

COMPLETE AND INCOMPLETE CALCULATION Expert Systems Apps on the Special Cases of Islamic Inheritance Law

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Abstract

The traditional method of resolving inheritance cases typically involves manual processes using pen and paper. However, advancements in expert systems of technology have made it possible to develop applications that expedite and simplify the calculation. This research aims to investigate the capabilities of Android-based expert systems applications in handling specific cases (*masail syawadz*) within Islamic inheritance law. Data were obtained by simulating cases (experiments) involving ten randomly selected inheritance apps from the Android Play Store. These applications were tested to solve *al-gharawain*, *al-kehuraqa*, *al-akdariyah*, *al-musyarakah*, and *al-faridah al-malikiyah* cases. The research found that only two applications consistently managed to solve specific cases in Islamic inheritance law based on a particular school of thought (*madhab*). Other applications were only able to solve a portion of the tested cases. The majority of applications failed to identify the presented cases, although their calculations were acceptable based on one of the schools. Several factors contributed to the failure of these applications in solving inheritance cases, including limitations in simulating *masail syawadz* issues, inconsistency in the opinion adopted by the application developers to formulate the expert system, a limited list of available heirs, and errors in determining the portions of the heirs.

[Kemajuan dalam sistem pakar teknologi telah memungkinkan untuk mengembangkan aplikasi yang mempercepat dan menyederhanakan perhitungan kewarisan. Penelitian ini bertujuan untuk menyelidiki kemampuan aplikasi sistem pakar berbasis Android dalam menangani kasus-kasus khusus (*masail syawadz*) dalam hukum kewarisan Islam. Data diperoleh dengan mensimulasikan kasus-kasus ke dalam sepuluh aplikasi warisan yang dipilih secara acak dari Android Play Store. Aplikasi-aplikasi ini diuji untuk menyelesaikan

kasus-kasus *al-gbarawain*, *al-keburaqa*, *al-akdariyah*, *al-musyarakah*, dan *al-faridah al-malikiyah*. Penelitian ini menemukan bahwa hanya dua aplikasi yang secara konsisten berhasil menyelesaikan kasus-kasus tertentu dalam hukum warisan Islam berdasarkan satu mazhab tertentu. Aplikasi lain hanya mampu menyelesaikan sebagian dari kasus-kasus yang diuji. Sebagian besarnya gagal mengidentifikasi kasus-kasus yang disajikan, meskipun perhitungan mereka diterima berdasarkan salah satu mazhab. Beberapa faktor berkontribusi pada kegagalan aplikasi-aplikasi ini dalam menyelesaikan kasus-kasus warisan, termasuk keterbatasan dalam mensimulasikan masalah-masalah *masa il syawadz*, ketidaksesuaian dalam pendapat fikih yang diadopsi oleh pengembang aplikasi untuk merumuskan sistem pakar, daftar pewaris yang terbatas, dan kesalahan dalam menentukan bagian-bagian pewaris.]

Keywords

Expert system apps, Islamic inheritance law, Islamic inheritance calculation, *masail syawadz*

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Introduction

The rules regarding the determination of eligible heirs and the allocation of their respective shares in the Islamic inheritance law have been detailed.¹ However, since the time of Prophet's companion until present scholar, several issues in Islamic inheritance consistently

¹ Faiqah Nur Azizah, "Pembaharuan Dalam Sistem Pembagian Waris Secara Proporsional Antara Laki-Laki Dan Perempuan" (Fakultas Syariah dan Hukum Universitas Islam Negeri Syarif Hidayatullah Jakarta, n.d.).

triggered debates.² The most common debate among scholars could be found in the special cases, such as *umariyatain*, *al-keburaqa*, *akdariyah*, *musyarrakab*, or *al-faridah al-malikiyah*. The complexity of the rules of Islamic inheritance law makes it difficult for some society to learn certain aspects of Islamic inheritance law. To overcome this problem, experts use various approaches, including writing books on Islamic inheritance law³ and developing expert systems that can assist users in determining heirs and their respective shares.

Currently, the process of calculating and dividing inheritance in the community still relies on traditional methods (using paper and pen). This method involves gathering family members to divide the inheritance after the death of the deceased. When they face difficulties in resolving inheritance-related issues, they seek the help of a mufti or community leader who has an understanding of inheritance law to determine the eligible heirs and allocate their respective shares. Traditional methods can lead to miscalculations due to human error. In addition, the traditional distribution process is known to take a considerable amount of time to complete.⁴

Traditional inheritance calculations are known to be complicated, difficult, time-consuming, error-prone, and expensive.⁵ This process also leads to inaccurate calculations and inefficient time management.⁶ Therefore, some computer science experts have developed an expert system on Islamic inheritance law to simplify the division of inheritance. One of the objectives of developing an expert system for Islamic inheritance law is to assist humans in performing inheritance calculations efficiently. The expert system on Islamic inheritance application promises a solution that offers convenience and

² Nizaita Omar and Zulkifly Muda, "Change of Mazhab (School of Thought): The Effects on Inheritance in Islamic Family Law," *International Journal of Academic Research in Business and Social Sciences* 7, no. 11 (2017): 633–42.

³ Muhammad Lutfi Hakim, "Islamic Law of Inheritance in the Kubu Kingdom: The Analysis of Majmū 'Al-Mirāth Fī Ḥukm Al-Farā'Id of Ismail Mundu," *Al-Jami'ah: Journal of Islamic Studies*, 2023.

⁴ Desi Minarni, Indra Griha Tofik Isa, and Asri Yanik, "Aplikasi Bagi Waris Islam Dengan Metode Forward Chaining Berbasis Web," *Jurnal Online Informatika* 2, no. 2 (2017): 127–33, <https://doi.org/https://doi.org/10.15575/join.v2i2.107>.

⁵ Samia Zouaoui and Khaled Rezeg, "Islamic Inheritance Calculation System Based on Arabic Ontology (AraFamOnto)," *Journal of King Saud University-Computer and Information Sciences* 33, no. 1 (2021): 68–76, <https://doi.org/https://doi.org/10.1016/j.jksuci.2018.11.015>.

⁶ Yosep Septiana, Dede Kurniadi, and Asri Mulyani, "Perancangan Program Aplikasi Faraidh Sebagai Sistem Pendukung Keputusan Pembagian Harta Waris Berorientasi Solver," *Jurnal Algoritma* 14, no. 2 (2017): 582–88, <https://doi.org/https://doi.org/10.33364/algoritma/v.14-2.582>.

efficiency in the calculation process. Solving inheritance problems can be done more efficient than the traditional way of using paper and pen.⁷

Previous research on issues related to special cases in inheritance are still limited to theoretical studies and analysis of specific cases. Yusron stated that the *ijtihad* on *gharamian* and *musytarakab* cases initiated by Umar was always based on rational reasoning and *maslahah* considerations.⁸ Aminu focused on Zayd bin Tsabit's contribution to Islamic inheritance law, one of which was in the case of "*umariyatain*." He highlighted that Zayd's opinions on inheritance law were agreed upon by the Companions.⁹ Wahidah criticized the *gharawain* case from the perspective of gender justice. She stated that the *gharawain* settlement method should not be applied in Indonesia.¹⁰

Research focusing on testing the calculation accuracy of inheritance applications is limited. Cheema examined 6 web-based online calculators by testing 20 inheritance cases. The results showed that only 1 calculator effectively answered the proposed cases.¹¹ Meanwhile, Nadya conducted a study by comparing the calculation results of the I-Waris application with manual calculations. By only testing one basic case, she argues that there is a level of conformity between application calculations and manual calculations.¹² Wahyudi et al. developed the Far-Aid application aimed at assisting high school students in learning Islamic inheritance law. They compared the accuracy of the application's calculations with similar web-based and mobile-based applications to validate their application.¹³ This article focuses on the study and experimentation of ten Android-based Islamic inheritance law

⁷ Alaa N Akkila and Samy S Abu-Naser, "Proposed Expert System for Calculating Inheritance in Islam," 2015.

⁸ Muhammad Yusron, "Penalaran Rasional Dan Maslahah: Ijtihad Umar Ibn Al-Khattab Pada Kasus-Kasus Kewarisan Islam," *Journal of Islamic Law (JIL)* 2, no. 2 (2021): 197–223, <https://doi.org/https://doi.org/10.24260/jil.v2i2.327>.

⁹ Muntaka Yahaya Aminu, "Contributions of ZaydBnThabit in the Development of Islamic Law of Inheritance," *International Journal of Research and Innovation in Social Science (IJRISS)* 2, no. 11 (2018): 177–81, <https://doi.org/http://dx.doi.org/%2010.37876/adhki.v3i2.53>.

¹⁰ Wahidah Wahidah, "Kasus Kewarisan Istimewa Gharawain Ditengah Isu Keadilan Gender," *Adbki: Journal Of Islamic Family Law* 3, no. 2 (2021), <https://doi.org/https://doi.org/10.1109/5.771073>.

¹¹ Shahbaz Ahmad Cheema, "Distribution of Inheritance under Islamic Law: An Appraisal of Online Inheritance Calculators," *Available at SSRN 3674913*, 2020, <https://doi.org/http://dx.doi.org/10.2139/ssrn.3674913>.

¹² Nadya Febriani Meldi et al., "Klarifikasi Perhitungan Matematika Menggunakan Aplikasi I Waris Terintegrasi Hukum Waris," *Jurnal Alwatzikhoebillah: Kajian Islam, Pendidikan, Ekonomi, Humaniora* 9, no. 1 (2023): 49–69, <https://doi.org/https://doi.org/10.37567/alwatzikhoebillah.v9i1.1540>.

¹³ Diki Wahyudi, Farhan Haq, and Reza Budiawan, "Aplikasi Belajar Hukum Faraid Bagi Siswa Sma Berbasis Android," *EProceedings of Applied Science* 6, no. 3 (2020).

expert systems in solving five specific problems in Islamic inheritance law. The aim is to assess the ability of the expert systems to solve inheritance problems in Islam.

This article is a qualitative research that uses literature sources as its database. In addition, this article also uses an experimental research approach to test the accuracy of calculation results from Android-based inheritance applications. The data in this study was obtained through trials of ten inheritance calculation applications that can be downloaded for free. The selection of applications was done randomly using the search keywords "*waris, warisan, and faraidh*." The application will be identified as a calculator, namely: calculator 1 Hitung Waris Islam (Faraid),¹⁴ calculator 2 i-Waris,¹⁵ calculator 3 Kalkulator Waris Shafi'iyah,¹⁶ calculator 4 Pembagian Harta Waris,¹⁷ calculator 5 Hitung Waris MUI SUMUT,¹⁸ calculator 6 Faraidh – Kalkulator Warisan,¹⁹ calculator 7 Kalkulator Waris (Faraid),²⁰ calculator 8 Simulasi Waris Islam,²¹ calculator 9 Faraidh Ilmu Waris & Kalkulator,²² calculator 10 al-Faraid – Hisab al-Mawaris.²³ Each inheritance calculator application will be tested with five special in Islamic inheritance law, such as determining and calculating *umariyatain, al-kehuraqa, akdariyah, musyarrakah, atau al-faridah al-malikiyah* cases. The calculation results from the inheritance calculator applications will be validated through the comparison toward manual calculations that refer to the provisions of the *fiqh* of the four Sunni schools.

Differences in Expert Systems for Islamic Inheritance Law: App-by-App

The field of Islamic inheritance law provides significant challenges for studying this subject. People often face difficulties in understanding and applying the complex rules. Moreover, finding a qualified expert in Islamic inheritance law for guidance in dividing the estate is not an easy task. Nonetheless, the integration of information technology in religious studies, such as the development of inheritance apps, has facilitated the learning process

¹⁴ <https://play.google.com/store/apps/details?id=com.strukturkode.hitungwarisislam>

¹⁵ <https://iwaris.or.id/live/>

¹⁶ <https://play.google.com/store/apps/details?id=com.tohakepriben.kalkulatorwaris>

¹⁷ <https://play.google.com/store/apps/details?id=com.faraidh.pembagianhartawaris>

¹⁸ <https://play.google.com/store/apps/details?id=com.muisumut.hitungwaris>

¹⁹ <https://play.google.com/store/apps/details?id=com.joglo.android.kalkulatomawaris>

²⁰ <https://play.google.com/store/apps/details?id=com.Syaban.KalkulatorWaris>

²¹ <https://play.google.com/store/apps/details?id=com.harnantowaris.simulasiwarisislam>

²² <https://play.google.com/store/apps/details?id=com.fenproductions.faraidh>

²³ <https://play.google.com/store/apps/details?id=com.moussaoui91.alfaraid>

and practical implementation of inheritance law.²⁴ By understanding the core principles of Islamic inheritance law, it is unnecessary for heirs to consult the experts or rely on available apps. However, with the widespread use of these apps, developers encourage users to still seek expert advice when facing certain issues. Developers highlight that the calculation results generated by such apps cannot be considered as authoritative and definitive fatwas.²⁵

Expert systems, as the basis of inheritance application design, are systems used to assist in decision-making by using knowledge and analysis methods that have been established by experts.²⁶ These systems can mimic human decision-making capabilities. These systems consist of intelligent programs that utilize knowledge and inference procedures to solve complex problems. The goal is to mimic the expertise of a human specialist in all aspects.²⁷ Expert systems use specialized knowledge specifically designed to handle problems with the same level of proficiency as human experts. Human expert has unique knowledge and skills in a particular field that are not shared by others in that domain.²⁸ There are two important aspects that an expert system adopt from an expert: knowledge and conceptual thought processes.²⁹

The integration of religious norms and expert systems is seen as the first step in creating awareness among the Muslim community to gain a deeper understanding of the application of Quranic verses.³⁰ In the context of the banking industry in Malaysia, the utilization of expert systems is one of the approaches used to resolve banking disputes. Expert systems have the ability to simplify the arbitration resolution process and provide

²⁴ Cheema, "Distribution of Inheritance under Islamic Law: An Appraisal of Online Inheritance Calculators."

²⁵ Kosim Kosim, "The Effectiveness of I-Waris Application to Increase Inheritance Understanding Based on Islamic Law," *World Journal of Advanced Research and Reviews* 14, no. 1 (2022): 368–76.; Evita Rahmawati, "Efektivitas Penggunaan Aplikasi I-Waris Terhadap Peningkatan Pemahaman Konsep Mawaris Peserta Didik Kelas XI Di MAN 1 Bandar Lampung" (UIN Raden Intan Lampung, 2019).

²⁶ I Purwanto et al., "Android-Based Intangible Cultural Heritage Expert System In Banten Province Using Backward Chaining Method," in *IOP Conference Series: Materials Science and Engineering*, vol. 1115 (IOP Publishing, 2021), 12008, <https://doi.org/10.1088/1757-899X/1115/1/012008>.

²⁷ Rosyid Ridlo Al Hakim, Erfan Rusdi, and Muhammad Akbar Setiawan, "Android Based Expert System Application for Diagnose COVID-19 Disease: Cases Study of Banyumas Regency," *J Int Comp & He Inf* 1, no. 2 (2020).

²⁸ Siler William and J James, "Fuzzy Expert Systems and Fuzzy Reasoning," *New Jersey: Willey-Interscience*, 2005.

²⁹ Ridwan Setiawan, Dini Destiani Siti Fatimah, and Cepy Slamet, "Perancangan Sistem Pakar Untuk Pembagian Waris Menurut Hukum Islam (Fara'id)," *Jurnal Algoritma* 9, no. 1 (2012): 1–8, <https://doi.org/https://doi.org/10.33364/algoritma/v.9-1.1>.

³⁰ Yasser A Nada and Sultan Aljahdali, "Expert System for Islamic Punishment (ESIP)," in *The International Arab Conference on Information Technology (ACIT 2011)*, 2012, 286–93.

efficient, fast and cost-effective solutions in handling Islamic banking disputes.³¹ Several expert systems developed have shown that religious disciplines, including Islamic inheritance knowledge, have begun to utilize advances in information technology as a potential tool to better understand Islamic inheritance law. Some researchers state that technology can be used to resolve various inheritance cases.³²

Inheritance expert system applications have the potential to become a reference for the community in understanding the division of inheritance based on Islamic law. Through these applications, people can gain Islamic inheritance law knowledge, because some inheritance applications have provided relevant information about Islamic inheritance law. The information presented by these applications includes the basics of inheritance law and materials related to Islamic inheritance law.³³ The development of an Android-based inheritance expert system application facilitates Muslim mobile users in gaining a better understanding of Islamic inheritance law. The main objective of developing this application is to provide easy access to users to learn the basic concepts of Islamic inheritance law, so that users can have sufficient knowledge about the principles of the distribution of inheritance in accordance with Islamic rules.³⁴

The purpose of developing an Islamic inheritance application is to provide the necessary information in determining the entitled heirs and allocating their respective shares. The design of this inheritance application aims to provide a comprehensive understanding to the community regarding the provisions of Islamic inheritance law in detail, starting from matters relating to the deceased to the process of dividing the inheritance. In addition, the use of this inheritance application also facilitates the community in dividing the inheritance, reducing the possibility of errors in the calculation of inheritance, and increasing efficiency in the process of calculating the division of

³¹ Mohamad Fateh Labanich, Mohammad Azam Hussain, and Nazli Mahdzir, "The Potential Application Of The Expert System In Facilitating Arbitration In Malaysia," *E-Book Of Extended Abstract*, 2021, 45.

³² Cheema, "Distribution of Inheritance under Islamic Law: An Appraisal of Online Inheritance Calculators."

³³ Cucut Susanto, "Pembagian Hak Waris Dengan Aplikasi Sistem Pakar," *Jurnal VOI (Voice Of Informatics)* 11, no. 2 (2022): 27–36.

³⁴ Abdul Nasir Zulkifli, Qais Ali Batiha, and Mustafa Moosa Qasim, "Design and Development of M-Faraid: An Islamic Inheritance Mobile App," *Journal of Advanced Research in Dynamical and Control Systems* 10, no. 10 (2018): 1569–75.

inheritance.³⁵ The following are some of the Islamic inheritance law expert system applications that was tested in this study:

1. *Hitung Waris Islam (Faraid)*

This app was developed by Strukturkode Studio, based in West Java. It is version 4.0, last updated on October 2, 2018. The app has been downloaded by more than 100,000 users and received a rating of 4.7 on the Play Store. The developer claims that this calculator-like app can quickly and accurately calculate the inheritance for each heir. The app has a section on inheritance issues that refers to various books of inheritance *fiqh*, such as *Fiqihul Islam wa Adillatib*, *al-Mualim Fil Fara'idh*, *Fatwa Lajnah Daimah Lil Bubuts al-Ilmiyah wal Ifta*, *al-Muntaqa min Fatawa*, *at-tabqiqat al-mardhiyyah fil mabahits al-fardhiyyah*, *al-khulashah fil ilmil faraidh*, *al-fawaidul jaliyyah fil mabahits al-fardhiyyah*, and *maktabah ash-syamilah*. In addition to the inheritance material, the app also comes with a "calculate" function that can be used to calculate the inheritance.³⁶

2. *i-Waris*

The *i-Waris* application was developed with the aim of facilitating individuals who want to learn Islamic inheritance law based on Sharia. This application was developed by a team consisting of consultants from various disciplines related to inheritance studies and technology, namely the Al-Azhar Islamic Boarding School Foundation and CPU Indonesia. Initially, this application was initiated through a presentation by Ustadz H. Asiful Akib, Lc, MA, and then expanded for Muballigh Training (PMA-2) at Al-Azhar Grand Mosque Jakarta. The app is designed to automatically exclude hidden heirs to simplify the user experience and has been downloaded 50,000 times. The app has three main functions: the "about" feature, which provides background information about the app developer; the "sharia" feature, which offers a brief explanation of Islamic inheritance law (although there is a bug that displays code instead of explanation); and the "calculate" feature, which allows users to simulate inheritance calculations.³⁷

³⁵ Septiana, Kurniadi, and Mulyani, "Perancangan Program Aplikasi Faraidh Sebagai Sistem Pendukung Keputusan Pembagian Harta Waris Berorientasi Solver."

³⁶ <https://play.google.com/store/apps/details?id=com.strukturkode.hitungwarisislam>

³⁷ <https://iwaris.or.id/live/>. This application is no longer available in the Play Store.

3. *Kalkulator Waris Syafi'iyah*

The Syafi'iah inheritance calculator application is the creation of students from a *salaf pesantren* (Toha Kepriben). The app has three main functions: an inheritance calculator (including cases of jadd ikhwah, akdariah, ghorowain, and musytarokah), complete material on inheritance science, and a guessing game to hone the user's ability to determine the siham of inheritance. This application is version 4.0, last updated in 2021, and has been downloaded 10,000 times. The app refers to the book *Uddatul Farid*, which follows the Shafi'i school of thought. The app's "inheritance calculator" feature only allows users to input the gender of the deceased and the estate. Unlike the previous app, it does not provide features to calculate debts, wills and funeral expenses.³⁸

4. *Pembagian Harta Waris*

This application was presented as a means to fulfill the needs of the general public in solving inheritance division problems. This application was launched on December 25, 2022, and has only been downloaded about 10 times. This application was developed by lecturers and students of UIN Sjech M. Djamil Djambek Bukittinggi. The app offers several features, such as "faraidh/mawaris," which provides a brief knowledge of the science of inheritance, including some explanations of masail *syawadz* (special cases). The "case examples" feature consists of 5 inheritance cases and their solutions. The "division of inheritance" feature functions as a calculator that allows users to simulate inheritance cases. After inputting the data of the deceased, the user will be faced with a display of heirs, including sons and daughters, spouse, father, mother, grandfather, grandmother, and siblings. However, other heirs, both fixed-share heirs and residual heirs, are not found in this application. Therefore, only basic inheritance cases involving immediate family members have the potential to be resolved using this application. This application does not explain the share of the heirs. Instead, the app directly divides the inheritance based on the heir's distributions.³⁹

5. *Hitung Waris MUI SUMUT*

This application was developed by the Fatwa Commission of MUI North Sumatra, Medan. This application is designed to make it easier to learn faraidh (Islamic inheritance law) and

³⁸ <https://play.google.com/store/apps/details?id=com.tohakepriben.kalkulatorwaris>

³⁹ <https://play.google.com/store/apps/details?id=com.faraidh.pembagianhartawaris>

automatically calculate the division of inheritance in accordance with Islamic principles. This application consists of three main menu: "Inheritance Law" which provides information on Islamic inheritance law referring to the Compilation of Islamic Law Book II, specifically from Article 171 to Article 214; "case example menu" which presents five examples of inheritance cases along with their solutions; and "calculate inheritance menu" which functions as an inheritance division calculator. In the "sample inheritance menu", the application provides examples of special cases such as *gharawain*, *musyarakah*, *aul*, and *radd*.⁴⁰

6. *Faraidh – Kalkulator Warisan*

This application is an Islamic inheritance division calculator that is claimed to be able to calculate the division of inheritance quickly. The application, developed by Romi Kusua Bakti from MAN 1 Boyolali and Joglosoft, is claimed to be able to calculate *aul*, *radd*, and several special cases, such as *gharawain*, *musyarakah*, and *akedariyah*. The "help" menu in this application provides an explanation of some nasabiah heirs, which refers to patrilineal kinship lines. There is no other menu besides the inheritance calculation feature, such as an explanation of the basis of Islamic inheritance law or the particular madhhab used by the developer in making this application.⁴¹

7. *Kalkulator Waris (Faraid)*

This application is designed to calculate the division of inheritance. The app has several main functions, including a *muqaddimah* (introduction) section that provides a definition of the science of faraid (Islamic inheritance law); an heir section that explains the categories of male and female heirs, residual heirs, fixed-share heirs, and deprivation (*hajib*); a “*dali*” section includes three Quranic verses and two hadith relating to inheritance; a *hajib* section explains the concept of al-hajib in Islamic inheritance law; and a calculator feature allows users to calculate inheritance.⁴²

8. *Simulasi Waris Islam*

This application was developed to simulate the calculation of inheritance based on Islamic inheritance law. This app was developed by Fidazka Apps and has been downloaded 500 times. The app is solely designed for simulation purposes without providing additional

⁴⁰ <https://play.google.com/store/apps/details?id=com.muisumut.hitungwaris>

⁴¹ <https://play.google.com/store/apps/details?id=com.joglo.android.kalkulatormawaris>

⁴² <https://play.google.com/store/apps/details?id=com.Syaban.KalkulatorWaris>

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features, such as basic knowledge of Islamic inheritance law. Interestingly, the app displays the heirs in a family tree concept, thus adding visual appeal to the user experience.⁴³

9. *Faraidh Ilmu Waris & Kalkulator*

This application is designed to learn inheritance law and calculate inheritance based on the Quran and Sunnah. The app consists of two main menus: the "Learn" menu, which provides information about Islamic inheritance law, and the "Calculator" menu. Under the "Learn" menu, there are several folders covering topics such as definitions, heirs, pillars of inheritance, verses related to inheritance, traditions related to inheritance, inheritance rights, causes and conditions, *hajib* to inheritance rights, and inheritance problems. In the "inheritance issues" folder, the app explains the various laws of inheritance relating to fetuses in the womb, concurrent deaths, siblings from the same mother, distant kindred, *zina* (adultery) and *li'an* (accusation of adultery), missing persons, and *kebuntsa* (people with multiple sexes). In the "heirs" folder, the app mentions that the source used is "*Hukum Waris*" by the Al-Azhar University Sharia Faculty Committee. Therefore, it is not surprising that this app presents explanations of inheritance issues from various perspectives of scholars from different madhhabs.⁴⁴

10. *al-Faraid – Hisab al-Mawaris*

This application is an Arabic-language inheritance calculation application. The developers explain that the app was designed based on the Zayd bin Thabit school of inheritance, which is the majority opinion among scholars. More specifically, the app explains that they used the Maliki school of thought in developing the app. The app has two main menus: "mas'alah jadidah" (new issues) and "masail masyhuroh" (old issues). In the "masail masyhuroh" menu, the application provides explanations for 19 inheritance cases that are included in the discussion of *masail yawadz*. The "mas'alah jadidah" menu functions as an inheritance calculator where users can enter the data of the heirs. In addition to automatically calculating the heir's share and determining the origin of the problem, this

⁴³ <https://play.google.com/store/apps/details?id=com.harnantowaris.simulasiwarisislam>

⁴⁴ <https://play.google.com/store/apps/details?id=com.fenproductions.faraidh>

application also provides the final result in the form of a percentage. The user is also given the option to input the total inheritance.⁴⁵

The Way Expert Systems answer *Masail Syawadz*: Complete and Incomplete Simulation

1. *Al-gharawain atau al-umariyatain*

Al-gharawain or *al-umariyatain* is a classic problem in Islamic inheritance law that arose during the time of the caliphs. This problem arose in two forms: first, when the deceased left the husband, father, and mother; second, when the heirs consisted of the wife, father, and mother. If we follow the basic principles of Islamic inheritance law, in both cases, the mother's share is 1/3 of the total assets. However, when the rule applied, the father's share would be smaller than the mother's.⁴⁶ Therefore, the mother's share modified to 1/3 of the remaining share of the husband or wife, while the father's share is 2/3 of the remaining share. Thus, the father's and mother's shares are in accordance with the basic principle of male and female inheritance, which is 2:1.

This opinion was first put forward by Umar bin Khattab based on rational reasons and *qiyas*,⁴⁷ as this issue is also known as *umariyatain*. After he solved this issue, the majority of the Companions, such as Uthman, Zayd bin Thabit, and Ibn Mas'ud, agreed with it. Hence, this opinion became the consensus of the Companions and scholars. On the other hand, Ibn Abbas had a different opinion, stating that the mother should receive 1/3 of the total estate. The difference between the opinion of the majority and Ibn Abbas stems from the interpretation of the phrase "*fa in lam yakun labu walad, wa waritsahu abawahu fa li ummih ats-tsuluts*." Ibn Abbas stated, this verse means, that the mother's share is 1/3 of the inheritance. Meanwhile, the majority are of the opinion that the phrase "*wa waritsahu abawahu*" means that both mother's share (1/3) and the father's share (2/3) are the

⁴⁵ <https://play.google.com/store/apps/details?id=com.moussaoui91.alfaraid>. Some devices are not compatible for this app

⁴⁶ Faridah Ahmad, Fauziah Mohd Noor, and Alias Azhar, "Sejarah Pelaksanaan Hak Pewarisan Pusaka Di Zaman Jahiliyyah Dan Zaman Pasca Islam: Kajian Perbandingan," *UUM Journal of Legal Studies* 8 (2017): 132–33.

⁴⁷ Muhammad Biltaji, *Manhaj Umar Bin Al-Khattab Fi Al-Tasyri'* (Dar al-Fikr al-Arabi, n.d.).

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remaining share of the husband or wife.⁴⁸ The case of *al-gharawain/al-'umariyatain* (husband, father, and mother; or wife, father, and mother) can be illustrated as follows.

Table 1: *al-gharawain/al-'umariyatain* Illustration 1

Umar, Uthman, Zayd bin Thabit, dan Ibnu Mas'ud			
Heirs Name		2	6
Husband	1/2	1/2	3/6
Mother	1/3 of remaining estate	-	1/6
Father	Residuary	-	2/6

Table 2: *al-gharawain/al-'umariyatain* Illustration 2

Umar, Uthman, Zayd bin Thabit, dan Ibnu Mas'ud			
Heirs Name		4	4
Wife	1/4	1/4	1/4
Mother	1/3 of remaining estate	-	1/4
Father	Residuary	-	2/4

The inheritance calculator can be said to be successful if it effectively addresses the *al-gharawain/al-'umariyatain* issue by providing accurate results, recognizing, and explaining the nature of the case as *al-gharawain*. Following this criterion, only 3 calculators managed to solve this case perfectly, including calculators 3, 6, and 10. In particular, calculators 3 and 10 have the more value of being in accordance with the Shafi'i school of thought (calculator 3) and the Maliki school of thought (calculator 10), as claimed in their applications. As for the other calculators (1, 2, 5, 7, 8, 9), based the calculation's substance, these calculators solve the *al-gharawain/al-'umariyatain* problem. However, these calculators did not identify or explain that the case they solved was *al-gharawain/al-'umariyatain* case. However, there were some problems, such as calculator 2, which identified this first case as

⁴⁸ Wahbah az- Zuhaili, *Al-Fiqh Al-Islāmī Wa Adillatuh* Juz VIII, 2nd ed. (Damaskus: Dār al-Fikr, 1985). 341.

“asal masalah (*binafsibi*),” and second case as “asal masalah (*raad*). As for calculator 4 fails to explain the share of each heir.⁴⁹

2. *Al-Khuraqa*

Al-Khuraqa is one example of a deviation from the general principles of Islamic inheritance law. In this case, the heirs consist of the mother, the paternal grandfather and the full sister. There are six opinions sourced from the Companions regarding this case. The first opinion, is the consensus of the scholars (Maliki, Shafi’i and Hanbali) who refer to the opinion of Zayd bin Tsabit. They stated that in this case, the mother receives 1/3, while the rest is divided between the grandfather and the full sister in a 2:1 ratio. The second opinion, is attributed to Ali bin Abi Talib, who states that the mother gets 1/3, the full sister gets 1/2, and the paternal grandfather gets the remaining share, which is 1/6. The third opinion, is attributed to Ibn Abbas and adopted by the Hanafi school, which states that the full sister receive nothing as they are deprived by the paternal grandfather who is considered residual heirs.⁵⁰

Another opinion comes from the narration of Abdullah bin Abbas. He narrated two different opinions on the issue of *al-kehuraqa*. First, the full sister receive 1/2, the mother receives the remaining 1/3 (or 1/6), and the paternal grandfather receives the remaining share. This is analogous to the case of *gharawain*.⁵¹ Secondly, the full sister receives 1/2, while the paternal and maternal grandfather each receive the remaining 1/4. It is said that this second opinion is attributed to Umar bin Khattab.⁵² The last opinion is from Uthman bin Affan, who stated that each heir receives 1/3 (divided equally). Some of the scholarly opinions on *al-kehuraqa* (mother, paternal grandfather, full sister) is explained in the following table.

Table 3: *al-kehuraqa* Illustration 1

Majority of scholar (Malik, Shafi’i, dan Ahmad) which refer to the opinion of Zayd bin Tsabit

⁴⁹ Mu’tashim Billah, “Uji Aplikasi Waris (Kasus Al-Gharawain),” Youtube, 2023.

⁵⁰ Zuhaili, *Al-Fiqh Al-Islami Wa Adillatuh Juz VIII*. 342.

⁵¹ Muhammad bin Ahmad As-Sarkhasi, *Al-Mabsuth Li as-Sarkhasi Juz 29* (Beirut: Dar al-Ma’rifah, 1993), 190.

⁵² Muhannad Esteete, “Uniqueness of the Companion Abdullah Bin Masoud in the Inheritance of the Grandfather with Brothers and Sisters, Brothers and Father: Legal Jurisprudence Study,” *Jordan Journal of Islamic Studies* 18, no. 4 (2022): 479–503.

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Heir Name		3 x 3	9
Mother	1/3	1	3/9
Paternal grandfather	residuary	2	4/9
Full sister	residuary		2/9

Table 4: *al-keburaqa* Illustration 2

Ali bin Abi Thalib

Heir Name		6	6
Mother	1/3	2	2/6
Paternal grandfather	residuary	1	1/6
Full sister	1/2	3	3/6

Table 5: *al-keburaqa* Illustration 3

Ibnu Abbas adopted by Mazhab Hanafi

Heir Name		3	3
Mother	1/3	1	1/3
Paternal grandfather	residuary	2	2/3
Full sister	deprived	-	-

Table 6: *al-keburaqa* Illustration 4

First opinion of Ibnu Mas'ud

Heir Name		6	6
Mother	1/2	3	3/6
Paternal grandfather	1/3 of remaining aset (1/6)	1	1/6
Full sister	residuary	2	2/6

Table 7: *al-keburaqa* Illustration 5

Second opinion of Ibnu Mas'ud and Umar

Heir Name		4	4
Mother	1/2	2	2/4

Paternal grandfather	1/2	2	1/4
Full sister			1/4

Table 8: *al-keburaqa* Illustration 6

Uthman bin Affan			
Heir Name		3	
Mother	1/3	1	1/3
Paternal grandfather	1/3	1	1/3
Full sister	1/3	1	1/3

The inheritance calculator can be said to be successful if it follows any of the six examples mentioned above. In addition, the calculator is able to identify (*al-keburaqa*) and explain it in the calculation results. The calculator also explain whose opinion it is following. Following this standard, only calculators 3 and 10 meet the criteria. The calculation results of these two calculators are in accordance with the opinions of the Shafi'i (calculator 3) and Maliki (calculator 10) schools of thought, as claimed in their respective apps.

Other calculators can be substantively justified as they correspond to the division of the mentioned opinions. However, most of these calculators do not identify or explain that the case being solved is the issue of *al-keburaqa*. Moreover, these calculators do not explicitly state that they follow one of the scholarly opinions on *al-keburaqa*. Calculators 4 and 7, in substance, conform to the Hanafi school, but do not provide any further explanation regarding this particular case. Calculator 6, in substance, is in accordance with the opinion of Ali ibn Abi Talib, but does not identify *al-keburaqa* and mention its reference. Calculator 8, following the formulation of the majority opinion, does not identify the case of *al-keburaqa* and explain its reference.

As for the other calculators, they cannot be practically justified. Although, in the end, the calculations of these calculators can be adjusted to the opinion of Ibn Abbas which is adopted by the Hanafi school. The most critical practical error in calculators 1, 5 and 9 is that when the user enters the data of one of the heirs (the grandfather), the calculator automatically prevents the other heirs (the sibling group) from being included as heirs. This

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is most likely the main reason why these calculators cannot identify *al-khuraqa* cases as full sisters cannot be included as heirs, despite their *hajib* status. Meanwhile, calculator 2, in substance, follows the opinion of Zayd bin Tsabit, which is the majority opinion among the scholars of the schools. However, fatally, this calculator identifies this case as an *akdariyah* case.⁵³

3. *al-akdariyah*

The next issue is *al-akdariyah*. According to the majority of scholars, except for the Hanafi's who follow the opinion of Zayd ibn Tsabit, full sister or a consanguine sister does not inherit 1/2 share when inherits with grandfather. Instead, the sister and grandfather will inherit the rest of the estate in a ratio of 2:1, except in the case of *al-akdariyah*. Therefore, the husband receives 1/2, the mother 1/3, the grandfather 1/6, and the full sister 1/2. It was found that total share 6 is raised 9 due to *'aul*, and then the total share was corrected and raised to 27 (multiplied by 3), because the grandfather's share should be combined with the share full sister sister (resulting in 4 shares). This merger was done to ensure that the grandfather and the sisters inherit together in the ratio of 2:1.

The second opinion, held by Umar, Ali and Ibn Mas'ud, states that the sister's share is 1/2 without combining it with the grandfather's share of 1/6. The grandfather does not become residual heir, because if he does, he will not get a share of the remaining inheritance. The third opinion, held by Abu Hanifah, follows the opinion of Ibn Abbas and Abu Bakr. According to them, full sisters do not receive anything (*saqital*).⁵⁴ The fourth opinion, expressed by Ibn Mas'ud, stated that the husband gets 1/2, the full sister gets 1/2, the grandfather gets 1/6, and the mother gets 1/6. This division is done to ensure that the mother's share does not exceed the grandfather's share.⁵⁵ The differences between the scholars in the case of *al-akdariyah* (husband, mother, grandfather, full sister, and seayah sister) is explained in the following table.

Table 9: *al-akdariyah* Illustration 1

Jumhur ulama following Zayd bin Tsabit,

⁵³ Mu'tashim Billah, "Uji Aplikasi Waris (Kasus Al-Khuraqa)," Youtube, 2023.

⁵⁴ Zuhaili, *Al-Fiqh Al-Islami Wa Adillatuh Juz VIII*, 343.

⁵⁵ As-Sarkhasi, *Al-Mabsuth Li as-Sarkhasi Juz 29*, 191.

Heir Name		6	$\frac{9}{x \ 3}$	27	27
Husband	$\frac{1}{2}$	3		9	$\frac{9}{27}$
Mother	$\frac{1}{3}$	2		6	$\frac{6}{27}$
Paternal Grandfather	$\frac{1}{6}$	1		8	$\frac{8}{27}$
Ful sister	$\frac{1}{2}$	3		4	$\frac{4}{27}$

Table 10: *al-akdariyah* Illustration 2

Umar, Ali, and Ibn Mas'ud

Heir Name		6	$\frac{9}{9}$	9	
Husband	$\frac{1}{2}$	3		$\frac{3}{9}$	
Mother	$\frac{1}{3}$	2		$\frac{2}{9}$	
Paternal Grandfather	$\frac{1}{6}$	1		$\frac{1}{9}$	
Ful sister	$\frac{1}{2}$	3		$\frac{3}{9}$	

Table 11: *al-akdariyah* Illustration 3

Abu Hanifah followed Ibn Abbas and Abu Bakar

Heir Name		6		6	
Husband	$\frac{1}{2}$	3		$\frac{3}{6}$	
Mother	$\frac{1}{3}$	2		$\frac{2}{6}$	
Paternal Grandfather		residuary	1		$\frac{1}{6}$
Ful sister		deprived	-		

Table 12: *al-akdariyah* Illustration 4

Ibnu Mas'ud

Heir Name		6		8	
Husband	$\frac{1}{2}$	3		$\frac{3}{8}$	
Mother	$\frac{1}{6}$	1		$\frac{1}{8}$	
Paternal Grandfather	$\frac{1}{6}$	1		$\frac{1}{8}$	
Ful sister	$\frac{1}{2}$	3		$\frac{3}{8}$	

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A calculator succeeds if it follows any of the four examples mentioned above. In addition, the calculator identifies (*al-akdariyah*) and explain it in the calculation results. As an added value, the calculator also is able to explain whose opinion it is following. Following this standard, only calculators 3 and 10 meet the criteria. This is because the calculation results of these two calculators are in accordance with the opinions of the Shafi'i school of thought (calculator 3) and the Maliki school of thought (calculator 10) as claimed in their respective applications.

The other two calculators, in substance, can be justified as succeeds as they follow of one the companions' opinion. However, they do not explain this in the application or the process of solving the problem. Calculator 4 fails to identify the case of *akdariyah*, but its calculation can be justified by referring to the opinion of the Hanafi school. However, the drawback is that this calculator does not mention the specific share of each heir. Calculator 6, which previously followed the opinion of Ali, in this case refers to the opinion of Zayd which is followed by the majority of scholars. Although it successfully identifies the case of *akdariyah*, it does not mention whose opinion it refers to. Calculator 8 fails to identify the case of *akdariyah*, but the solution can be aligned with the opinion of Ali, despite previously following the majority opinion (Zayd). The clear mention of references in special cases is important to avoid confusion among opinions in one or two other cases, as found in calculators 6 and 8.

On the other hand, the other calculators were deemed to have failed in resolving *akdariyah* cases due to several factors. Calculators 1 and 9 do not identify *akdariyah* cases, although the end result can be aligned with the Hanafi opinion, but it is not practical. These calculators restrict the user from adding a full sister after selecting the grandfather as residual heir. Calculator 2, able to identify *akdariyah* cases, but it does not follow any particular school of thought in the distribution of inheritance. It gives a share of $1/9$ to the grandfather and $1/8$ to the sister. The use of three different denominators in the total share makes the division of inheritance among the heirs unclear. Calculators 5 and 7 have the same problem as calculator 1. However, fatally, these calculators give a share of $1/6$ to the mother, which should be $1/3$.⁵⁶

⁵⁶ Mu'tashim Billah, "Uji Aplikasi Waris (Kasus Al-Akdariyah)," Youtube, 2023.

4. *al-Musyarrakah/al-musyarakah, al-hijariyah, al-himariyah*

This case happened because, according to the original principle of inheritance law, full brothers who inherit together with husbands, mothers, and uterine brothers become residual heirs. However, when the inheritance is divided according to each share, the full brother or consanguine brother who are residual heirs do not get the inheritance because it has been distributed to fixed-share heirs. Therefore, the Shafi'iyah and Malikiyah scholars which refer to the opinions of Umar, Utsman, and Zayd decided to combine the share of full or consanguine brother with the share of a uterine brother. Then, the 1/3 share is divided equally between the siblings. On the other hand, according to Abu Hanifah and Imam Ahmad, who followed the opinion of Ali, the siblings do not get any share as residual heirs as the inheritance has been distributed to fixed share heirs. This opinion refers to the explicit meaning of verse 12 of An-Nisa, which states that the "siblings" mentioned in the verse refer to uterine brothers and sisters. They also rely on the hadith that instructs to distribute the inheritance to the rightful heirs (fixed-share heirs), while the residual heirs receive the remaining portion.⁵⁷ The differences of opinion among the scholars in the case of *al-musyarrakah* (husband, mother, siblings, brothers and sisters) is explained in the following table.

Table 13: *al-musyarrakah* Illustration 1

Abu Hanifah, Imam Ahmad following Ali			
Heir Name		6	
Husband	1/2	3	3/6
Mother	1/6	1	1/6
2 uterine brothers	1/3	2	2/6
Full brother	Residuary	-	-

Table 14: *al-musyarrakah* Illustration 2

Shafi'iyah dan Malikiyah following Umar, Uthman, and Zayd				
Heir Name	6 x 3	18	18	18

⁵⁷ Zuhaili, *Al-Fiqh Al-Islāmi Wa Adillatub Juḡ VIII*, 343.

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Husband	1/2	3	9	9/18	9/18
Mother	1/6	1	3	3/18	3/18
2 uterine brothers	1/3	2	6	6/18	4/18 @ 2/18
Full brother					2/18

An inheritance calculator can be considered successful if it follows any of the two examples mentioned. Moreover, the calculator is able to identify (*al-musyarakah/al-musyarakah*) and explain it in the calculation results. The calculator also explains whose opinion it is following. According to this standard, only calculators 3 and 10 meet the criteria, as their calculation results are in accordance with the opinions of the Shafi'i (calculator 3) and Maliki (calculator 10) schools of thought, as claimed in the application.

The calculations of the other four calculators can be substantively justified as they correspond to the division in one of the two examples mentioned above. However, these calculators (1, 8, and 9) do not make it clear that they are based on the Hanafi school, and they also fail to identify the case of *al-musyarakah*. Meanwhile, calculator 2 follows the method of the Shafi'i school but does not explain it in the calculations or application. This calculator fails to identify the case of *al-musyarakah* which is mentioned as “asal masalah (*binafsil*).”

The other four calculators are failed in solving *al-musyarakah* cases due to several factors. The main factor behind the failure of these four calculators was their inability to identify the case of *al-musyarakah* and to explain whose opinion they were following. Calculator 4 fatally lacks a complete list of heirs (no uterine brothers in the list). Calculator 5 shows inconsistency between the case in the menu “example” and the calculation. In the example, the calculator displays the solution according to the opinion of Zayd bin Tsabit, while in the calculation, it displays the Hanafi opinion which refers to the opinion of Ali bin Abi Talib. Calculator 6 successfully identifies this case as *al-musyarakah*, but in the calculation, the calculator does not divide the 2/6 share to the full brother and two uterine brothers equally. Instead, the calculator gives 1/6 to the full brother and 1/6 is halved to each of the two uterine brothers, resulting in the remaining share of the inheritance (*radd*). Calculator 7 tries to solve the problem based on the Hanafi opinion, but there is an error in

the division of the inheritance, where the total share of the heirs exceeds the total inheritance.⁵⁸

5. *al-faridah al-malikiyah*

The next case is *al-faridah al-malikiyah*, where the deceased left heirs consisting of the husband, mother, grandfather, 2 uterine brothers, and consanguine brother. According to the opinion of Zayd and Shafi'i, the grandfather gets a share of 1/6, while the rest of the inheritance is provided to the consanguine brother. Whereas according to Malik, the husband gets 1/2, the mother gets 1/6, and the grandfather becomes residual heir who takes the rest of the inheritance, while the 2 uterine brothers and consanguine brother do not get anything as they are deprived by the grandfather.⁵⁹ Differences of opinion among scholars regarding *al-faridah al-malikiyah* is explained in the following table.

Table 15: *al-faridah al-malikiyah* Illustration 1

Zayd and Shafi'i			
Heir Name		6	
Husband	1/2	3	3/6
Mother	1/6	1	1/6
Paternal grandfather	1/6	1	1/6
2 uterine brothers	Deprived	-	-
Consanguine brother	Residuary	1	1/6

Table 16: *al-faridah al-malikiyah* Illustration 2

Imam Malik			
Heir Name		6	
Husband	1/2	3	3/6
Mother	1/6	1	1/6
Paternal grandfather	Residuary	2	2/6
2 uterine brothers	Deprived	-	-

⁵⁸ Mu'tashim Billah, "Uji Aplikasi Waris (Kasus Al-Musyarrakah)," Youtube, 2023.

⁵⁹ Zuhaili, *Al-Fiqh Al-Islami Wa Adillatub Juz VIII*, 344.

An inheritance calculator can be considered successful if it follows one of the two examples above. In addition, the calculator is be able to identify the case (*al-faridah al-malikiyah*) and explain it in the calculation results. The calculator is able to explain whose opinion it is following. According to this standard, only calculators 3 and 10 meet the criteria. The results of both calculators are in accordance with the opinions of the Shafi'i school (calculator 3) and the Maliki school (calculator 10), as claimed in the app.

The other two calculators successfully solve the case of *al-faridah al-malikiyah* but fail to identify the case by not providing an explanation of the case and whose opinion is followed. Calculator 7 solved it according to the Maliki school, but in the second case, it used the Hanafi school. Hence, there is an inconsistency in the use of school opinions. Calculator 8 solves it based on the Shafi'i school, but in the previous cases, it often uses Ali's opinion which is different from the Shafi'i opinion.

On the other hand, other calculators failed to solve this problem due to several factors. The main factor behind this failure was that the calculator could not identify the case of *al-faridah al-malikiyah* and do not mention whose opinion was used as a reference. Also, another factor that led to the failure of the calculator in solving this case was that the user was unable to include the heirs of the brothers who were deprived (*mahjub*) by the grandfather. Other detail factors are as follows: calculator 1 considers the mother's share to be 1/3 of the husband's share, as the *gharawain* case. Calculator 2 considers the grandfather and consanguine brother as residuary, hence 2 uterine brothers receive 1/3, leaving no residue for the residual heirs. Calculator 4, like the previous cases, does not have a complete list of heirs. Calculators 5 and 9, due to the inability to select brother heirs (deprived by the presence of the grandfather), gave a share of 1/6 to the mother, which according to the theory of *hajib bi asy-syakhsbi*, takes into account the presence of the deprived heir and reduces the share of the other heirs through *hajib nuqshan*. Calculator 6 has an error where the total share of the heirs exceeds the total inheritance.⁶⁰

⁶⁰ Mu'tashim Billah, "Uji Aplikasi Waris (Kasus Al-Faridah Al-Malikiyah)," Youtube, 2023.

Based on the experiments conducted, it can be concluded that the majority of the tested inheritance calculators are not able to identify special cases in inheritance law. The calculators have many errors in solving cases, to the point of inconsistency in the chosen method of solving special cases. While there are various apps available to calculate inheritance shares, it is important for individuals to make a careful selection before downloading and using such apps. This is because not all available apps are adequately qualified to address the complexity of inheritance-related issues. Users of these apps need to carefully consider the advantages and disadvantages of each app. There are various problems encountered in inheritance apps, for example, some apps only consider inherited assets in the form of money, whereas in practice, inherited assets have a wider scope. In addition, there are also problems with the explanations provided by some apps regarding the results of inheritance calculations.⁶¹

There are several main factors that cause the inability of expert systems to solve inheritance problems, especially those related to *masail syawadz*. First, at a systemic level, the applications refuse to simulate *masail syawadz* problems. For example, if the user enters the grandfather as the heir, then the hidden heir cannot be entered. This means that the rightful heirs do not receive their actual fixed share. For example, a mother who should have received 1/6 could have received 1/3 because the hidden heirs were not included in the list of heirs. Secondly, the absence of mentioned references led to inconsistencies in choosing which school of thought was used by the app developers when formulating the expert system. In some cases, the app appeared to follow the Hanafi school of thought, while in other cases, it appeared to follow the opinions of the Shafi'i and Maliki schools of thought. Thirdly, the app failed to address certain inheritance cases due to the limited list of heirs available. Fourthly, problems arose in determining the fixed share of eligible heirs, thus confusing the origin of the problem and causing errors in the distribution of the inheritance. Finally, there were inconsistencies between the examples given in the cases and the calculator's calculations for similar cases. These factors contributed to the app's failure to identify specific cases in inheritance law.

⁶¹ Febry Aditya Wibisono Romadhon, Ismiarta Aknuranda, and Retno Indah Rokhmawati, "Evaluasi Aplikasi I-Waris Menggunakan Pengujian Usability," *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer* 4, no. 9 (2020): 2945–50.

The Consistency of Inheritance Calculator Apps with Fiqh Madzhab

The success or the failure of the inheritance calculator in solving the *masail syawadz* problem in this article is based on two standards: first, the calculator ability to identify that the presented case falls into the category of *syawadz* problem; and second, the calculator ability to clarify which school of thought is used to solve the *syawadz* problem. This means that the tested calculator is effective in solving *syawadz* problems by fulfilling these two criteria. The application of these two standards is very important because, in reality, *syawadz* cases are resolved in an unconventional manner and can be considered to deviate from the basic principles of Islamic inheritance law.⁶²

The first standard was created with the aim of distinguishing between the settlement of *syawadz* and ordinary inheritance cases. Hence, the calculator needs to have expertise in distinguishing between the two. If the calculator fails to identify a *syawadz* case, then this means that the calculator will only solve it based on the calculation of regular inheritance rules. However, this does not negate the fact that in resolving *syawadz* cases, Ibn Abbas always adhered to the basic principles of Islamic inheritance law derived from explicit textual evidence (*nash*).⁶³

To complement these facts, a second standard was also established. In addition to being able to identify *syawadz* issues, the calculator needs to ascertain which opinion (*mazhab*) is used to resolve *syawadz* cases. This second standard is set based on two considerations: first, the possibility of the calculator following the opinion of Ibn Abbas which is adhered to by the Hanafi school, and second, evaluating the consistency of the calculator in solving all cases of *syawadz*.

The calculator's consistency in following a particular opinion when solving *syawadz* problems is very important. This is useful for users who want to make sure that the solution of the *syawadz* problem is in accordance with the adopted mazhab. In addition, the absence of clear references can lead to the practice of mixing opinions from different schools (*talfiq*) in solving Islamic inheritance cases, especially the problem of *syawadz*. This phenomenon can be seen in some cases, as calculator 7 refer to the Maliki school in the fifth case, yet it refer to the Hanafi school in the second case. Hence, there is an

⁶² Wahidah, "Kasus Kewarisan Istimewa Gharawain Ditengah Isu Keadilan Gender."

⁶³ Zuhaili, *Al-Fiqh Al-Islami Wa Adillatub Juz VIII*. 340.

inconsistency in the use of school opinions. Calculator 8 refer to the Shafi'i school in the fifth case, yet in the previous cases, it often uses Ali's opinion which is different from the Shafi'i opinion. Undoubtedly, providing a reference when solving a *syawadz* problem is also very beneficial for calculator users, as it facilitates a more accurate understanding of the different approaches in solving *syawadz* problems.

The test results showed that the majority of the calculators failed to demonstrate expertise in solving *syawadz* cases. This is because the algorithms used in developing the expert database were not designed to identify or determine that a solved case falls into the category of a *syawadz* problem, which requires consistent determination from expert knowledge. The expert system is designed with rules that yield certain and consistent outcomes in accordance with the predefined flow in its decision tree diagram.⁶⁴

Based on the two standards mentioned above, only two calculators met the qualifications as the expert system: calculator 3, which follows the Shafi'i school based on the opinion of Zayd bin Tsabit, and calculator 10, which follows the Maliki school, also based on the opinion of Zayd bin Tsabit. These two calculators are called expert systems because they have successfully acquired consistent expert-derived knowledge. Some of the remaining calculators have not achieved the status of expert systems because, in certain cases, they acquire knowledge from different expert sources. This can be seen from the references used, which consist of various (mixed) sources, resulting in inconsistencies in solving the *syawadz* case.

The tendency of the Shafi'iyah Inheritance Calculator can be reflected in its statement that has been stated in the application, that they refer to the Shafi'i school of thought which refers to the school of Zayd, because he is the companion who best understands inheritance science. The tendency of this application to solve inheritance problems in accordance with the Shafi'i school of thought can also be seen from how it resolves the issue of radd. the remaining share of the inheritance is left to the baitul mal institution. However, in later times, the scholars of the Shafi'iyah school of thought stated that if the

⁶⁴ Hersatoto Listiyono, "Merancang Dan Membuat Sistem Pakar," *Dinamik* 13, no. 2 (2008).

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baitul mal was not properly organized, then the remaining inheritance property would be given to the *zawi al-furud* heirs other than the husband and wife.⁶⁵

Meanwhile, the tendency of the 10 al-Faraid-Hisab al-Mawaris calculator to implement the Maliki school of thought can also be noted from the statements and that have been stated in their application. In addition, this tendency can be seen from the way this application resolves the radd problem. In the issue of radd, where there is a remaining share of the inheritance, the Maliki madhhab does not give it to any of the heirs. According to the maliki school, which also refers to the opinion of Zayd bin Tsabit, if there is a remaining share of the inheritance, the one who is eligible to get the property is the baitul mal.⁶⁶ However, like the Shafi'i school, contemporary malikiyah scholars argue that if the baitul mal is not well organized, the beneficiaries of the remaining inheritance property are ahab al-furud other than husband and wife.

In the case of *radd* inheritance, for example, if a person leaves a husband and 2 daughters, then there are three approaches to the distribution of inheritance according to the views of the Maliki and Shafi'i schools of thought. The first approach is that the husband gets 1/4 share, while the two daughters get 2/3 share, and remaining 1/12 share goes to the baitul mal. The second approach is that the husband only gets 1/4 share, while the two daughters get 2/3 share, plus the remaining share of inheritance. The third approach is, the rest of the radd inheritance is given to the heirs of *zawi al-arham*. However, it should be noted that the developed system expert ensures consistency in the settlement of inheritance, so that there is no discrepancy between the method chosen by the application and the reference used as the basis for the algorithm.

Calculator 3 consistently uses the references of contemporary Shafi'i schools of thought (*muta'akkibirin*) and applies them in the calculation of radd. In calculating the inheritance of the husband and two daughters, Calculator 3 only gives the remaining inheritance to the two daughters, in accordance with several Shafi'iyah books written by contemporary Shafi'iyah scholars, which are used as the basis for the application algorithm,

⁶⁵ Ibrahim bin Abdillah bin Ibrahim al-Fardhi, *al-'Adzbu al-Fadbi Syarah 'Umdat al-Farid*, vol 2, 4.

⁶⁶ Zuhaili, *Al-Fiqh Al-Islami Wa Adillatub Juz VIII*, 358.

such as *tabrir al-kifayah*,⁶⁷ *syarh al-fusul al-muhimmah*,⁶⁸ *al-'Adzbu al-Fadhi Syarah 'Umdat al-Farid jilid 2*,⁶⁹ dan *Kitab at-talkhis fi 'ilmi al-faraid*.⁷⁰ Those books are available download at the application.

Calculator 10, on the other hand, consistently follows the early opinion of the Maliki Mazhab, which states that the remaining shares are not distributed to any heirs, but are provided to the baitul mal. In the calculation of *radd*, the method of distribution generated by this application is consistent with the book references that are used as the basis for the application algorithm, such as the Book of Mukhtashor Kolil and all its explanatory books (*syarah*).⁷¹

Despite the success of these two calculators in solving *masail syawadz* consistently based on the Maliki and Shafi'i schools of thought, they are not fully able to answer classical and contemporary issues. In classical fiqh discourse, for example, this application is not designed to solve the problems of *dzawi al-arham*, pregnant inheritance, *kehunsa*, *munasakabah*, and *takharuj*. Meanwhile, in contemporary mawaris fiqh discourse, this application is not compatible with the development of inheritance law, especially in Indonesia. There are several themes that cannot be resolved by the calculator, such as joint property, mandatory wills, and substitute heirs.

Conclusion

The existence of an expert system can help people in learning and solving problems related to Islamic inheritance law. However, The use of expert systems in inheritance is not as comprehensive as the illustrations described in classical fiqh books. This study finds that only two applications consistently resolved particular cases in Islamic inheritance law. Only a percentage of the tested cases could be resolved by other programs. Even though their computations were valid according to one of the schools, most apps were unable to recognize the examples *syawadz* cases provided. The inability of these applications to solve

⁶⁷ Zakaria bin Muhammad bin Ahmad al-Anshari, *Nibayah alHidayah ila Tabrir al-Kifayah* (Beirut: Dar al-Kutub al-'Ilmiyah, 2003), 291.

⁶⁸ Badruddin bin Muhammad Sabath al-Mardini, *Syarh al-Fushul al-Muhimmah fi Mawaris al-Ummah* juz 1 (Riyad: Dar al-'Ashimah, 2004), 690.

⁶⁹ Ibrahim bin Abdillah bin Ibrahim al-Fardhi, *al-'Adzbu al-Fadhi Syarah 'Umdat al-Farid*, vol. 2, 4.

⁷⁰ Abu Hakim Abdullah bin Ibrahim, *Kitab at-Talkhis fi 'Ilmi al-Fara'id* juz 1 (Madinah: Maktabah al-Ulum wa al-Hukm), 179.

⁷¹ Kholil bin Ishaq al-Maliki, *Mukhtashor al-'Allamah Kholil* (Kairo: Dar al-Hadis, 2005), 261.

inheritance cases was caused by a number of factors, such as their inability to accurately simulate *masail syawadq* issues, the inconsistent viewpoint that the application developers used to create the expert system, the small number of heirs that were available, and mistakes made in identifying the heirs' portions.

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