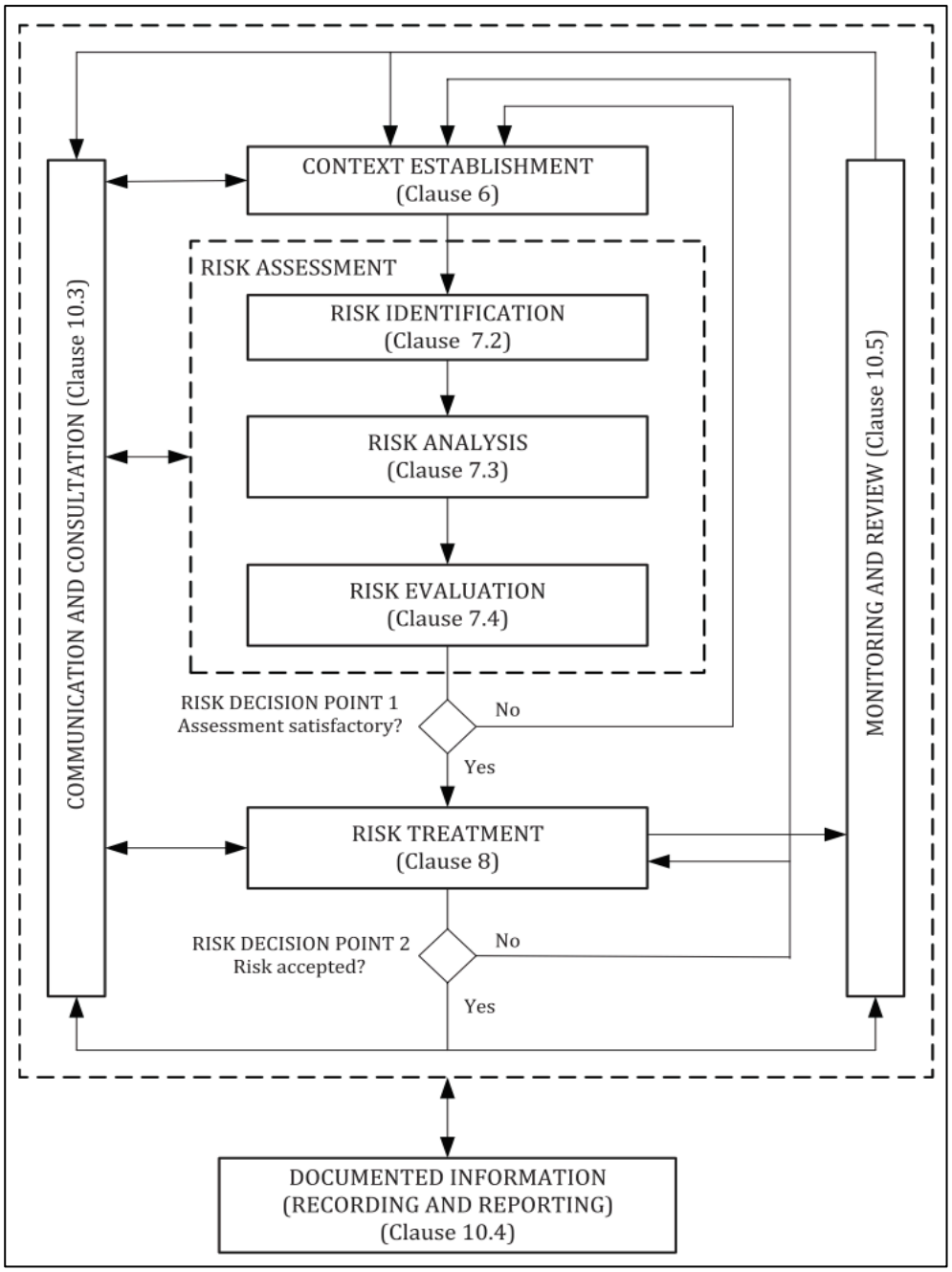

Fig. 2. Framework by ISO/IEC 27005, 2022

The ISO/IEC 27005 framework (ISO/IEC 27005, 2022) prepares for assessment by establishing a risk context in the wider risk management framework, integrating core elements of risk assessment to ensure a comprehensive approach. It systematically identifies events that could pose a risk, the sources of these risks, and the potential impacts, thereby constructing a comprehensive risk profile. The inclusion of likelihood assessment and risk level determination allows organisations to gauge the severity and prioritize their responses effectively. A unique feature of this framework is the identification of a risk owner for each identified risk, ensuring that accountability is assigned and that actions are owned and managed. Despite its thorough approach in these areas, the framework does not explicitly focus on monitoring and review, which may suggest an expectation for these activities to be integrated within the broader organisational risk management processes.

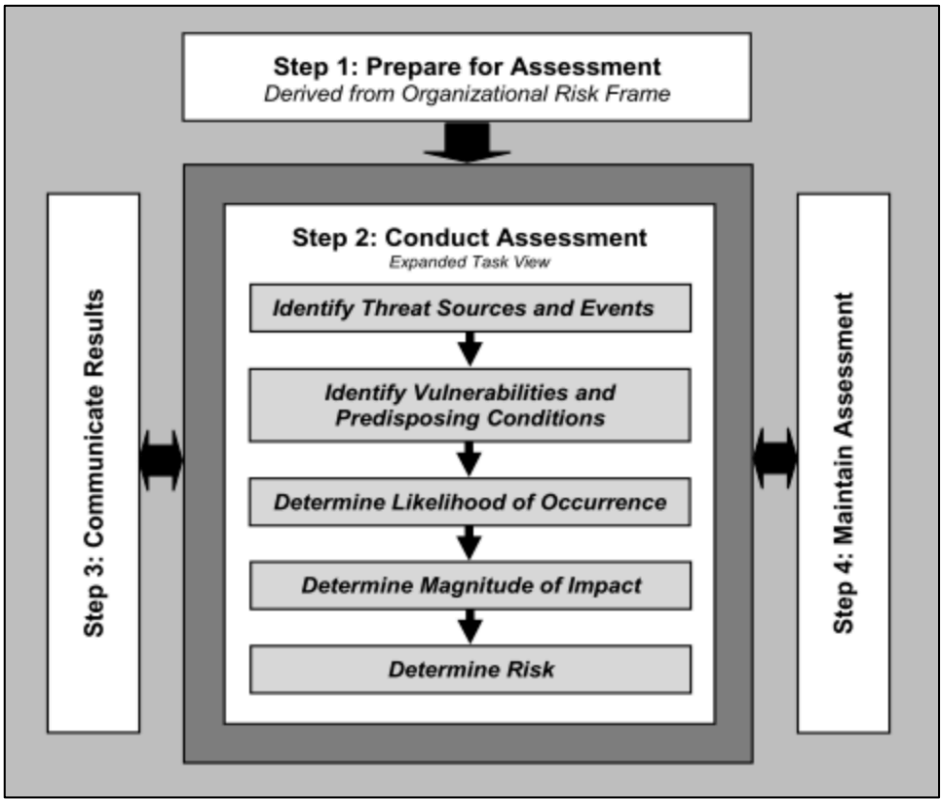

Fig. 3. Framework by NIST SP 800-30, 2012

The NIST SP 800-30 framework (NIST SP 800-30, 2012) emphasizes a more structured approach, beginning with a distinct preparation phase. This suggests a recognition of the importance of setting the stage for a comprehensive assessment by understanding the organisational context and resources at the outset. It shares commonalities with the ISO framework in identifying events, sources, impacts, and likelihoods of risks, demonstrating a consensus on these critical steps in risk assessment. However, it departs from ISO by not assigning a risk owner, perhaps reflecting a preference for a shared responsibility framework or the integration of risk ownership into wider roles. The framework notably includes a dedicated monitoring and review component, indicating a commitment to ongoing risk management and the adaptation to changing threat landscapes over time.

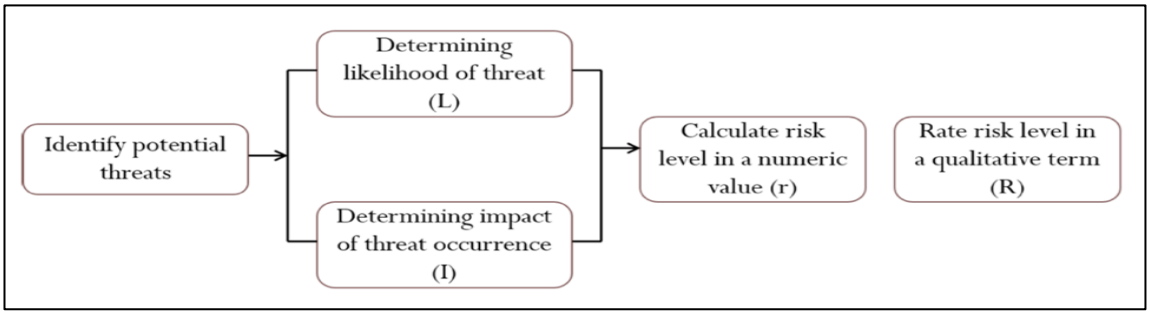

Fig.4. Framework by Elmarady & Rahouma, 2021

The Elmarady & Rahouma framework (Elmarady & Rahouma, 2021) presents a concise event-based approach to risk assessment. It consists of a preparatory phase by identifying the scope of the system that needs to be protected. It bypasses

the identification of risk sources, suggesting a focus on the agile response to threats rather than detailed planning or source tracing. The framework aligns with the others in the identification of events, impacts, and likelihoods, but it does not stipulate the determination of risk owners, pointing towards the framework operating within a pre-defined risk ownership structure. Additionally, the absence of prescribed communication and consultation steps, as well as a lack of a monitoring and review phase, indicates the framework is designed for rapid assessment within the civil aviation environment where other mechanisms provide for these functions.

The comparison of components across three adapted cybersecurity risk assessment frameworks is presented in Table 3. ISO/IEC 27005, NIST SP 800-30 and Elmarady & Rahouma show varying levels of inclusion for different risk assessment components.

Table 3: Components comparison of three adapted risk assessment frameworks

Parameters	ISO/IEC 27005 (2022)	NIST SP 800-30 (2012)	Elmarady et.al (2021)
Prepare for Assessment	Yes	Yes	Yes
Identify Events	Yes	Yes	Yes
Identify Risk Sources	Yes	Yes	No
Identify Impact	Yes	Yes	Yes
Identify Likelihood	Yes	Yes	Yes
Determine Risk Level	Yes	Yes	Yes
Identify Risk Owner	Yes	No	No
Communication & Consultation	Yes	Yes	No
Monitor & Review	Yes	Yes	No

The synthesis of the parameters for ISO/IEC 27005, NIST SP 800-30, and Elmarady & Rahouma frameworks reveals both commonalities and distinctions in their approaches to cybersecurity risk assessment. All three frameworks include the essential step of preparing for assessment, ensuring that organizations establish a structured process before identifying risks. They uniformly emphasize the importance of identifying events, a critical component for understanding potential cybersecurity threats.

When it comes to identifying risk sources, both ISO/IEC 27005 and NIST SP 800-30 recognize this step, highlighting their comprehensive approach to understanding where threats originate (ISO/IEC 27005, 2022; NIST SP 800-30, 2012). In contrast, the framework by Elmarady & Rahouma does not specifically

address identifying risk sources, which might suggest a more streamlined or focused approach within the civil aviation context (Elmarady & Rahouma, 2021).

All three frameworks concur on the importance of identifying the impact and likelihood of events, which are fundamental for evaluating potential risks (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022; NIST SP 800-30, 2012). This commonality underscores a shared understanding of assessing both the severity and probability of cybersecurity incidents. Consequently, each framework also determines the risk level (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022; NIST SP 800-30, 2012), providing a quantified measure of the identified risks, essential for prioritizing and managing them effectively.

A significant divergence appears in the identification of risk owners, where ISO/IEC 27005 stands out by assigning responsibility for risk management (ISO/IEC 27005, 2022; NIST SP 800-30, 2012), which is not addressed in the other two frameworks. This element emphasizes accountability and clear delineation of roles within the risk management process. Although NIST SP 800-30 does not suggest organisations identify the risk owner, NIST SP 800-30 suggests organisations identify the information systems owner or business/mission owner (NIST SP 800-30, 2012).

Communication and consultation are integral to both ISO/IEC 27005 and NIST SP 800-30, ensuring that stakeholders are engaged and informed throughout the risk assessment process (ISO/IEC 27005, 2022; NIST SP 800-30, 2012). However, Elmarady & Rahouma do not explicitly include this parameter (Elmarady & Rahouma, 2021), which may reflect a narrower focus on technical assessment over stakeholder engagement.

Finally, the parameter of monitoring and review is included in NIST SP 800-30 (NIST SP 800-30, 2012), ISO/IEC 27005 (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022) and the Elmarady & Rahouma framework (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022). The inclusion of monitoring and review highlights the importance of continuous improvement and reassessment in managing cybersecurity risks, ensuring that the risk management process remains dynamic and responsive to new threats.

Each framework presents a different philosophy and set of priorities in cybersecurity risk assessment. ISO/IEC 27005 framework is meticulous and assumes ongoing risk assessment practices; NIST SP 800-30 framework is procedural and continuous; while Elmarady & Rahouma framework is streamlined and potentially embedded within a specific framework. These frameworks underscore that the choice of a risk assessment framework must align with the organisation's risk appetite, operational style, and the specific threats it faces.

4.2. Development of the Proposed Framework

The proposed framework as presented in Fig. 5 includes a sequence of components that outline the risk assessment process. The process starts with the preparation step to implement risk assessment (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022; NIST SP 800-30, 2012). The key elements in cybersecurity risk assessment are risk identification, risk analysis and risk evaluation (ISO/IEC 27005, 2022; NIST SP 800-30, 2012; Whitman & Mattord, 2018). Therefore, the researchers proposed three (3) main levels of risk assessment: Level 1- Risk

Identification, Level 2- Risk Analysis and Level 3- Risk Evaluation. By referring to ISO/IEC 27005 and NIST SP 800-30, risk communication and consultation are carried out throughout the risk assessment involving the three main levels (ISO/IEC 27005, 2022; NIST SP 800-30, 2012). Monitoring and review are conducted at all three main stages (NIST SP 800-30, 2012).

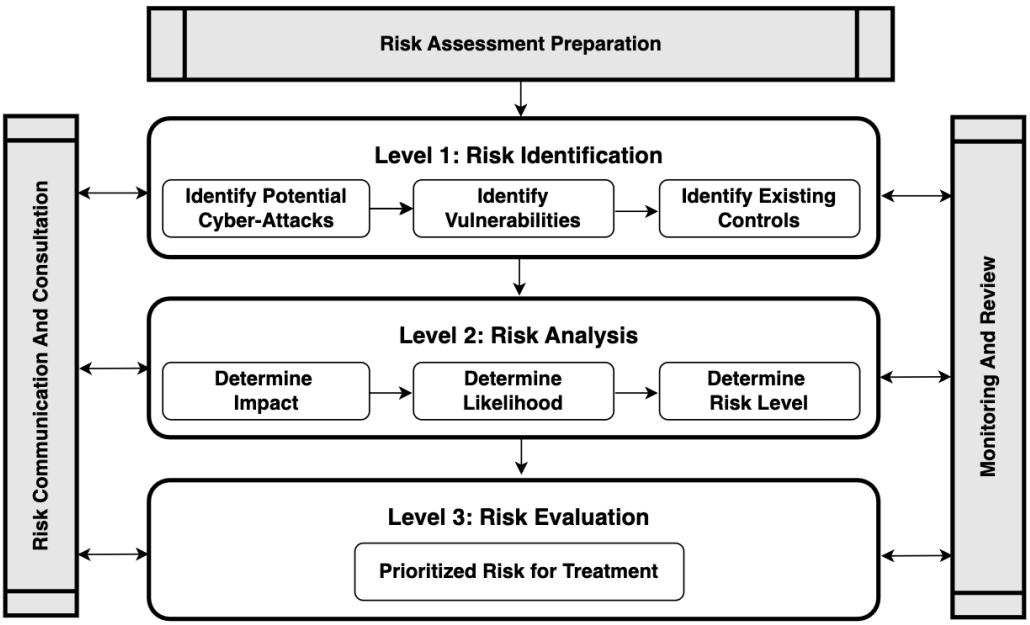

Fig. 5. Proposed Framework

4.2.1. Risk Assessment Preparation

Organisations should establish risk acceptance criteria before conducting a risk assessment (ISO/IEC 27005, 2022). These criteria help determine if a risk is acceptable. The risk acceptance criteria depend on the organization's policies, objectives and goals considering the aspects of business/service reputation, law, technology, finance, operations and social factors (Department of Prime Minister, 2024). Elmarady & Rahouma categorize risks into acceptable, tolerable, and intolerable levels (Elmarady & Rahouma, 2021). Acceptable risks require no further action, tolerable risks need some mitigation measures, and intolerable risks require immediate action to reduce the risk to a tolerable level. Therefore, the researchers proposed specific risk acceptance criteria as presented in Table 4 as guidance for organisations to determine the risk level.

Table 4: Proposed Risk Acceptance Criteria

Risk Level (Elmarady et.al,2021)		Details (Department of Prime Minister,2024)	Risk Acceptance Criteria (Elmarady et.al,2021)
Intolerable	3	Risks that have significant and immediate implications for the organization's functions, services and reputation and involve significant cost increases.	The cybersecurity risk index of the consequences is unacceptable. Immediate actions should be taken to mitigate the risk and reduce the cybersecurity risk index to a tolerable level
Tolerable	2	Risks that have moderate implications as well as additional costs to the organization's functions, services and reputation.	The risk level can be tolerated based on some risk mitigation measures
Acceptable	3	Risks that do not / less affect the organization's functions, services and reputation.	Risk Accepted. No further risk mitigation and control measures are required

4.2.2. Level 1 – Risk Identification

Risk identification aims to generate a list of risks based on those events that can prevent, affect or delay the achievement of cybersecurity objectives (ISO/IEC 27005, 2022). In an event-based approach, risks are identified and assessed by evaluating events and consequences, often determined through top management's concerns, risk owners, and organisational context (ISO/IEC 27005, 2022). Interviews with top management and responsible individuals help identify relevant events, consequences, and risk owners (ISO/IEC 27005, 2022). Elmarady & Rahouma identify potential cyber-attack scenarios that could harm an organisation's services, affecting integrity, confidentiality, and availability (Elmarady & Rahouma, 2021). NIST SP 800-30 states that threats to organisations or those directed through them are identified at the risk identification level (NIST SP 800-30, 2012). Thus, the researchers propose identifying potential cyber-attack scenarios at this stage.

4.2.2.1 Identify Potential Cyber-Attack Scenario

Event-based approaches identify potential cyber-attack scenarios by considering risk sources and their impact on organisations (ISO/IEC 27005, 2022). Both ISO/IEC 27005 and NIST SP 800-30 emphasise that identifying risk or threat sources helps recognise potential cyber threats. Therefore, the researchers suggest organisations identify risk sources based on the examples and typical attack methods from ISO/IEC 27005 as shown in Table 5.

Table 5: The Examples and Usual Methods of Attack by ISO/IEC 27005 (ISO/IEC 27005, 2022)

Risk Source	Examples and Usual Method of Attacks
State-related	States, intelligence agencies
	Method: Attacks generally conducted by professionals, working under a calendar and a method of attack that are predefined. This attacker profile is characterized by its ability to carry out an offensive operation over a long period of time (stable resources, procedures) and to adapt its tools and methods to the topology of the target. By extension, these actors have the means of purchasing or discovering 0-Day vulnerabilities and some are able to infiltrate isolated networks and to conduct successive attacks in order to reach a target or targets (e.g. by means of an attack aimed at the supply chain).
Organized crime	Cybercriminal organizations (mafias, gangs, criminal outfits)
	Method: Online scams or in person, ransom request or attack via ransomware, use of bot-nets, etc. Due in particular to the proliferation of attack kits that are readily available online, cybercriminals are conducting increasingly sophisticated and organized operations for lucrative or fraudulent purposes. Some have the means of purchasing or discovering 0-Day vulnerabilities.
Terrorist	Cyber-terrorists, cyber-militias
	Method: Attacks that are usually not very sophisticated but which are conducted with determination for the purposes of destabilization and destruction: denial of service (aimed for example at making the emergency services of a hospital centre unavailable, untimely shutdowns of an energy production industrial system), exploitation of vulnerabilities of Internet sites and defacement.
Ideological activist	Cyber-hacktivists, interest groups
	Method: The methods of attack and sophistication of the attacks are relatively similar to those of cyber-terrorists but are motivated by less destructive intentions. Some actors conduct these attacks in order to convey an ideology, a message (e.g. massive use of social networks as a sounding board).
Specialized outfits	"Cyber-mercenary" profile with IT capacities that are generally high from a technical standpoint. Because of this, it should be distinguished from script-kiddies with whom it shares however the spirit of a challenge and search for recognition but with a lucrative objective. Such groups can be organized as specialized outfits that propose veritable hacking services.
	Method: This type of experienced hacker is often at the origin of the designing and creating of attack kits and tools that are available online (possibly for a fee) which can then be used "turnkey" by other groups of attackers. There are no particular motivations other than financial gain.
Amateur	Profile of the script-kiddies hacker or who has good IT knowledge; motivated by the quest for social recognition, fun, challenge.
	Method: Basic attacks but with the capacity of use the attack kits that are available
Avenger	The motivations of this attacker profile are guided by a spirit of acute vengeance or a feeling of injustice (e.g. employee dismissed for serious fault, discontented service provider following a contract that was not renewed, etc.).
	Method: This attacker profile is characterized by its determination and its internal knowledge of the systems and organizational processes. This can make it formidable and provide it with substantial power to do harm.
Pathological attacker	The motivations of this attacker profile are of a pathological or opportunistic nature and are sometimes guided by the motive for a gain (e.g. unfair competitor, dishonest client, scammer, and fraudster).

	Method: Here, either attackers have a knowledge base in computing that leads them to attempt to compromise the IS of their target, or they use the attack kits available online, or decide to subcontract the IT attack by calling upon a specialized outfit. In certain cases, attackers can direct their attention to an internal source (discontented employee, unscrupulous service provider) and attempt to corrupt the latter.

4.2.2.2. Identify Vulnerabilities and Existing Controls

Cyber-attacks exploit a vulnerability of an asset or control to compromise the confidentially, integrity and/or availability of corresponding digital information. A vulnerability is a weakness in an asset or control that can be exploited by a risk source, leading to negative consequences (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022; NIST SP 800-30, 2012). Vulnerabilities can exist in governance structures, such as inadequate risk management strategies, poor communication, and misaligned enterprise architecture. They can also be found in external dependencies, mission processes, and security architectures (NIST SP 800-30, 2012).

Based on identified potential cyber-attacks and vulnerabilities, organisations should identify existing controls to avoid duplication and unnecessary costs (Department of Prime Minister, 2024). Reviewing these controls ensures they are effective. Therefore, the researchers suggest identifying vulnerabilities and existing controls in the risk identification phase.

4.2.3. Level 2 – Risk Analysis

Risk analysis aims to determine the risk level (ISO/IEC 27005, 2022). Activities in risk analysis involve determining impact, likelihood and risk level (Elmarady & Rahouma, 2021; ISO/IEC 27005, 2022; NIST SP 800-30, 2012).

4.2.3.1. Determine Impact

The impact of a threat event is the magnitude of harm from unauthorized disclosure, modification, destruction, or loss of digital information or service availability. Organisations assess impact based on loss value using a loss scale. ISO/IEC 27005 states that impact criteria should specify the damage or harm extent from loss of confidentiality, integrity, and availability of functions, missions, services, and data (ISO/IEC 27005, 2022). Elmarady & Rahouma rate impact on a five-point scale from high to low with descriptions of the impact on operations, services and reputation (Elmarady & Rahouma, 2021). The Department of Prime Minister rates impact on a five-point scale starting from very high, high, medium, low and very low (Department of Prime Minister, 2024) as shown in Table 6.

Table 6: Proposed Ratings of Impact

Scale	Impact Rating (Department of Prime Minister,2024)	Impact on Operations and Services (Elmarady & Rahouma, 2021)	Impact on Reputation (Elmarady & Rahouma, 2021)	Priority Level of Cybersecurity Incidents Handling (Department of Prime Minister,2022)
5	Very High	Serious impact where no operational services can be provided for an extended time period	The reputation cannot be recovered with stakeholders and the organization may not continue in its current form	If occur, priority level of cybersecurity incidents handling is 1
4	High	Major impact where a majority of operational services cannot be provided for some time	The reputation can be affected on capability to provide function services by the majority of the stakeholders	If occur, priority level of cybersecurity incidents handling is 1
3	Medium	Moderate impact where some operational services cannot be provided	The reputation can be affected on organization services and activities by a key stakeholder	If occur, priority level of cybersecurity incidents handling is 2
2	Low	Minor impact where some operational services are degraded	The reputation can be affected by the complaints of a key stakeholder on organization service and activities	If occur, priority level of cybersecurity incidents handling is 2
1	Very Low	Insignificant impact where operational services can be provided as usual	The reputation can be affected by the isolated compalints of individual stakeholder	If occur, priority level of cybersecurity incidents handling is 2

The Department of Prime Minister outlines two priority levels for cybersecurity incident management: Priority Level 1, which includes incidents with high impact on national defense, security, economic stability, reputation, government function, public health, safety, and privacy; and Priority Level 2 includes incidents other than priority level 1 and less impactful (Department of Prime Minister, 2022). The researchers propose incorporating these priority levels into the impact ratings, as demonstrated in Table 6, to aid organizations in accurately determining the impact rating.

4.2.3.2. Determine Likelihood

Likelihood is the chance of something happening (ISO/IEC 27005, 2022). After identifying risk scenarios, analyse the likelihood of each scenario using qualitative or quantitative techniques (ISO/IEC 27005, 2022). Findings from risks, vulnerabilities, and existing controls help in this analysis. Elmarady & Rahouma rate likelihood on a five-point scale with the frequency of occurrence of past similar attacks (Elmarady & Rahouma, 2021). The researchers proposed to rate likelihood based on the five-point scale as determined in the impact rating by the Department of Prime Minister (Department of Prime Minister, 2024) as shown in Table 7.

Table 7: Proposed Ratings of Likelihood

Scale	Likelihood Rating (Department of Prime Minister,2024)	Frequency of occurrence of past similar attacks (Elmarady et.al,2021)
5	Very High	At least once every two weeks
4	High	At least once every three months
3	Medium	Once every three months to a year
2	Low	Once every one to three years
1	Very Low	Once every three years or more

This scale is used to assess and prioritize risks based on their historical frequency, which in turn helps in the allocation of resources to mitigate such risks effectively.

4.2.3.3. Determine Risk Level

Based on the findings from the impact and likelihood assessment, organisations need to assess risk levels by considering (i) the potential impact and (ii) the probability of events (NIST SP 800-30, 2012). According to ISO/IEC 27005, a qualitative risk level matrix should align with the organisation's risk acceptance criteria (ISO/IEC 27005, 2022). Researchers propose determining risk level, *r*, as follows, where *L* is the likelihood scale (1-5) and *I* is the impact rating:

$$r = L\ x\ I$$

Elmarady & Rahouma suggest converting *r* into a qualitative term, *R*, to assess cybersecurity risk tolerability and apply necessary mitigation measures (Elmarady & Rahouma, 2021). The conversion formula is:

$$R = \begin{cases} intolerable, & r \geq 15 \\ tolerable, & 15 > r \geq 5 \\ acceptable, & r < 5 \end{cases}$$

The researchers adapted the cybersecurity risk matrix from Elmarady & Rahouma in which the risk index with acceptable levels is shown in light green, while tolerable levels is shown in yellow and intolerable is shown in red (Elmarady & Rahouma, 2021) as presented in Table 8.

Table 8: Cybersecurity Risk Matrix

Risk Level (*r*)	**Impact (I)**				
Likelihood (L)	Very Low	Low	Medium	High	Very High
Very Low	1	2	3	4	5
Low	2	4	6	8	10
Medium	3	6	9	12	15
High	4	8	12	16	20
Very High	5	10	15	20	25

The researchers adopted the conversion of risk level, *r*, into an equivalent five-point scale from Elmarady & Rahouma as presented in Table 9 (Elmarady & Rahouma, 2021).

Table 9: Five-point scale of risk level (Elmarady & Rahouma, 2021)

Risk Level (r)	**Tolerability of risk (R)**	**Five-point scale of risk level**
$\boldsymbol{r \geq 20}$	$intolerable$	5
$\boldsymbol{20 > r \geq 15}$	$intolerable$	4
$\boldsymbol{15 > r \geq 10}$	$tolerable$	3
$\boldsymbol{10 > r \geq 5}$	$tolerable$	2
$\boldsymbol{r < 5}$	$acceptable$	1

Intolerable risk includes any level $r \geq 15$. Both $r \geq 20$ and $20 > r \geq 15$ are intolerable, scored as 5 and 4 on the five-point scale. Tolerable risk falls between $15 > r \geq 5$, with $15 > r \geq 10$ and $10 > r \geq 5$ corresponding to 3 and 2. Acceptable risk, $r < 5$, is rated as 1. Higher numerical values indicate less tolerable risks, with 5 being intolerable and 1 acceptable.

4.2.4. Level 3 – Risk Evaluation

Risk evaluation compares risk analysis results with risk criteria to determine if a risk is acceptable or tolerable (ISO/IEC 27005, 2022). Applying risk acceptance criteria (Table 1) is essential in this process. Risk evaluation uses insights from risk analysis to recommend actions, focusing on the need for risk mitigation and prioritizing risks based on their level (ISO/IEC 27005, 2022).

4.2.5. Risk Communication and Consultation

Risk Communication and Consultation are continuous, iterative processes for sharing information and engaging with stakeholders on risk management (ISO/IEC 27005, 2022). NIST SP 800-30 emphasizes their importance for ensuring accurate risk assessment inputs, utilizing intermediate results, and providing meaningful inputs for risk response in the risk management process (NIST SP 800-30, 2012). The researchers suggest the process of risk communication and consultation is carried out throughout the risk assessment involving the three main stages.

4.2.6. Risk Monitoring and Maintenance

Potential cyber-attacks, vulnerabilities, existing controls, impact, likelihood, and level of risk are constantly changing, requiring continuous monitoring. According to NIST SP 800-30 maintaining risk assessments involves (NIST SP 800-30, 2012):

- Monitoring identified risk factors and understanding changes; and
- Updating risk assessment components based on monitoring activities.

ISO/IEC 27005 defines monitoring risk-related events using indicators from strategic scenarios, prioritizing events by consequence magnitude and likelihood (ISO/IEC 27005, 2022). Therefore, organisations should regularly review Potential cyber-attacks, vulnerabilities, existing controls, impact, likelihood, and level of risk.

4.2.7. Example of a complete risk assessment (Levels 1 to 3)

Table 10 presents the example of a complete risk assessment of level 1 to 3 of an organisation.

Table 10: Example of a complete risk assessment of levels 1 to 3

LEVEL 1 : RISK IDENTIFICATION			LEVEL 2 : RISK ANALYSIS					LEVEL 3: RISK EVALUATION
Potential Cyber Attack	Vulnerabilities	Existing Control	Impact (*I*)	Likelihood (*L*)	Risk Level (r = *I* x *L*)	Tolerability of Risk	Five-point Scale of Risk Level	
DOS/DDOS	Volumetric Vulnerabilities	deploying firewalls	Medium-High	Low	4	Acceptable	1	No further risk mitigation and control measures are required
		network segmentation						
		intrusion detection systems						
	Protocol Vulnerabilities	using secure protocols						
Website defacement	No web application firewalls (WAFs)	using web application firewalls (WAFs)	Medium-Low	High	10	Tolerable	3	The risk level can be tolerated based on some risk mitigation measures
	Server Misconfiguration	conducting security audits						
	User Authentication Vulnerabilities	penetration testing, code review						
	SQL Injection Vulnerabilities							
	Cross-Site Scripting (XSS) Vulnerabilities							
	Remote File Inclusion (RFI) Vulnerabilities							
	Outdated Software	regular updates to software						
Ransomware, Data breach	Server Misconfiguration	conducting security audits	High	Medium-High	20	Intolerable	5	Immediate actions should be taken to mitigate the risk and reduce the cybersecurity risk index to a tolerable level
	User Authentication Vulnerabilities	penetration testing, code review						
	SQL Injection Vulnerabilities							
	Cross-Site Scripting (XSS) Vulnerabilities							
	Remote File Inclusion (RFI) Vulnerabilities							
	absence of a robust data backup strategy	implement regular data backup strategy						
	Outdated Software	regular updates to software						
Phishing emails	lack of effective email filtering	strengthen the email filtering configuration - block phishing email	Medium-Low	High	10	Tolerable	3	The risk level can be tolerated based on some risk mitigation measures
Email spoofing	less awareness on email spoofing	monthly regular awareness						
Brute force system access	Weak password	strong password policies						
	No input validtion	provide input validation						
Trojan, Worms, Botnet	outdated software	regular updates to software	Medium-Low	High	10	Tolerable	3	The risk level can be tolerated based on some risk mitigation measures
	lack of effective email filtering	strengthen the email filtering configuration - block phishing email						
	insecure credential management	secured credential management						
Malware hosting	outdated software	regular updates to software	Medium-High	Low	4	Acceptable	1	No further risk mitigation and control measures are required
	lack of effective email filtering	strengthen the email filtering configuration - block phishing email						
	insecure credential management	secured credential management						
Directory listing	improper web server configurations	secured web server configurations	Low	Medium-Low	2	Acceptable	1	No further risk mitigation and control measures are required

5. CONCLUSION

In conclusion, as the digital landscape continues to evolve and cyber threats become more sophisticated, it is imperative for organizations to adopt a more dynamic and responsive approach to cybersecurity risk assessment. While the traditional asset-based approach has been widely used, it may not fully capture the complexities of modern cyber risks. This study highlights the benefits of an event-based approach, which focuses on identifying and evaluating specific cyber incidents and their potential impacts on an organization's operations and data integrity. By synthesizing existing frameworks from ISO, NIST, and academic research, this paper provides a comprehensive framework for implementing event-based cybersecurity risk assessments. Adopting this approach can enhance an organization's ability to anticipate, prepare for, and respond to cyber threats, thereby strengthening overall cybersecurity posture. Future research could be expanded by evaluating the approaches in specific sectors with unique cybersecurity challenges contributing to the enhanced cybersecurity posture of organisations.

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WOMAN HIJAB DETECTION USING TRANSFER LEARNING

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ABSTRACT: Person clothing is considered one of many important issues related to Islamic rulings (Sharia). One of these issues is the woman dress where an Islamic woman is required to keep consistent wearing of Hijab (veils) when she is outside. Based on Sharia and most of Islamic scholars, Hijab must cover woman's hair, ears, and neck along with the top of chest. Classifying woman images into one who wearing Hijab or not can be significantly facilitated using the current approaches of deep learning. In this paper we proposed a structured method consisting of multiple steps for accurately classifying women's images into Hijab and Non-Hijab by utilizing transfer learning approach of deep neural networks. We initially created a balanced and labeled dataset that includes 12,000 images from multiple sources, one half of the dataset for women wearing Hijab and the other for women not wearing Hijab. The dataset is then preprocessed for normalization techniques. After that we used three well-known pretrained models of transfer learning which are VGG16, Xception and MobileNetV2 to conduct our experiments. The feature extraction and fine-tuning strategies were used for examining the models. The selected models gave better performances when applying fine-tuning strategy where the accuracies values of 96.85%, 97.6% and 96.3% were achieved for VGG16, Xception and MobileNetV2 respectively. Our results proved the capability of transfer learning in detecting Hijab in women's images in order to help individuals, institutions and others who are interested in Islamic dress.

KEY WORDS: *Hijab, Deep Neural Networks, VGG16, Xception, MobileNetV2*

1. INTRODUCTION

People across societies have always cared about clothing to enhance their look and appearance. Further, clothing can be semantically analyzed to forecast human's dress style, characteristics and profession (Malisiewicz et al., 2011). However, the shape, style and what parts of the human body the clothes cover are affected by the commitment of Islamic rulings (Sharia). Based on Sharia, and most of Islamic scholars, a woman must not show her body parts in public (outdoor) except her face and palms. Therefore, she is required to wear Hijab (veil) that covers her hair, ears, neck and the top part of her chest.

The classification of women's images into Hijab and Non-Hijab classes has significant needs for individuals, institutions and others in Islamic societies. This classification process can be significantly simplified by computer vision approach which is an important field of deep learning. Additionally, applying convolutions

through deep learning layers give better input transformations in producing considerable spatial features and knowledge for images.

Further, the availability of deep learning models that pretrained previously on very large dataset (e.g. ImageNet) gives the researchers and practitioners the capability for transferring features learned by these models to other novel computer vision problems especially when using smaller datasets (Chollet & Chollet, 2021). There are various deep learning models available in literature for transfer learning that mostly applied the concepts of convolutional neural networks (ConvNets).

Although there are significant studies found in the literature for the use of transfer learning for computer vision problems in the domain of human apparel, fewer have addressed veiling practices. To the best of our knowledge, no prior study has applied transfer learning specifically to the detection of hijab by classifying images of women into Hijab and Non-Hijab classes.

In this paper we used three well-known models which are VGG16, Xception and MobileNetV2 for classifying women's images into Hijab and Non-Hijab classes. The results showed that the selected models provide significant performances in the classification problem of this study. Additionally, the results showed the capability of transfer learning in providing good solutions for handling this novel computer vison problem. The results also help interested institutions and individuals in determining if a woman wears a hijab or not.

The rest of the paper is organized as follows: the related work is provided in Section 2. Section 3 introduces the designed method regarding the transfer learning approach and the strategies used. The experimental results and discussion are drawn in Section 4. Threats to validity are provided in Section 5. Section 6 concludes the paper and recommends for future work directions.

2. Related Work

Clothing and attire in images of people have attracted the interest of many researchers. For instance, Zhao (2001) built a vison system that is able to detect people in different shapes, sizes and clothing, whilst Liang et al. (2016) developed a clothing co-parsing system (CCP) for parsing clothing images into semantic configurations. Their system performs two main steps. In the first step which is called "image cosegmentation" it applies an exemplar-SVM approach to segment the images into refined regions, and in the second step which is called "co-labeling" the system applies a Graph Cuts algorithm to combine clothing configuration into the segmented regions. Additionally, Usmani et al. (2022) developed a framework for clothing segmentation by utilizing the feature and fusion extraction modules. They used Mask Region Convolutional Neural Network (RCNN) for extracting low-level features and used InceptionV3 for extracting high-level features. Both levels are fused by fusion module to improve clothing segmentation performance.

With regard to veil-related research such as studies on face masks, Almghraby & Elnady (2021) proposed a method for detecting face mask in real-time using MobileNetV2, while Rokhana et al. (2021) applied MobileNetV2 for classifying images to detect if the face mask is properly used or not.

With regard to the effect of veils in image processing, Sikandar et al. (2017) used RGB and YCbCr color spaces to analyze face skin with Hijab and Niqab (a

veil that mostly covers the whole face except the two eyes). The authors found that YCbCr is more suitable in detecting the skin and non-skin areas when the fabric color is different from the skin tone.

In the context of research related to Hijab, Nugraha & Nasrudin (2015) utilized the approach of augmented reality for displaying hijab that virtually best fit to Islamic woman face. They applied both face and mask detection techniques. On the other hand, Oktavianti et al. (2016) built a prototype for creating a hijab model that conforms to a person face type and obeys to Sharia as well. They applied a classification process based on canny operator and matching correlation template for defining the type of face. The satisfaction of the prototype results is evaluated by analyzing users' responses which are collected via a questionnaire.

Khaliluzzaman et al. (2017) applied parallel processing approaches in the images of women to detect hijab and define if it is *Shar'i Hijab* or not where Shar'i is a known style of clothing worn by Indonesian Muslim women. To reduce the time of image processing, the authors utilized the CUDA platform developed by Nvidia that lets professional programmers to easily apply the concepts of parallel computing in Graphical Processing Unit (GPU) processor. They also applied the artificial neural network approach using Yolo feature to quickly and accurately detect objects in images.

Madkour et al. (2019) developed a model that applied fully convolutional network to segment a woman image into three semantic regions which are skin, hijab (veil) and background.

Cholissodin et al. (2020) proposed a framework including multiple steps for detecting hijab in images. They initially utilized the Viola-Jones cascade classifier to detect the regions of face and eyes of the person. Then they used the YCbCr color model to extract the surrounding face region. After that, the bounding box of the eyes region is used to detect the hair and neck. Finally, the hijab is detected based on the cover of hair and neck.

Based on the previously stated literature review, there is no such study found in the literature that applies the transfer learning for classifying women's images into Hijab and Non-Hijab classes. Therefore, this study is performed to demonstrate the capability of three different models in detecting hijab in women's images.

3. Designed Method

To achieve the objective of this paper, a structured methodology that adopts the approach of transfer learning is proposed. As shown in Fig. 1, our proposed methodology includes four main steps, which are data collection and preparation, data preprocessing, examining pretrained models with two strategies, and models evaluation and results analysis.

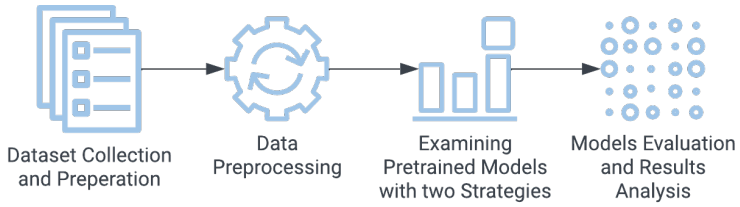


Fig. 1. Main steps of the adopted methodology

3.1. Dataset Collection and Preparation

We collected the data using two main sources. We used the “Hijab dataset” published by Najamudin Ridha (2020) as the main source that includes 10,000 images, one half of them labeled as Hijab images and the second half labeled as Non-Hijab images. An additional 2,000 images were added to the dataset, which were sourced from the Internet. These images have different characteristics than those found in the main source. Typically, 1,000 of them are Hijab images where 800 images have different backgrounds and the remaining 200 images are of women wearing niqab (where most of the head is covered except the two eyes). The other 1,000 images are Non-Hijab images with different backgrounds, other clothing situations like a woman wearing a hat or scarf. Additionally, some of the 2,000 images includes other situation such as a woman rises her hand close to head, face or neck regions. Eventually, our constructed dataset is balanced and includes 12,000 images; 6,000 for Hijab class and 6,000 for Non-Hijab class. It is noteworthy that the regions of interest in the images for the potential experiments are the head, face, neck and top of chest.

3.2. Data Preprocessing

Some preprocessing on the dataset images is performed. Each image in the dataset is resized to 224 X 224 scale so the images can be easily fed to the selected pretrained models. Additionally, each image is rotated by 90 degrees and its brightness is adapted while keeping the original colors of each image. A sample images from the dataset after preprocessing is provided in Fig. 2.

Fig. 2. Sample images from dataset after preprocessing step

3.3. Examining Pretrained Models with Two Strategies

In this study the concept of transfer learning is adopted for detecting hijab in women's images. Next, we provide the concepts and background of convolutional neural networks, transfer learning, the selected pretrained models and the strategies used.

3.3.1. Convolutional Neural Network

Convolutional neural network is a type of deep learning models that used commonly in computer vision field. It is also known as ConvNet and CNN. ConvNet is preferred over dense (fully connected) network for classifying images because it has the ability of preserving the spatial information and relationships of an image during data transformation of the learning process.

The ConvNet consists mainly of three types of layers which are convolutional, pooling and fully connected layers. It starts with a convolutional layer, followed by alternating convolutional and pooling layers, and ends up with one or more of fully connected layers. The core processing of a ConvNet is done by the convolutional layer. This layer takes an input, such as an image, and uses a filter (kernel) to detect features from a specific part (location) of this input to produce a vector of feature map. This process is called convolution, and it is repeated for the other input parts by moving the filter with a distance called a stride to finally produce a stack of feature maps. The convolution is often characterized by two main parameters; the size of the filter that is called a window, for example 3 X 3 or 5 X 5, and the depth of the feature map which is represented by the number of filters, for example 32 or 64. The pooling layer accesses the entire input and always applies one of the two types of aggregation, which are max pooling or average pooling, in order to produce an output vector. The fully connected layer is used to produce the predictions of the model based on the preceding transformations of the network. The earlier convolutional layers always use filters to learn easier and general features, while the later layers learn more sophisticated and more specific features (Chollet & Chollet, 2021; Kapoor et al., 2022).

3.3.2. Transfer Learning Using Pretrained Models

A pretrained model is a model that was previously trained on some specific deep learning task (e.g. classification task) using a very large dataset such as ImageNet which consists of 1.4 million of images labeled within 1,000 different classes. The hierarchy of features learned works as a generic model that can be effectively used in a novel computer vison task, although this novel task has different number and type of classes other than those learned originally.

We adopted two strategies (Chollet & Chollet, 2021) for applying the pretrained images, which are extracting features from pretrained model, and fine-tuning of pretrained model, which are explained in the following subsections.

3.3.3. Extracting Features from Pretrained Model

The pretrained model is mainly used for extracting the features learned from previously training task of classification in order to be reused for a new problem. Practically, it consists of two main parts, the first part is called the base convolution that consists of mostly multiple alternating convolutional and pooling layers. The second part that followed the first one in processing, consists of a fully connected classifier. In this strategy the base convolution part is executed over the dataset at

hand in order to extract features, knowledge and data representations that previously learned from previous classification problem, then applying a complete new training with a suitable added fully connected classifier to produce the classification predictions.

3.3.4. Fine-tuning of Pretrained Model

In this strategy, some of the deeper (top) layers of the pretrained model especially the convolutional layers are unfrozen in order to be retrained on the dataset at hand. Deeper layers always are unfrozen because these layers hold more specific features while the earlier layers hold more general ones. In other words, while the network gets deeper and deeper, it moves from holding more general features to more specific features. So, it is not convenient to unfreeze and retrain the earlier layers because this will not produce considerable transformations from smaller dataset with comparison to the previously obtained from huge dataset. In this strategy, a newly customized fully connected layer is added and trained with the previously (already) trained base convolutional layer of the model without freezing the layers, then unfreeze few layers from the base convolutional alongside the customized added one in order to retrain the whole model on the new dataset. It is necessary to train the model with the customized layer before implementing the unfreezing process to avoid destroying the pretrained transformations of the model. It is noteworthy that this strategy implicitly includes the concepts of feature extraction strategy in addition to the capability of added customized layers.

3.3.5. The Selected Pretrained Models

A three well-known pretrained models were selected to achieve the objective of this study, which are VGG16, Xception and MobileNetV2. It is worthy to note that all of these models were trained on the well-known huge dataset, ImageNet. In the following subsections we provide an explanation for each of the selected models.

VGG16

The architecture of VGG16 was created by Simonyan & Zisserman (2014) and consisted of 16 layers that are distributed into 5 blocks. Each block includes two adjacent 2D convolutional layers followed by one pooling layer, except the fifth block that includes three 2D convolutional layers instead of two. It is noteworthy that the layers explained here are the parameterized layers holding weight and known as activation layers. Nonetheless there are other types of layers such as pooling layers.

Xception

Xception is an “Extreme” form of the Inception model that applies the technique of depthwise separable convolution. Using this technique, the convolution layer achieves spatial convolution for every channel (e.g. 3x3) on its input separately then concatenating them by pointwise convolution layer to produce 1x1 convolution. Additionally, Xception applies the idea of residual networks (ResNet) by which the output of earlier layers can be forwarded and fed fast to the deeper layers. This idea is also called fast-forward/skip connections technique and it is used to reduce gradient explosion and dying of the deeper networks.

MobileNetV2

MobileNetV2 is a lightweight deep learning network built mostly for mobile devices because of their limitation in memory size (capacity) and processing efficiency. It also applies the separable depthwise convolution technique explained previously. To reduce the heavyweight of deep learning structure, MoblieNetV2 applies the inverted residual technique. By applying this technique, the skip-connected channels become smaller and as a result a reduction is performed in layers parameters.

3.4. Models Evaluation and Results Analysis

We evaluated the performances of the selected models int terms of precision, recall, F1-score and accuracy. Precision (P) is calculated using the ratio of: $P = (\frac{TP}{TP+FP})$, where TP is the number of input instances (images) that correctly predicted to the class whereas FP is the number of input instances that predicted incorrectly and actually belongs to the other class. Precision is important for reducing the FPs.

Recall(R) is calculated using the ratio of: $R = (\frac{TP}{TP+FN})$, where FN are the number of input instances that incorrectly classified to the other class but actually belongs to the current class of input images. Recall is always used to reduce the FNs.

F1-score (F1) is calculated using the formula of: $F1 = (\frac{2\times TP}{8\times TP+FP+FN})$, which is the harmonic mean of precision and recall.

Accuracy (A) is calculated using the formula: $A = (\frac{TP+TN}{TP+TN+FP+FN})$, which represents the ratio of the total number of input instances of images that predicted correctly to the total number of instances that predicted correctly and incorrectly.

4. Experimental Results

We experimented three pretrained models on a balanced and labeled dataset consisting of 12,000 images, 6,000 images for women wearing hijab and the other 6,000 images for women not wearing hijab. The dataset was split into approximately 67%, 16.5% and 16.5% for training, validation and testing as shown in Table 4. Typically, we experimented the VGG16, Xception and MobileNetV2 models by applying both feature extraction and fine-tuning strategies.

Table 4: The distribution of the experimented dataset

Total	Training	Validation	Testing
12,000	8,044	1,978	1,978

4.1. Conducting experiments and analyzing results

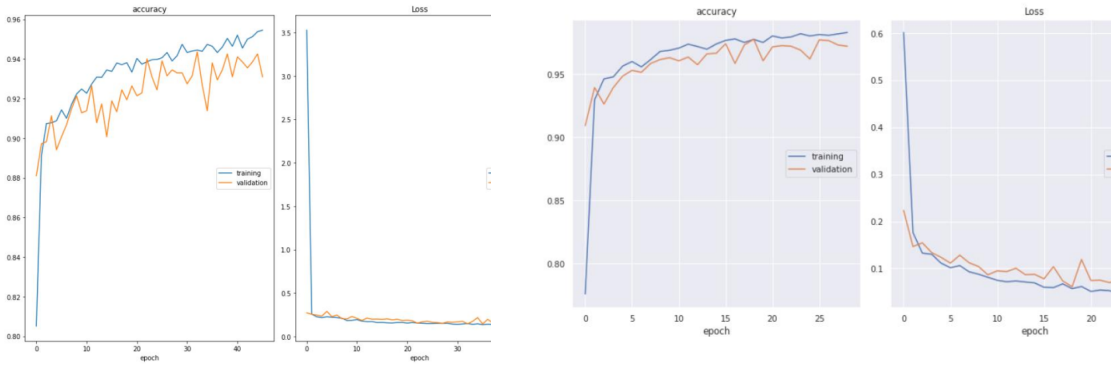
For applying both strategies in each model, we added a fully connected block on the top (end) of the model that consists of two dense layers with 4,096 and 1,024 nodes respectively, followed by a dropout layer that set to 0.25, and finally an output layer that consists of only one node that set to sigmoid activation function to appropriately classify the input to one of two classes.

Regarding the fine-tuning strategy, unfreezing blocks is applied as follows: block 5 (layers 15 to 18) in VGG16 model, blocks 11 to 16 (layers 98 to153) in

MobileNetV2 model, and blocks 13 and 14 (layers 116 to 131) in Xception model. It is noteworthy that the number of layers here are all the types of layers including activation (parameterized) and non-activation layers as built by Keras library.

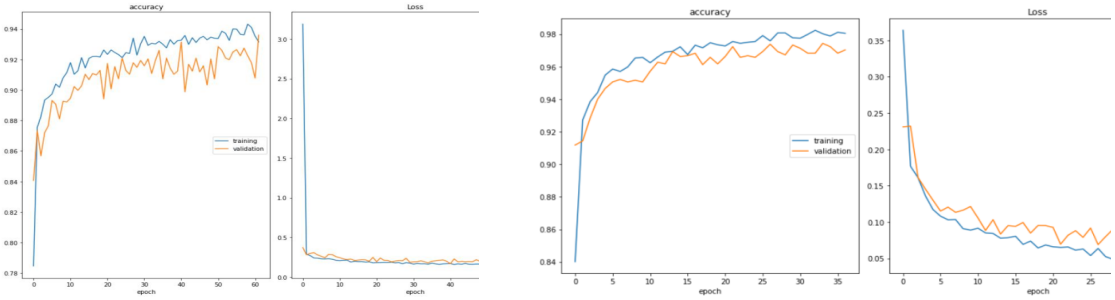
Each model is compiled using Adam optimizer and binary entropy loss function and fitted using 64 epochs. Practically, we used the approach of early stopping to improve model generalization. Early stopping is mostly used for reaching the best fit boundary between underfitting and overfitting. This situation obtained when reaching several epochs (iterations) by which there is no further increase in accuracy nor decrease in loss. Fig. 3, Fig. 4, and Fig. 5 depict the curves of accuracy and loss reached for each model when applying both training strategies. Table 5 summarizes the final number of epochs reached when the best maximum (Max) accuracy and minimum (Min) loss are obtained on the validation portion of the dataset, and the time taken by the model to reach these values. The starting (Min) values of accuracies and starting (Max) values of losses are also shown in the table.

It is noteworthy that the pretrained models were downloaded from Keras library and the code was run on Google Collab using Python 3.6 version utilizing the GPU processor.



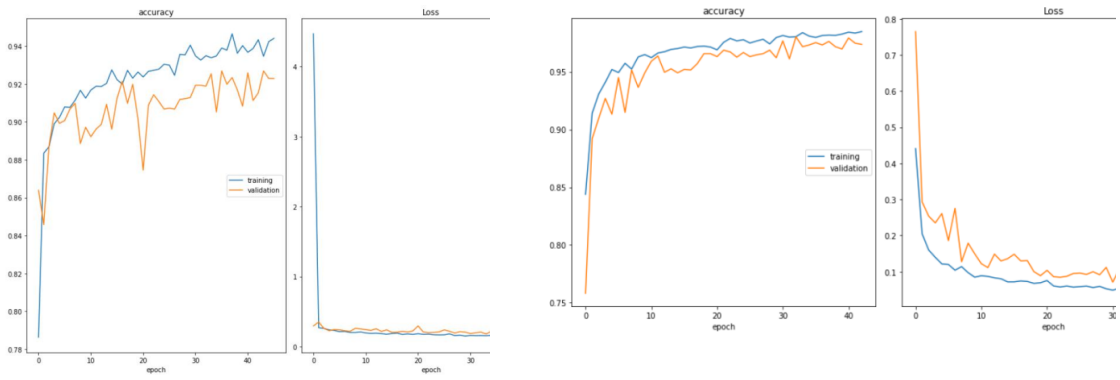
(a) **(b)**

Fig. 3. Accuracy and loss per epoch for VGG16 model with a) Feature extraction, b) Finetuning



(a) **(b)**

Fig. 4. Accuracy and loss per epoch for Xception model with a) Feature extraction, b) Finetuning



(a) **(b)**

Fig. 5. Accuracy and loss per epoch for MobileNetV2 model with a) Feature extraction, b) Finetuning

Table 5: Results summary of applying early stopping technique for experimenting pretrained models

	Feature Extraction				Finetuning			
	Time Taken (m)	**Number of Epochs**	**Min-Max Accuracy**	**Max-Min Loss**	**Time Taken (m)**	**Number of Epochs**	**Min-Max Accuracy**	**Max-Min Loss**
VGG16	180	45	0.88-0.95	3.53-0.12	90	30	0.91-0.97	0.60-0.05
Xception	180	60	0.84-0.94	3.19-0.14	145	40	0.91-0.97	0.36-0.05
MobileNetV2	210	45	0.85-0.93	4.47-0.14	180	42	0.76-0.97	0.44-0.04

The detailed classification results as achieved by the examined models are shown in

Table 6 and Table 7 when applying the feature extraction and finetuning strategies respectively.

Table 6: Performance of three pretrained models using feature extraction strategy

	VGG16		**Xception**		**MobileNetV2**	
	Hijab	Non-Hijab	Hijab	Non-Hijab	Hijab	Non-Hijab
Precision	0.9344	0.9680	0.9250	0.9861	0.9296	0.9626
Recall	0.9668	0.9320	0.9870	0.9200	0.9640	0.9270
F1-Score	0.9509	0.9491	0.9550	0.9519	0.9465	0.9444
Accuracy	0.9500		0.9535		0.9455	

Table 7: Performance of three pretrained models using fine-tuning strategy

	VGG16		Xception		MobileNetV2	
	Hijab	Non-Hijab	Hijab	Non-Hijab	Hijab	Non-Hijab
Precision	0.9689	0.9671	0.9675	0.9847	0.9705	0.9557
Recall	0.9670	0.9690	0.9850	0.9670	0.9550	0.9710
F1-Score	0.9680	0.9680	0.9762	0.9758	0.9627	0.9641
Accuracy	0.9685		0.9760		0.9630	

Although remarkable performances results were achieved, it is clear that the fine-tuning strategy gave slightly better performances than the feature extraction strategy. The best accuracy results obtained are 97.6%, 96.85 and 96.3 for Xception, VGG16 and MobileNetv2 models respectively when adopting fine-tuning strategy as shown in Table 4. Additionally, it is obvious that all models produced better results for all metrics when implementing the fine-tuning strategy except for the VGG16 precision value when classifying Non-Hijab class (shown in Italic format in Table 4).

Moreover, significant improvements were performed in the recall measurements for the Non-Hijab class. This ensures that adopting the fine-tuning strategy minimizes the incorrectly predictions of Non-Hijab images to other class (Hijab).

By comparing the performances of the three examined pretrained models, the Xception model performs slightly better than both VGG16 and MobileNetV2 model. The VGG16 also slightly outperforms the MobileNetV2 model.

4.2. Testing the models with real life images

To prove the effectiveness of the examined pretrained models, we tested them with new samples that were not seen in the original experimented dataset. A collection of new 60 real-life images, 30 for Hijab class and 30 Non-Hijab class were used in the testing process. Table 8 summarizes the results.

Table 8: Results of testing models using two strategies with new real-life samples

	Feature Extraction		Finetuning	
	Hijab	Non-Hijab	Hijab	Non-Hijab
VGG16	26	27	27	30
Xception	28	29	29	29
MobileNetV2	28	30	28	29

The comparison of our results to the other results found in the literature is not provided due to the differences on the datasets used and, to the best of our knowledge, no such classification problem has been addressed for detecting the Hijab in the women's images through transfer learning with the three well-known models examined in this paper.

5. Threats to Validity

This section provides the threats of validity of this research concentrating on the most important limitation.

1. This study used transfer learning approach for classifying women's images into Hijab and Non-Hijab classes. To lessen bias results due to using only

one model, we used three various models including the older one named VGG16, and the newer two models named Xception and MobileNetV2 where the later was built dedicatedly for mobile devices.

2. Although the transfer learning models provide a good classification technique for novel problems with small-sized datasets, a considerable large dataset including 12,000 images was used in order to not negatively affect the results obtained from applying the strategies of transfer learning especially fine-tuning.
3. To ensure that the classification results are not prone to overfitting, we used part of the dataset including new images (that were not used in model training) for testing the selected models.
4. Although the study showed results with very good performances in classifying women images into Hijab and Non-Hijab classes, it does not provide an approach for detecting whether the Hijab obeyed Sharia, as defined by Islamic rulings and scholars.

6. Conclusion and Future Work

In this paper, we used the approach of transfer learning provided by pretrained models for classifying women's images into Hijab and Non-Hijab classes. We created a dataset of 12,000 women's images to evaluate three well-known pretrained models which are VGG16, Xception and MobileNetV2. Both feature extraction and fine-tuning strategies were applied in performing the experiments on the created dataset where outperforming results were obtained. The examined pretrained models were evaluated in terms of precision, recall, F1-score and accuracy metrics where outperforming results were obtained when applying both strategies. However, the results showed that the fine-tuning strategy performs slightly better than feature extraction in the classification problem. When comparing the results of the three selected pretrained model, it is found that the Xception model outperforms the other two models.

For future work, a larger dataset can be used in addition to experimenting more pretrained models. The issue of detecting the *Shar'i Hijab* can be also examined.

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