Sustaining Digital Assets Through Mobile Estate Planning

الحفاظ على الأصول الرقمية من خلال التخطيط العقاري عبر الهاتف المحمول

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Abstract

Many people own online accounts, with some having financial values like Internet banking, e-wallet and cryptocurrency. In the case of sudden death, their heirs are unaware of the digital assets possessed by the deceased person, which causes the assets to be lost forever, and the heirs might not receive the assets. If an estate plan did not account for digital assets properly, the beneficiaries would not be able to access them. Therefore, this paper addresses this issue by implementing a software development approach in designing a suitable model for sustaining digital assets through smartphones to allow the inheritance of digital assets to the heirs. The software development life cycle was adopted as the methodology to identify the model's components through four phases: requirements analysis, system design, implementation and test and evaluation. First, this work proposed a model named Mobile Estate Planning for Digital Assets (MEPDA). Second, the study demonstrated the component of the model in a smartphone application, and finally, it was tested and evaluated through a usability study with a group of users. Most users suggested that MEPDA is useful and easy to use. Further, they were also satisfied with its functionalities and features. Mobile application for digital asset estate planning is necessary today due to the exponential increase of digital asset ownership with financial values. It could be one way of

helping users to allow an efficient inheritance process for their heirs in the case of death.

Keywords: Estate Planning, Digital Asset, Digital Asset Inheritance, Digital Asset Management, Mobile Applications

ملخص

يمتلك العديد من الأشخاص حسابات عبر الإنترنت، حيث يمتلك البعض منها قيمًا مالية مثل البنوك الإلكترونية، والمحافظ الإلكترونية، والعملات المشفرة، في حالة الوفاة المفاجئة، يكون الورثة غير مدركين للأصول الرقمية التي يمتلكها الشخص المتوفى، مما يتسبب في فقدان الأصول إلى الأبد، وقد لا يتلقى الورثة الأصول. إذا لم يأخذ تخطيط العقار الأصول الرقمية في الاعتبار بشكل صحيح، فلن يتمكن المستفيدون من الوصول إليها. لذلك، تعالج هذه الورقة هذه المشكلة من خلال تنفيذ نهج تطوير البرمجيات في تصميم نموذج مناسب للحفاظ على الأصول الرقمية عبر الهواتف الذكية للسماح بوراثة الأصول الرقمية للورثة. تم تبني دورة حياة تطوير البرمجيات كمنهجية لتحديد مكونات النموذج من خلال أربع مراحل: تحليل المتطلبات، تصميم النظام، التنفيذ والاختبار والتقييم. أولاً: اقترحت هذه الدراسة نموذجًا باسم التخطيط العقاري (MEPDA) للأصول الرقمية عبر الهاتف المحمول. ثانيًا: أظهرت الدراسة مكونات النموذج في تطبيق الهاتف الذكي، وأخيراً تم اختباره وتقييمه من خلال دراسة استخدام مع مجموعة من المستخدمين. اقترح معظم المستخدمين أن (MEPDA) مفيد وسهل الاستخدام. بالإضافة إلى ذلك كانوا راضين يضًا عن وظائفه وميزاته. يعد تطبيق الهاتف المحمول لتخطيط العقارات للأصول الرقمية ضروريًا اليوم نظرًا للزيادة الكبيرة في ملكية الأصول الرقمية ذات القيم المالية. يمكن أن يكون هذا أحد الطرق لمساعدة المستخدمين على السماح بعملية توريث فعالة لورثتهم في حالة الوفاة

الكلمات المفتاحية: التخطيط العقاري، الأصول الرقمية، وراثة الأصول الرقمية، إدارة الأصول الرقمية، التطبيقات المحمولة.

Introduction

The advancement in Internet technology has made digital communication part of people's lifestyles, creating various forms of digital assets in cyberspace. They comprised valuable data in emails, social media content, websites, blogs, content in the cloud, and electronic wallet (Ifediora, 2022; Schreiber, 2021; Singh, *et al*. 2022), to name a few. A digital asset is anything in digital form that can generate value (Bolshakov, *et al.* 2021). They are files created electronically as data on a digital storage drive or a computer, such as bank account details, cryptocurrencies, insurance

information, company or business management details, and social media accounts (Hopkins, 2013b).

Consider a YouTube channel owned by Internet celebrities or influencers that generated millions of income; what would happen to the channel if the owners passed away? Another example of cryptocurrencies developed on blockchain technology (Katuk, 2019) are digital assets claimed to be secure financial technology; however, in terms of inheritance, it has no apparent means of doing it. The transfer of ownership and inheritance of digital assets is primarily neglected and does not receive attention from the research community (Singh, *et al.* 2022).

Like physical assets, digital assets should be able to transfer ownership to someone else via purchase, gifting, or other means, as well as the value the item can bring. Every day, more and more services are being digitalised, forcing people to subscribe or create credentials to access them. Consequently, we hold an increasing number of data forming our digital assets. Indirectly, it leads to issues of digital asset management, like credentials management, security of the data and inheritance of the assets in the case of death. Like other assets, the estate plan must also document these credentials (Cummings, 2022).

Social and legal problems related to digital assets are not yet apparent due to the age of the owner, who is still young. However, let us imagine this situation when the owners die in the next five to ten years. An abundance of digital assets is left behind. How will digital assets be managed after the owner's death? This situation must be addressed immediately to protect the sustainability of digital assets and the community's well-being. Currently, research to overcome this problem is still in its infancy.

There is still a lot of in-depth research and exploration covering technological, social and legal aspects. Technology is an approach that can provide solutions based on current conditions and user interest in using smartphones. For example, mobile applications installed on smartphones present the most efficient, direct, customisable, and accessible information retrieval (Moh, 2021). Furthermore, the process for digital asset management can be enhanced by involving other parties like estate planners for a

more efficient and reliable process. It must also be discoverable or stored where it can be found.

Consequently, the asset owner can save much grief for surviving family members if proper digital estate planning is performed (Moh, 2021). The desire to make life more manageable for family members to protect valuable digital assets has increased the need for a well-designed digital estate plan (Hopkins, 2013b). During this COVID-19 pandemic, most individuals lost loved ones owing to this condition after they died. Most of them are unaware of the digital assets possessed by the deceased. The digital assets would be lost forever, and the heirs might not receive all the money that the dead would like to leave to them. If an estate plan did not account for digital assets properly, the beneficiaries would not access them. Therefore, digital estate planning has become crucial in the current digital age.

Estate planning management is a complex process that requires careful attention to detail (Herzberg, 2022). Unfortunately, many people are unaware of the importance of managing their digital assets (Steen et al. 2023). This lack of awareness of digital asset management literacy has resulted in many individuals not preparing for estate planning, leading to losing valuable digital assets after death. Moreover, the adoption of online/digital tools for managing digital estate planning is minimal (Brown, 2019). Recent research has shown that estate practitioners are also not utilising available digital tools for estate planning. For example, over 80% of estate practitioners have not used a cloud provider's pre-planning tools on their accounts, while over 40% have not even heard of them (Michels, *et al*. 2021). Furthermore, the adoption of online/digital tools for managing digital estate planning is even lower among non-estate planners. Many individuals who are not estate planners or legal professionals may not even be aware that such tools exist, let alone how to use them (Brown, 2019). It creates a significant problem, as people may not take the necessary steps to manage their digital assets, resulting in the loss of valuable data after death.The above scenario was mainly caused by a lack of standardisation in managing digital assets. No universally accepted framework or guidelines for managing digital assets available has created confusion and uncertainty.

As a result, many digital assets are often overlooked in estate planning, leading to the risk of loss of value and access to the assets after the owner's death. The complexity of the estate planning process and the lack of simple estate planning management tools have also contributed to the problem. Existing tools are often designed for legal professionals and are not accessible to the average person. As a result, it is challenging for individuals to create a comprehensive estate plan that considers all their digital assets. The lack of simple estate planning management tools is a significant problem that must be addressed to ensure individuals can manage their digital assets effectively. There is a need for innovative solutions that are accessible, easy to use and can provide a comprehensive view of all digital assets. It will ensure the smooth transfer of digital assets and provide peace of mind for individuals knowing that their digital assets will be taken care of after death.

Therefore, the work presented in this paper addressed this issue by implementing a software development approach in designing a suitable model for sustaining digital assets. The scope is on the mobile-based application and its requirements to facilitate the entire estate planning process and management of digital assets.

Background and Related Studies

This section provides background information on estate planning, discusses its significance, explains how to manage digital assets quickly, and investigates user perceptions of and readiness for using technological solutions. Later in this section, information technology solutions are explored, facilitating the development and management of digital assets electronically.

Electronic or digital gadgets, such as mobile phones or computers, are not considered digital assets, but the data contained within them are. As digital assets comprise electronic information, it is easier to use it electronically as an application, website, or application. Furthermore, the recent development and growth in the Internet have made it possible to store digital assets and related information or metadata in the cloud (Hopkins, 2013a). It has led to great success in the popularity and success of e-

commerce and online trading by developing user-friendly and secure mobile applications.

The transition of digital assets has been addressed in the literature. For instance, Zhu et al. (2018) proposed using blockchain in conjunction with an attribute-based access control (ABAC) mechanism to use transactions as a connecting mechanism between and the blockchain. Furthermore, they developed a novel environment for the sharing and distributing assets by offering a system that allows for flexible permissions, a transparent authorisation procedure, and the verification of user identities. The adoption of blockchain technology is attractive enough; however, the underlying technology follows a distributed trust management approach, making it less suitable for succession planning at a personal level within the family members.

Moreover, the advancement of the industrial revolution 4.0 (IR 4.0) has led to the development of new technologies to fuel economic growth, including the concept of will and trust. Several research studies investigated the opportunities and challenges of emerging technologies in IR 4.0. For instance, Abdullah et al. (2021) looked at the challenges of estate planning in the age of IR 4.0 and its impact on Malaysians.

Digital technology for estate planning is only getting started in 2018. "Tomorrow.me" is an example of a mobile application in the market developed for asset planning purposes. The assets information they would like the user to store their estate information to be recollected by their family members after their demise. Tomorrow.me is an app that helps users create a will, and a living trust, distribute assets and buy life insurance if they do not have any. This application handles users' end-of-life affairs (Online Will Makers, 2022). However, this application has some weaknesses, such as a) not being able to take lawyer trusts and b) not being able to handle digital assets and their inheritance. This application was developed by Dave Henley, the company's CEO. He wants to take the morbid out of planning for the end of life since he knows most people will not think about their mortality (Online Will Makers, 2022). This application is available for iPhone and Android environments, free to install on mobile.

Young Jack has developed the EZ Estate application, the most effective and accessible smartphone software for managing and storing estate plans and life stories in one location. In addition, this software lets the user preserve critical document information and communicate users' financials and personal documents when they pass away. It relieves the user's family of unnecessary stress and aids those members in coping better after their demise. However, this application is not free for the user as it provides lifetime access and is for iOS and Android environments. Furthermore, the user interface is not well-designed and does not attract people to use it. Moreover, the EZ Estate application is not a substitute for legal advice or legally binding (Jack, 2022). So, users should talk to an expert, like a lawyer, about how to use the application in their plan.

Mobile applications are helpful for smartphone users (Norki, *et al.* 2020). It has been used extensively to address societal needs like managing mental health (Zolkipli, *et al*. 2022), religious education (Zakaria & Nawi, 2020), service rating (Hussain, *et al*. 2019), personal travel planning (Hussain, *et al*. 2019; Imtiaz & Suki, 2022), managing groceries (Katuk, Jayasangar, *et al*. 2019), managing facilities (Ali, *et al*. 2021) and local food search (Mat, *et al*. 2020). As smartphones become prevalent today (Katuk, Zakaria, *et al*. 2019), their role can be extended to facilitate digital asset estate planning. In light of this, a growing need exists to extend the role of new technology (e.g. mobile applications) to facilitate digital asset estate planning (Steen, *et al*. 2023). Mobile applications can provide a convenient and efficient platform for individuals to manage their digital assets and ensure that their loved ones can access them after they pass away. However, developing such applications requires careful consideration of the various legal and ethical implications involved in digital estate planning.

Therefore, the software development approach (Kahtan, *et al.* 2023) is suitable and can be used as a research method (Marinho, *et al*. 2019) to design a model for sustaining digital assets through smartphones. This approach involves designing, developing and evaluating software prototypes (Groeger & Schweitzer, 2020) that comes along with a software model to ensure that the application meets the needs of its intended users. In

addition, the approach allowed the researchers to identify and address potential problems in the early development process (Aldayel & Alnafjan, 2017); then, the model can be refined and optimised to provide simple steps for managing digital assets. Further, the approach also produces a model that can help ensure that the tool is practical, effective, and meets the needs of those using it. The software development approach is explained in the methodology section.

Methodology

This study followed a software development approach named the waterfall model in the software life cycle (SDLC) (Rodrigo, *et al*. 2021; Ryu, *et al.* 2022). Figure 1 shows the phases of the waterfall model, which consisted of four activities: requirement analysis, system design, implementation, and test and evaluation.

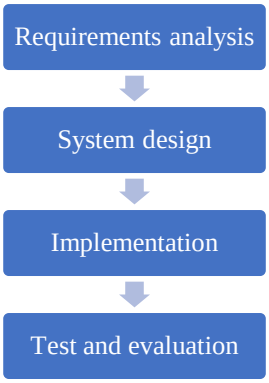

Figure (1): Phases of activities in the waterfall model (Ryu, *et al*. 2022).

The waterfall model was adopted as the methodology is easy to understand and implement (Alshamrani & Bahattab, 2015). Moreover, this methodology has been widely used in other studies, including Manunog et al. (2022), Maulana, *et al.* (2021), and Miranda, *et al*. (2021), which applied it in disaster risk management, diet management, and telemedicine during the pandemic. The first process followed the literature-based requirements analysis review suggested by Idrees, *et al*. (2021). First, an extensive literature search was conducted to identify all potential digital asset

estate planning requirements. Then, the requirements were filtered and prioritised to include only relevant and essential functionalities and features in the model. Finally, an estate planning expert and a software developer validated the list of requirements.

After the requirements were validated, they were transformed into software models, including architectural and use case diagrams (Liu, *et al*. 2004) that shows the static interaction between the users (i.e. actors) and the system. Then, the design of the proposed solution is transformed into a working mobile application. Next, the application interfaces were developed with the input/output components and the data structure. Finally, a usability evaluation was conducted with real users to measure the application's usefulness, ease of use, and user satisfaction. The subsequent sections describe the outcomes derived from the phases of the activities.

Analysis, Design and Implementation

This work was carried out following the four phases of the waterfall model in Figure 1. First, the work proposed a model named Mobile Estate Planning for Digital Assets (MEPDA) that intends to address the issue of digital asset inheritance through a smartphone application. MEPDA was proposed as a technological solution to digital asset estate planning.

The requirements were gathered by analysing documents and mobile-based applications related to digital asset inheritance. Google search engine was primarily used with the keywords "Digital Assets Planning". The documents were examined to determine the need for a mobile-based application for managing the requirements. The requirements-gathering approach delivered eight key requirements, as shown in Table 1. The compulsory requirements are (1) Store Digital Assets based on Category, (2) Manage Digital Asset Information, (3) Configure Reminder, (4) Manage Asset Changes Reminder, (5) Generate Digital Asset Information, (6) Register Profile, (7) Authenticate Profile, and (8) Manage Profile Information.

Table (1): The functional requirements of the MEPDA application.

Requirement Description
01:Store digital assets based on category
The application can receive inputs from the asset owner.
The application allows the asset owner to choose categories.
The application can record the asset owner's digital asset information.
The application can record the asset owner's corresponding heirs for each category.
02: Manage digital asset information
The application allows an asset owner to view their digital asset information and corresponding heirs.
The application allows the asset owner to update their digital assets information.
The application allows the asset owner to update the corresponding heirs for each category.
The application allows the asset owner to update their digital account passwords.
03: Configure a reminder
The application will provide a monthly reminder for the asset owner.
The application will allow the estate planner to message the PIN to the asset owner each month, in which they must enter an answer to complete the monthly quiz.
04: Manage asset changes reminder
The application will allow an estate planner to track the asset owner's participation in the asset reminder for every month.
The application allows the estate planner to message the asset owner if they are not answering the reminder.
05: Generate digital asset information
The application will generate the asset owner's digital asset information.
The application lets the estate planner and asset owner view digital asset information.
The application restricts the estate planner from viewing the asset owner's password for each digital account.

06: Register profile
The application will display the registration screen to the asset owner and estate planner.
The application allows the asset owner and estate planner to create a new account.
The application will request that the estate planner and asset owner key in their username, password, email and phone number.
The application will ensure there is no empty field.
The application will complete the registration process if the estate planner and asset owner click on submit button.
07: Authenticate profile
The application will request the estate planner and asset owner to type an email and password to log in.
The application provides the estate planner and asset owner a registration link if they do not have an account.
The application allows the estate planner and asset owner to stay logged in.
The application allows the estate planner and asset owner to log out.
08: Manage profile information
The application allows the estate planner and asset owner to view their profile information.
The application allows the estate planner and asset owner to update their password and phone number.
The application will update the information if the asset owner clicks on submit button.
The application allows the asset owner and estate planner to cancel any changes.

MEPDA is proposed as a mobile application that runs on a smartphone. First, it is necessary to identify the types of digital assets that MEPDA could support. Generally, digital assets include photos, videos, and documents stored on storage devices like hard disks and flash drives or cloud services. Other digital assets include online accounts like social media and emails. The last type of digital assets is those associated with

financial values like cryptocurrency, e-wallet, and Internet banking. These digital assets must have metadata recorded in the mobile application and finally stored in a remote database. The interaction of the users, particularly the asset owner and an estate planner, through the mobile application. In addition, the asset owner has access to the mobile application for managing the digital asset's metadata. Finally, the mobile application's main feature allows the estate planner to contact the owner through a reminder system. Figure 2 shows the architectural diagram of MEPDA.

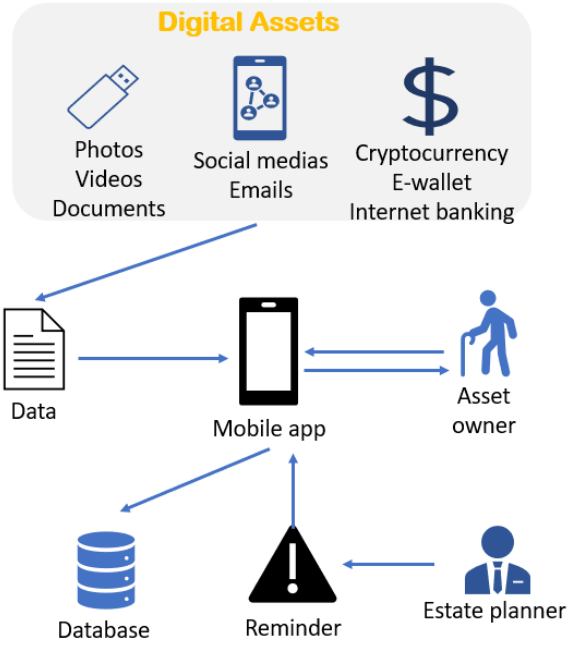

Figure (2): The architectural diagram of MEPDA.

The requirements were then translated into a use case diagram, as shown in Figure 3. The diagram describes the interaction between the asset owner and the estate planner with the MEPDA application. The asset owner only handles the use case of 'Store Digital Assets based on Category', 'Manage Digital Assets Information' and 'Configure Reminder'. The use cases of 'Register Profile', 'Authenticate Profile', 'Manage Profile Information'

and 'Generate Digital Asset Information' are handled by the asset owner and estate planner. The use case of 'Manage Asset Changes Reminder'is only handled by an estate planner. Both users can generate digital assets; however, the password of the digital account held by the asset owner will be hidden from the estate planner's view. All digital assets will be stored and accessible to the asset planner in a single application for future reference or clarification. Moreover, the asset owners also need to answer the monthly quiz as a life-monitoring approach to ensure the owners are in good health and alive.

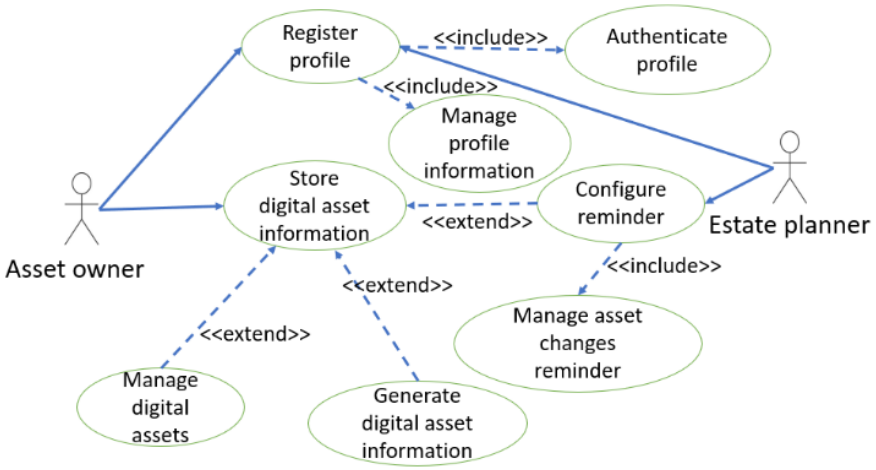

Figure (3): The use case diagram of MEPDA.

A mobile application for creating and managing digital assets for a mobile application was developed based on the requirements and use case. Android Studio, Flutter, and Dart programming languages were used as the primary integrated development environment (IDE) tools. Further, the Firebase development platform was used to facilitate crucial functions like user authentication and database for data storage. Screenshots in Figures 4, 5, and 6 show the selected interfaces of the MEPDA application.

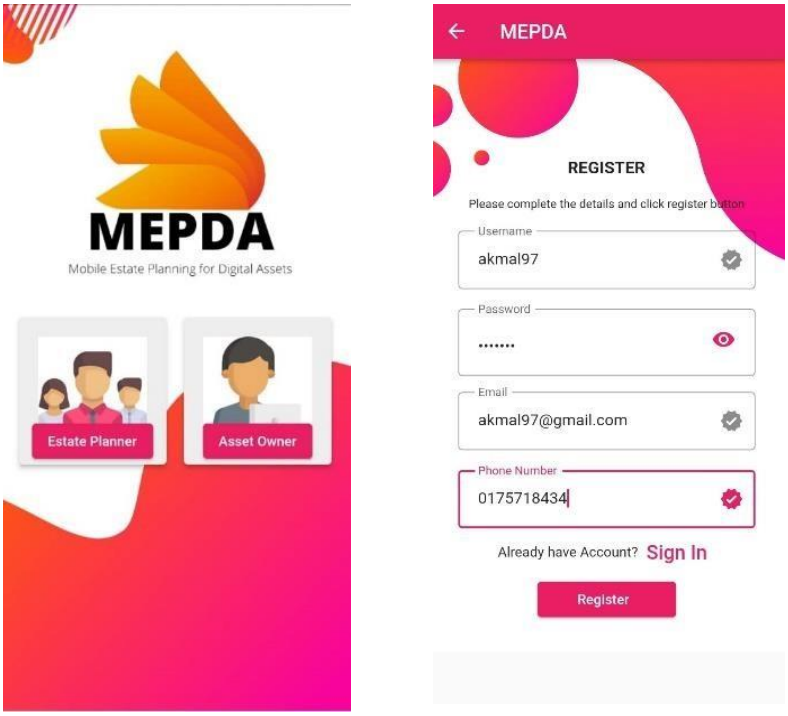

Figure (4): The main landing screen (left) and the registration screen (right).

MEPDA, a mobile-based digital estate planning application, offers various features to its users. The application's landing page allows users to choose between an estate planner and an asset owner. Estate planners and asset owners can quickly sign up on the system by providing their email and phone numbers and creating a unique username and password. Upon sign-up, an account for individual users will be created in the database, enabling them to access their information quickly. This feature ensures the security and privacy of user information and makes estate planning and digital asset management more convenient and efficient.

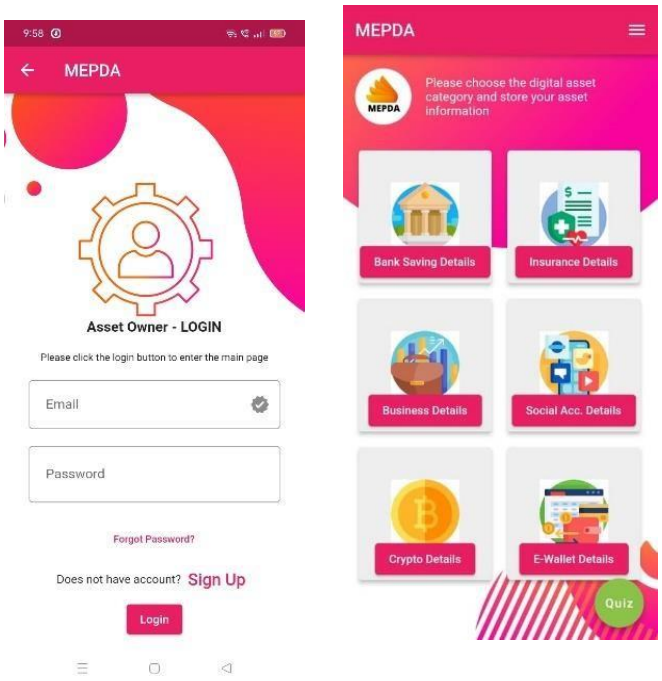

Figure (5): The login screen (left) and the dashboard screen (right).

To use the MEPDA mobile application, registered and authorised users must log in using their email and password. If they forget their password, an automatic support system is provided with a link to reset it. The reset password instructions will be sent to their registered email address. After successful login, the home interface of the application will display six types of digital assets, including bank savings, insurance, business, social media, crypto, and e-wallet, providing quick access to view the digital asset's credential information. Moreover, the home interface also features a quiz button that an appointed estate planner can activate to verify if the asset owner is still alive.

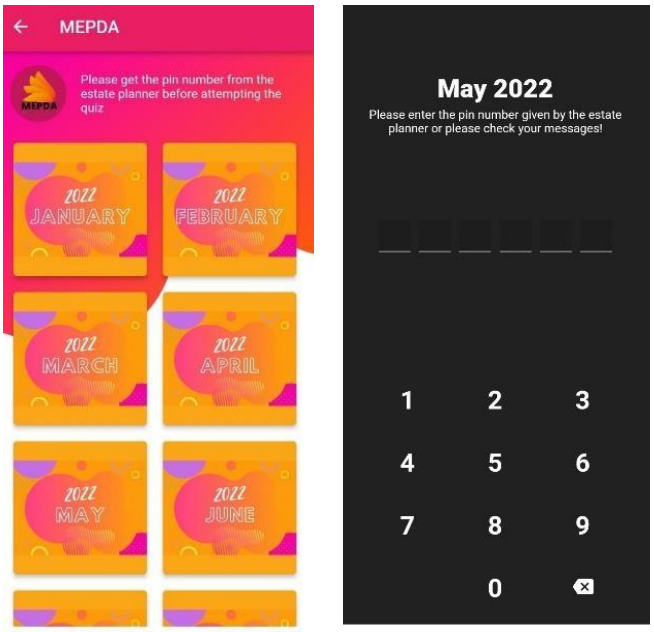

Figure (6): The monthly quizzes screen (left) and asset owner answering screen (right).

The MEPDA application provides monthly quizzes that estate planners can activate to check on the respective digital asset owners. The quiz can consist of any questions the estate planner creates and ask their client in a specific time interval. The intended asset owner's response to the quiz confirms their status as still alive. However, if no response is received from the intended asset owner, the estate planner may investigate and contact their family members to ensure their well-being. This quiz feature is an essential aspect of the MEPDA application, providing peace of mind for the asset owner and their families while keeping their digital assets safe and secure.

MEPDA safely preserves a person's digital assets information and makes it accessible to the asset planner (administrator) in a single

application for future reference or clarification. The developed prototype was able to store and manage the information of the digital asset and their credentials (i.e. usernames and passwords) such as internet banking accounts, online business accounts, social media accounts, insurances, and digital e-wallets (including cryptocurrencies) and accessible all the time. Besides, this mobile application allows owners to update their digital assets' information regularly while the asset planners maintain the assets. Additionally, the quiz feature enables estate planners to regularly check on the asset owner's well-being and ensure the safety of their digital assets. MEPDA's focus on security, convenience, and peace of mind makes it an excellent solution for anyone looking to manage their digital assets effectively. MEPDA is a simple tool for safeguarding one's digital assets and ensuring that their legacy is preserved.

Evaluation and Results

A usability evaluation was conducted on 30 respondents, consisting of employees, students and fresh graduates in Malaysia. The respondents were approached randomly and participated in the study voluntarily. The instruments used for the evaluation were the MEPDA application and a post-task questionnaire. The questionnaire included 36 questions, and the questions were divided into two sections which are 34 close-ended questions adapted from (Katuk, Jayasangar, *et al*. 2019) and two open-ended questions. Section A asked for the respondents' demographic information, while Section B asked the respondents' opinions about MEPDA on a five-point Likert scale where one represents strongly disagree and five represents strongly agree. In addition, the respondents performed the following step-by-step procedure for the evaluation: (1) read and signed a consent form, (2) interacted with the MEDPA application as stated in the experiment procedure, and (3) answered the post-task questionnaire.

The evaluation was conducted face-to-face in public places like cafeterias and parks, where the respondents were given a smartphone installed with the mobile application. They tested the application by performing tasks like registering their profile, authenticating their identity, storing digital assets' information, generating digital assets information, updating digital assets' information and receiving reminders from estate planners.

Upon completing the tasks, they were asked to answer post-task questions given through a Google Form.

Analysis of the respondents' demographic information revealed that 100% were aged between 20 and 29. Most respondents were female, 83%, followed by males, 17%. Moreover, 57% were students, 40% were employed, and 3% were fresh graduates. 93% of them were single, and 7% were married. 29% of employees were from the financial sector, 29% were from the technology sector, 18% were from the law and legal sector, and 24% were from the logistics and education sectors. Regarding the respondents' household income, 44% were in the range of RM 1001 to RM 2000, while 37% were in the range of RM 2001 to RM 5000. 19% had income below RM1000. Table 2 summarises the information.

Table (2): The respondents' demographic information.

Questions	**Data/Frequency**
Gender	Female – 83% Male – 17%
Age	20-29 – 100% 30-39 – 0% 40-49 – 0% Over 50 – 0%
Marital status	Single – 93% Married – 7%
Occupation	Employed – 40% Student – 57% Retired – 0% Others – 3%
Working Sector	Healthcare Sector - 0% Material Sector - 0% Financial Sector - 29% Technology Sector - 29% Law and Legal Sector - 18% Other – 24%

... Continue Table (2)

Questions	**Data/Frequency**
Household income	Below RM1000 – 19% RM1001 – RM2000 – 44% RM2001 – RM5000 – 37% RM5001 – RM10000 – 0% Above RM10000 – 0%
Previous knowledge about estate planning and digital asset	Yes – 63% No – 37%
Digital accounts that the respondents had	Facebook account – 87% YouTube account – 70% Cryptocurrency account – 20% Online Banking account – 90% E-Wallet account – 87% Others
Methods for storing password	Writing in diary – 33% Keep it in mind – 27% Share with family members– 0% Save password credentials in the browser – 37% Not storing in anywhere – 3% Others – 0%
Perceived importance of storing digital asset information	Important – 73% Not important – 0% Not sure – 27%

Most respondents (i.e. 63%) previously knew about digital estate planning. Meanwhile, 90% of the respondents have an online banking account, 87% have a Facebook account, 86% have an E-Wallet account, 70% have a YouTube account, and 20% have a cryptocurrency account. Regarding storing the digital account passwords, 37% saved their password credentials in the browser, 33% wrote their password in the diary, 27% remembered them, and 3% did not store the password anywhere. 73% of the respondents thought storing digital asset information was important, while the rest were not sure about it.

An analysis was conducted on the responses in Section B of the post-task questionnaire that measures the respondents' perception of MEPDA's usefulness and ease of use. It also measured the respondents' satisfaction with using the mobile application. Table 3 reported the frequency and average of the respondents' responses based on the three dimensions of usability. The usability evaluation results suggested that the respondents rated four or five of the post-task scales for the three usability aspects. Only a few rated neutral.

Table (3): The results of the usability evaluation.

Usability dimensions	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Usefulness	The app enhances my effectiveness in accessing the application.	0 (0.00%)	0 (0.00%)	1 (03.3%)	11 (36.7%)	18 (60.0%)
	The app makes it easier to store digital asset information.	0 (0.00%)	0 (0.00%)	1 (03.3%)	13 (43.3%)	16 (53.3%)
	The app makes it easier to generate all the digital asset information.	0 (0.00%)	0 (0.00%)	0 (0.00%)	12 (40.0%)	18 (60.0%)
	The app makes it easier to answer the monthly reminder (quiz).	0 (0.00%)	0 (0.00%)	2 (06.7%)	10 (33.3%)	18 (60.0%)
	The app meets my needs.	0 (0.00%)	0 (0.00%)	2 (06.7%)	8 (26.7%)	20 (66.7%)
	The app does everything I would expect it to do.	0 (0.00%)	0 (0.00%)	1 (03.3%)	14 (46.7%)	15 (50.0%)

... Continue Table (3)

Usability dimensions	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	The app is useful in over-all.	0 (0.00%)	0 (0.00%)	0 (0.00%)	9 (30.0%)	21 (70.0%)
Ease of Use	MEPDA is easy to use.	0 (0.00%)	0 (0.00%)	0 (0.00%)	12 (40.0%)	18 (60.0%)
	MEPDA is user friendly.	0 (0.00%)	0 (0.00%)	2 (06.7%)	8 (26.7%)	20 (66.7%)
	MEPDA is flexible.	0 (0.00%)	0 (0.00%)	0 (0.00%)	11 (36.7%)	19 (63.3%)
	MEPDA is easy to learn how to use it.	0 (0.00%)	0 (0.00%)	1 (03.3%)	10 (33.3%)	19 (63.3%)
	I can use MEPDA without writ-ten instruc-tions.	0 (0.00%)	0 (0.00%)	2 (06.7%)	11 (36.7%)	17 (56.7%)
	I can easily remember how to use it.	0 (0.00%)	0 (0.00%)	3 (10.0%)	10 (33.3%)	17 (56.7%)
	I don’t notice any inconsist-encies s as I use MEPDA.	0 (0.00%)	1 (03.3%)	1 (03.3%)	12 (40.0%)	16 (53.3%)
	I can recover from mistakes quickly and easily when using MEPDA.	0 (0.00%)	0 (0.00%)	2 (06.7%)	13 (43.3%)	15 (50.0%)
	I can use MEPDA suc-cessfully every time.	0 (0.00%)	0 (0.00%)	1 (03.3%)	12 (40.0%)	17 (56.7%

... Continue Table (3)

Usability dimensions	Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Satisfac-tion	I am satisfied with MEPDA.	0 (0.00%)	0 (0.00%)	1 (03.3%)	11 (36.7%)	18 (60.0%)
	I would rec-ommend MEPDA to my friend.	0 (0.00%)	0 (0.00%)	2 (06.7%)	10 (33.3%)	18 (60.0%)
	MEPDA works the way I want it to work.	0 (0.00%)	0 (0.00%)	2 (06.7%)	10 (33.3%)	18 (60.0%)
	I feel I need to have MEPDA ap-plication in my smartphone.	0 (0.00%)	0 (0.00%)	0 (0.00%)	9 (30.0%)	21 (70.0%)
	MEPDA is wonderful and pleasant to use.	0 (0.00%)	0 (0.00%)	1 (03.3%)	10 (33.3%)	19 (63.3%)
	I can success-fully create a digital asset using MEPDA.	0 (0.00%)	0 (0.00%)	0 (0.00%)	16 (53.3%)	14 (46.7%)
	The quiz is sufficient to ensure that the estate owners are alive.	0 (0.00%)	0 (0.00%)	2 (06.7%)	11 (36.7%)	17 (56.7%)

Regarding the usefulness of the mobile application, the responses to seven questions suggested that the app is useful in helping asset owners manage their digital asset estate planning. For example, almost all respond-ents agreed that the mobile application enhanced their effectiveness and made storing and managing digital asset information easy. They also

agreed that the application was very useful and that the reminder function sent by an estate planner is excellent in keeping up with the asset owners' situation.

Further, the usability evaluation results suggested that the mobile application was easy to use and navigate. Further, they can quickly pick up the application's steps, especially in managing their digital assets. Finally, the respondents were satisfied with the functionalities provided by the mobile application in managing digital asset estate planning. For example, the reminder features assist the estate planner in keeping track of the asset owner and whether they are alive.

Based on the results from the evaluation study, the mobile application was under a well-development. It is beneficial because users can store their digital assets successfully and generate digital asset information. Besides, there is some feedback and comment from the respondents after evaluating the application. Most respondents were satisfied with the application because the function and aim were achieved. However, some respondents suggested that the application's name could be more attractive. Moreover, some participants suggested enhancements to the user interface so that the older generation can use the system easily.

The evaluation of the MEPDA application has necessary implications for developing mobile applications for digital estate planning. The study reveals that most respondents rated MEPDA positively regarding its usefulness, ease of use, and satisfaction, which suggests that the application has good potential to be widely adopted. Furthermore, the high percentage of respondents with existing digital accounts and passwords highlights the need for better solutions for storing and managing digital assets. The study also reveals that users have varying preferences for storing password credentials, and this information can be used to improve the security features of MEPDA and other similar applications.

The study contributes in the following ways. First, the MEPDA model provides a practical framework for managing and preserving valuable digital assets, such as cryptocurrency and online banking accounts. It empowers individuals to secure their digital wealth and seamlessly pass it on to

their beneficiaries. Second, the research offers insights into the importance of digital assets in estate planning. By incorporating MEPDA into their practices, estate planners can guide clients in safeguarding and transferring digital assets effectively, ensuring a comprehensive approach to estate management. Third, the usability study conducted with users demonstrates that MEPDA is practical and user-friendly. Heirs and beneficiaries can easily navigate the smartphone application to access and claim their inherited digital assets, simplifying the inheritance process and providing peace of mind during challenging times. Hence, the MEPDA model presents a valuable resource for these groups, addressing their unique concerns and offering practical solutions to ensure the proper management of digital assets.

Overall, the proposed model (i.e. MEPDA) assisted software developers in developing mobile applications for managing digital assets, primarily through estate planning. This work can address the social issues expected to arise soon after the abundance of digital assets is left behind after the owner's death. This work is aligned with current issues of managing digital legacy, especially among older people (Maciel & Pereira, 2017). Mobile application is the most suitable platform for running the tools. Nevertheless, the use of such tools should be in pair with other trusted entities to manage the entire cycle of digital asset transfer, like estate planners or lawyers, to ensure that the data is not diminished in the same way as the digital assets. This situation can be addressed using the software development approach to protect the sustainability of digital assets and the community's well-being. Therefore, the work significantly contributes to the body of knowledge and overcoming this problem.

Conclusion and Future Works

This paper describes the design and development of a model and its visualisation in a mobile application for estate planning for digital assets. Other potential studies could also be carried out to enhance the process of storing digital asset information more securely. It is also important to look at relevant legislative areas to ensure that digital asset transfer after the death of the owner is smooth using the proposed MEPDA model.

Another critical aspect that researchers can explore from this work is incorporating other entities in the ecosystem to facilitate and validate the digital asset transfer to the heirs and how this could be done within a secure but straightforward process. Another interesting area to explore is the use of blockchain technology for digital asset inheritance and how technology can be utilised to provide a trusted link between all parties involved in digital asset estate planning. Further, studies can also be done to ensure that the older generation can easily access and store their information using this application. Overall, the model was validated through the mobile application to resolve the asset owner's information management, stored in one place and easily accessible for future reference.

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References

– Abdullah, M. M. i. Fariddudin, S. N. F. M. Muhamad, N. H. N. & Awang, A. B. (2021). Islamic estate planning in the industrial revolution 4.0 era: Issues and challenges. *Journal of Emerging Economies and Islamic Research*, *9*(2), 40-56. https://doi.org/10.24191/jeeir.v9i2.12413

– Aldayel, A. & Alnafjan, K. (2017). Challenges and best practices for mobile application development. Proceedings of the International Conference on Compute and Data Analysis,

– Ali, I. M. Nawi, M. N. M. Hamid, M. Y. Jalil, F. I. A. & Hussain, B. (2021). Integration of IoT, Data Analytics and Mobile Application towards Digitisation Facilities Management: A Case Study [Article]. *International Journal of Interactive Mobile Technologies*, *15*(22), 154-164. https://doi.org/10.3991/IJIM.V15I22.24115

- Alshamrani, A. & Bahattab, A. (2015). A comparison between three SDLC models waterfall model, spiral model, and Incremental/Iterative model. *International Journal of Computer Science Issues (IJCSI)*, *12*(1), 106.
- Bolshakov, N. Plyako, A. Celani, A. Azhimova, L. & Akimov, L. (2021). Digital Asset in the System of Real Estate Management. E3S Web of Conferences, Moscow, Russia.
- Brown, J. H. (2019). Online tools under RUFADAA: The next evolution in estate planning or a flash in the pan. *Prob. & Prop. 33*, 60.
- Cummings, B. (2022). Digital Assets Add New Concerns to Estate Planning. *Journal of Financial Planning*, *35*(8), 19-19.
- Groeger, L. & Schweitzer, J. (2020). Developing a design thinking mindset: Encouraging designerly ways in postgraduate business education. *Design Thinking in Higher Education: Interdisciplinary Encounters*, 41-72. https://doi.org/10.1007/978-981-15-5780-4_3
- Herzberg, P. (2022). Estate Planning Insights for Business Executives and Owners. *Journal of Financial Planning*, *35*(3), 54-57.
- Hopkins, J. (2013a). Afterlife in the cloud: Managing a digital estate. *Hastings Sci. & Tech. LJ*, *5*, 209.
- Hopkins, J. (2013b). Digital Estate Planning: Is Google Your Next Estate Planner? *The Student Lawyer, The American Bar Association*. https://doi.org/https://ssrn.com/abstract=2282585
- Hussain, A. Mkpojiogu, E. O. C. Jamaludin, S. Hilaluddin, K. & Nathan, S. (2019). Users' perception of their satisfaction and experience on a mobile cinema application [Article]. *International Journal of Recent Technology and Engineering*, *8*(2 Special Issue 2), 131-134. https://doi.org/10.35940/ijrte.B1025.0782S219
- Idrees, A. R. Kraft, R. Pryss, R. Reichert, M. & Baumeister, H. (2021). Literature-based requirements analysis review of persuasive systems design for mental health applications. *Procedia Computer Science*, *191*, 143-150. https://doi.org/10.1016/j.procs.2021.07.019

- Ifediora, C. O. (2022). Assessing the Use of Smart Phones-Based Apps, Software and Geographic Information System (GIS) in Real Estate Practice. *International Journal of Development and Economic Sustainability*, *10*(1), 26-40.
- Imtiaz, H. & Suki, N. M. (2022). Mobile Travel Apps Engagement: Measuring Tourists' Perception [Article]. *International Journal of Interactive Mobile Technologies*, *16*(14), 171-181. https://doi.org/10.3991/ijim.v16i14.31445
- Jack, Y. (2022). *EZ Estate is an all-inclusive app to help you prepare your final affairs*. https://appadvice.com/app/ez-estate-your-final-affairs/1480132988
- Kahtan, H. Abdulhak, M. Al-Ahmad, A. S. & Alzoubi, Y. I. (2023). A model for developing dependable systems using a component-based software development approach (MDDS-CBSD). *IET Software*, *17*(1), 76-92. https://doi.org/10.1049/sfw2.12085
- Katuk, N. (2019). The application of blockchain for halal product assurance: a systematic review of the current developments and future directions [Article]. *International Journal of Advanced Trends in Computer Science and Engineering*, *8*(5), 1893-1902. https://doi.org/10.30534/ijatcse/2019/13852019
- Katuk, N. Jayasangar, T. & Yusof, Y. (2019). Design and development of smart list: A mobile app for creating and managing grocery lists [Article]. *Baghdad Science Journal*, *16*(2), 462-476. https://doi.org/10.21123/bsj.2019.16.2(SI)0462
- Katuk, N. Zakaria, N. H. & Ku-Mahamud, K. R. (2019). Mobile phone sensing using the built-in camera [Article]. *International Journal of Interactive Mobile Technologies*, *13*(2), 102-114. https://doi.org/10.3991/ijim.v13i02.10166
- Liu, Z. He, J. Liu, J. & Li, X. (2004). Unifying views of UML [Conference Paper]. *Electronic Notes in Theoretical Computer Science*, *101*, 95-127. https://doi.org/10.1016/j.entcs.2004.02.018

- Maciel, C. & Pereira, V. C. (2017). Technological and human challenges to addressing death in information systems. In C. Boscarioli, R. M. de Araujo, & R. S. Maciel (Eds.), *Sociedade Brasileira de Computação*. https://doi.org/10.5753/sbc.2884.0
- Manunog, M. B. Manunog, M. R. Wales, A. R. F. Balili, D. A. & Togonon, J. N. (2022). Development of a records management system with GIS integration: enabling tool for disaster risk management [Article]. *Science and Engineering Journal*, *15*(2), 72-77. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85142243593&partnerID=40&md5=258b9c9848b1268d576933a4e1a6ecbf
- Marinho, M. Noll, J. Richardson, I. & Beecham, S. (2019). Plan-driven approaches are alive and kicking in agile global software development. 2019 ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM),
- Mat, R. C. Kazunori, M. & Rahman, A. A. (2020). The Development of Mobile Japanese Halal Gamification (MJHG) [Article]. *International Journal of Interactive Mobile Technologies*, *14*(17), 113-129. https://doi.org/10.3991/ijim.v14i17.16653
- Maulana, F. I. Susanto, V. Shilo, P. Gunawan, J. Pangestu, G. & Raharja, D. R. B. (2021). Design and Development of Website Dr.Changkitchen Diet Catering Using SDLC Waterfall Model. ACM International Conference Proceeding Series,
- Michels, J. D. Hartung, S. & Millard, C. (2021). Digital Assets: A Call To Action. *Available at SSRN 3925439*. https://doi.org/http://dx.doi.org/10.2139/ssrn.3925439
- Miranda, E. Aryuni, M. & Richard. (2021). Mobile-Based Telemedicine Application during COVID-19 Pandemic (Case Study in Sawah Besar Community Health Center). Proceedings of 2nd 2021 International Conference on Smart Cities, Automation and Intelligent Computing Systems, ICON-SONICS 2021,

- Moh, J. (2021). Digital assets find their way into estate planning. *The Sun*. https://www.thesundaily.my/business/digital-assets-find-their-way-into-estate-planning-YL8085735
- Norki, F. A. Mohamad, R. & Ibrahim, N. (2020). Context ontology in mobile applications [Article]. *Journal of Information and Communication Technology*, *19*(1), 21-44. https://doi.org/10.32890/jict2020.19.1.2
- Online Will Makers. (2022). *Tomorrow Me Review 2023*. Retrieved 1 November from https://onlinewillmakers.com/tomorrow-me-review/
- Rodrigo, M. N. N. Perera, S. Senaratne, S. & Jin, X. (2021). Systematic development of a data model for the blockchain-based embodied carbon (BEC) Estimator for construction [Article]. *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-02-2021-0130
- Ryu, H. Piao, M. Kim, H. Yang, W. & Kim, K. H. (2022). Development of a Mobile Application for Smart Clinical Trial Subject Data Collection and Management. *Applied Sciences*, *12*(7), 3343. https://doi.org/10.3390/app12073343
- Schreiber, B. (2021). *DESIGNING FOR TRUST: Futures of Digital Financial Experiences Beyond the Smartphone Era* OCAD University]. Toronto, Ontario, Canada.
- Singh, R. G. Shrivastava, A. & Ruj, S. (2022). A Digital Asset Inheritance Model to Convey Online Persona Posthumously [Article]. *International Journal of Information Security*, *21*(5), 983-1003. https://doi.org/10.1007/s10207-022-00593-8
- Steen, A. Graves, C. D'Alessandro, S. & Shi, H. X. (2023). Managing digital assets on death and disability: An examination of the determinants of digital asset planning literacy. *Australian Journal of Management*, 03128962231157005. https://doi.org/10.1177/03128962231157005

- Zakaria, G. A. N. & Nawi, A. (2020). Design and development of a PBL mobile application in Islamic education: A conceptual framework [Article]. *International Journal of Information and Education Technology*, *10*(1), 26-30. https://doi.org/10.18178/ijiet.2020.10.1.1334
- Zhu, Y. Qin, Y. Zhou, Z. Song, X. Liu, G. & Chu, W. C.-C. (2018). Digital asset management with distributed permission over blockchain and attribute-based access control. 2018 IEEE International Conference on Services Computing (SCC),
- Zolkipli, M. F. Said, Z. M. & Mahmuddin, M. (2022). SPKP: A Web-based Application System for Managing Mental Health in Higher Institution [Article]. *International Journal of Advanced Computer Science and Applications*, *13*(4), 666-675. https://doi.org/10.14569/IJACSA.2022.0130477