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Financial Wellbeing of Poor Households: Role of Digital Financial Inclusion

(Kesejahteraan Kewangan Isi Rumah Miskin: Peranan Keterangkuman Kewangan Digital)

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ABSTRACT

This study aimed to examine determinants of financial wellbeing and the mediating effects of digital financial inclusion for poor households in Malaysian Borneo. A total of 405 responses were collected from the poor households in Sabah and Sarawak using a self-administered questionnaire. The data were analyzed using PLS modeling techniques. The findings demonstrate that financial wellbeing is significantly determined by financial behavior, financial literacy, and digital financial inclusion. However, digital literacy is not associated with financial wellbeing. Digital financial inclusion plays a mediating role in enhancing financial wellbeing. The results of multigroup analysis show that the impacts of these relationships are higher for Sarawak than Sabah. This study enriches the literature on financial wellbeing by examining determinants from broader perspectives and focusing on poor households in Malaysian Borneo, an underexplored area. The multigroup analysis shed light on the differences in the paths to financial wellbeing of poor households in Sabah and Sarawak. Policies and strategies aiming to improve financial wellbeing and accelerate digitalization for poor households should be emphasized.

Keywords: Digital financial services; financial inclusion; financial wellbeing; Malaysia; Borneo; PLS multigroup analysis

ABSTRAK

Kajian ini bertujuan untuk menyelidik penentu kesejahteraan kewangan dan kesan pengantaraan keterangkuman kewangan digital terhadap pengaruh untuk isi rumah miskin di Borneo Malaysia. Kajian ini mengumpul maklum balas dari 405 isi rumah miskin di Sabah dan Sarawak menggunakan soal selidik yang dijalankan sendiri. Data dianalisis dengan menggunakan teknik pemodelan PLS. Dapatan kajian mendedahkan bahawa tingkah laku kewangan, celik kewangan dan keterangkuman kewangan digital adalah penentu penting untuk meningkatkan kesejahteraan kewangan. Walau bagaimanapun, celik digital didapati tidak ada hubungan dengan kesejahteraan kewangan. Selain itu, keterangkuman kewangan digital memainkan peranan pengantara dalam hubungan meningkatkan kesejahteraan kewangan melalui penyedia perkhidmatan kewangan dan infrastruktur perkhidmatan kewangan digital. Keputusan analisis multikumpulan menunjukkan bahawa kesan hubungan ini lebih tinggi untuk Sarawak berbanding Sabah. Kajian ini penting untuk pengamal kerana ia mengkaji cara mencapai kesejahteraan kewangan dari perspektif yang lebih luas di mana merangkumi faktor-faktor peringkat isi rumah dan sistem perkhimatan kewangan. Tambahan pula, analisis multikumpulan PLS menjelaskan perbezaan pencapaian kesejahteraan isi rumah miskin di Sabah dan Sarawak. Dasar and strategi yang bertujuan untuk meningkatkan kesejahteraan kewangan dan mempercepatkan pendigitalan untuk isi rumah miskin harus dititikberatkan.

Kata kunci: Perkhidmatan kewangan digital; keterangkuman kewangan; kesejahteraan kewangan; Malaysia; Borneo; analisis berbilang kumpulan PLS

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INTRODUCTION

Poverty refers to the condition of lack of income and resources for a standard living. The World Bank defined it as "pronounced deprivation in wellbeing" (Haughton & Khandker 2009). Poor groups are financially vulnerable as they have limited financial resources. They lack the ability to recover from unexpected financial shocks due to less financial

assets and possess uncertain jobs (Abid & Mohd Shafiai 2018). Financial accessibility is a crucial factor in poverty reduction, as the unbanked population often face difficulty to save money, invest, and build assets to protect against risks (Neaime & Gaysset 2018). Financial inclusion is one of the ways to help this vulnerable group enhance their financial wellbeing and is a tactic to escape poverty. Financial inclusion means accessibility to financial products and services that are useful and affordable, meet financial needs (savings, payments, credit, and insurance), and are delivered responsibly and sustainably (The World Bank 2022). Financial wellbeing shows an individual's ability to fulfill ongoing financial commitments, stay resilient to income shocks, achieve future financial goals, and make financial decisions that enhance their overall quality of life (Bank Negara Malaysia 2022).

Zhou and Wang's (2021) study demonstrated that digital financial services are a means of achieving financial inclusion and reducing poverty. The deployment of technology in financial services leverages alternative data sources such as smartphones and activities like social media, e-commerce, transaction history and web data to assess customers' characteristics and creditworthiness; hence, it can offer more customized and tailored financial services (Asian Development Bank 2017; OECD 2022) and has the potential to achieve a higher level of financial wellbeing (OECD 2016). Digital financial inclusion is the access and use of formal financial services by excluded and underserved populations via digital channels that meet their needs and at an affordable cost (CGPA 2015). Digital financial services such as internet banking, mobile banking, and digital payments address the limitations of the financial services offered by traditional brick-and-mortar financial institution by increasing outreach, reducing the complexity of the process, lowering transaction costs, increasing the speed of financial transaction, and enhancing security and transparency (The World Bank 2020).

A Household Income Estimates and Incidence of Poverty Report showed that Sabah and Sarawak are among the states with the highest poverty rates, which are 25.3% and 12.9%, respectively, higher than the national average poverty rate of 8.4% in 2020 (DOSM 2021). Poverty eradication is one of the goals of the Malaysia economic plan that aligns with the SDG1 of the United Nations. The government's initiatives such as *Bantuan Prihantin Rakyat*, *Bantuan Keluarga Malaysia*, *Program Peningkatan Pendapatan*, *Program Pemerkasaan Ekonomi Komuniti Bandar,* and others aim to address poverty in the country.

Khazanah Research Institute (2022a) investigated that factors such as poor access to infrastructure, low levels of education, and geographical inaccessibility contribute to the high poverty rate in Malaysian Borneo. These factors cause the states to lag economically and remain impoverished. There is a high proportion of rural population in Sarawak (Yap et al. 2023) and Sabah (Ationg et al. 2020), with the primary sector being agricultural, forestry, and fishery (Khazanah Research Institute 2022b). The contribution of these primary sectors to Malaysia's gross domestic product (GDP) is low (Ministry of Economy 2023), which correlates with lower income levels in these states. Efforts to alleviate poverty such as promoting savings and infrastructural development are important (Sulochana & Sagaran 2015).

Tedong et al.'s (2022) study found that the poverty alleviation initiatives in Borneo have not been efficiently distributed due to a lack of social infrastructure. Moreover, they added that issues such as financial illiteracy, low awareness of savings and investment due to lower education levels and cultural competency, and limited access to financial institutions significantly contribute to poverty. The limited access to financial institutions caused the poor households in Sabah and Sarawak to rely on informal credit sources (Ngidang 1995, as cited in Tedong et al. 2022). Connecting to formal financial services is crucial in escaping poverty, as it enables people to save for family needs, borrow to support businesses, and accumulate emergency funds (The World Bank 2022). This highlights that the financial accessibility barriers can potentially address by digital financial inclusion to build a more inclusive financial system that increases accessibility to financial services to improve financial wellbeing and address poverty.

Furthermore, a saving behavior survey by PIDM (2021) revealed that Sabah and Sarawak have the lowest rates of regular savings than other states in Malaysia. Digital financial services delivered through digital channels can increase the access to a broad range of financial services, such as savings, payments, credit, and insurance. People with good financial management skills tend to have higher levels of financial wellbeing (Sabri et al. 2023). Despite this, the Hand Phone Users Survey indicates a mobile phone penetration rate of more than 90% among those with monthly income levels below RM1000 and RM1000–RM3000 (MCMC, 2021). However, accessing banking activities remains the lowest internet activity. Hence, this suggests the significant potential of digital financial services to enhance the financial wellbeing of the poor groups in Malaysian Borneo.

Financial wellbeing has given attention to the researchers. Most of the studies examined psychological factors to explain financial wellbeing. Financial literacy and financial knowledge (Rahman et al. 2021; Sehrawat et al. 2021; Selvia et al. 2021; Mahdzan et al. 2023), financial behavior (Rahman et al. 2021; Sehrawat et al. 2021; Selvia et al. 2021; Mahdzan et al. 2023), locus of control (Mahdzan et al. 2023), financial stress (Rahman et al. 2021; Mahdzan et al. 2023), and financial inclusion (Selvia et al. 2021) are among the predictors used. Up to this point, there is no one unified framework for financial wellbeing (Kabadayi & O'Connor 2019; Rahman et al. 2021; Mahdzan et al. 2023), especially for poor households. Researchers measure it using various approaches. Poor households are one of the Malaysian government's targets in the economic blueprint, which aims to build an inclusive society. This requires more targeted and wider-ranging intervention that needs to be examined from a broader perspective to gain a better understanding of the issues.

This study aims to explore the determinants of financial wellbeing for Malaysian Borneo and examine the

mediating effect of digital financial inclusion. Partial least squares modeling is used to analyze the data for this study. The findings reveal that financial behavior, financial literacy, and digital financial inclusion are significant determinants of financial wellbeing. Digital financial inclusion plays a mediating role in enhancing financial wellbeing.

The contributions of this study include that it not only incorporates the household-level factors (financial literacy, digital literacy, and financial behavior) but also examines the mediator role of digital financial inclusion in the influence of financial service system factors (digital financial service infrastructure and financial service providers) on financial wellbeing. In addition, although previous studies such as Mahdzan et al. (2023) examined financial wellbeing across high-, middle-, and low-income groups, and Rahman et al. (2021) investigated the B40 group, our study expands the literature by investigating a subset of the B40 group, whose household income is below the poverty line. This investigation is crucial because this group encounters unique challenges related to financial stability. To further gain a deeper understanding of the issue, this study then conducts multigroup analysis by comparing the findings of Sabah and Sarawak.

The analysis of the findings provides new insights to policymakers in improving and designing policies that enable poor households to benefit from an inclusive financial ecosystem, achieving higher levels of financial wellbeing. Meanwhile, the findings could provide impactful discoveries to financial service providers in offering more tailored digital financial services that meet the needs and wants of poor groups in Malaysian Borneo, thereby increasing digital financial inclusion and financial wellbeing. The poor groups benefit from understanding how digital financial services help them improve their financial wellbeing and, thus, their living standard.

The remaining sections of this study are structured as follows: literature review, research methodology, results and discussion, implications, and conclusion.

LITERATURE REVIEW

The literature review provides a comprehensive overview of existing studies related to financial wellbeing, which include family resource management theory, financial behavior, financial literacy, digital literacy, digital financial service infrastructure, financial service providers, and digital financial inclusion. The research framework is developed based on the discussion of past studies.

FAMILY RESOURCE MANAGEMENT THEORY

The family resource management theory analyzes the management of family resources in achieving family goals (Deacon & Firebaugh 1988). It is a system-oriented management method that suggests that the input (family resources, goals, and demands) will be transformed by a throughputs (planning, decision-making, implementing, and controlling) that affect the outputs (financial behavior).

The family resource management theory has been used to investigate financial wellbeing, such as in the studies of Mokhtar et al. (2015), Rahman and Shafiai (2021), Sehrawat et al. (2021), and Bhatia and Singh (2024). This study is grounded in the theory of family resources management and proposed that financial behavior, financial literacy, digital literacy, digital financial service infrastructure and financial service providers are inputs that influence poor groups' participation in the digital financial system and financial wellbeing. The throughput process was digital financial inclusion system. The output is characterized as financial wellbeing.

FINANCIAL WELLBEING

The discussion of financial wellbeing (FWG) has been long explored in literature but is still lacking a conceptual definition (Sehrawat et al. 2021) and a standardized framework (Kabadayi & O'Connor 2019; Rahman et al. 2021; Mahdzan et al. 2023).

Past studies have examined the positive and significant relationship between financial wellbeing and psychological factors such as financial literacy and financial knowledge (Rahman et al. 2021; Sehrawat et al. 2021; Selvia et al. 2021), financial behavior (Rahman et al. 2021, Sehrawat et al. 2021; Selvia et al. 2021; Fan & Henager 2022; Mahdzan et al. 2023), financial capability (Muir et al. 2017), and locus of control (Sehrawat et al. 2021; Mahdzan et al. 2023). The higher the levels of these psychological factors, the higher the financial wellbeing as individual poses a better skills and knowledge in financial management.

Meanwhile, financial stress (Rahman et al. 2021; Fan & Henager; 2022; Mahdzan et al. 2023) was found negatively related to financial wellbeing. However, financial literacy (Mahdzan et al. 2023) and long-term financial behavior (Fan & Hanager 2022) contradicted with other past studies that was found negatively related to financial wellbeing. Fan and Hanager (2022) explained that this was due to the aspects of retirement planning that covered in long-term financial behavior may not be paid off in the short run.

Furthermore, Nandru et al.'s (2021) study examined the influence of financial inclusion on the financial wellbeing. Accessibility, availability, usage, and affordability were the dimensions of financial inclusion that significantly contribute to financial wellbeing. Selvia et al. (2021) explained that financial inclusion increases financial wellbeing because being

included in the financial system allows people to better manage their finance.

FWG can be categorized into two groups: objective and subjective. Objective FWG is an individual's potential to access financial resources that are measured by the indicators such as income earned, assets accumulated, and debts, while subjective FWG is determined by an individual's perceptions and satisfactions of financial situation (Erner et al. 2016).

The FWG of this study refers to subjective FWG that assesses satisfaction with financial services, the ability to meet financial commitments, and the quality of life. Subjective FWG provides a more precise assessment to reflect an individual's financial condition as it originates from an individual experiences (Kruger 2011) and consists of life satisfaction, the absence of unpleasant effects, and the presence of pleasant effect that brings up the cognitive aspects (Diener et al. 2010).

RELATIONSHIP BETWEEN FINANCIAL BEHAVIOR AND FINANCIAL WELLBEING

Financial behavior (FBR) is the decisions of financial actions. The actions such as budgeting, having an emergency fund, using savings wisely, and establishing financial goals are an individual's FBR (Morgan & Long 2020).

Many past studies have used financial behavior (FBR) to explain financial wellbeing (FWG). Studies by Sehrawat et al. (2021), Rahman et al. (2021), and Mahdzan et al. (2023) show that the levels of FWG are higher in individuals with good FBR than in those with poor FBR. A good personal financial management, well financial planning, and good financial decisions enhance their FWG. Rahman et al. (2021) demonstrate that FBR is the stronger predictor to the FWG and mediate the relationship between financial stress and FWG among urban poor in Malaysia, where a sound FBR, is better at managing financial stress and assures FWG. This is corroborated by the study of Selvia et al (2021) that found individuals with higher financial knowledge will be equipped with better FBR that increase their FWG.

In this study, FBR refers to the behavior in budgeting, keeping records of spending, savings, investment, and debt management. Hence, this study hypothesizes that:

H_1 The FBR of the poor households in Malaysian Borneo has a significant positive impact on FWG.

RELATIONSHIP BETWEEN FINANCIAL LITERACY AND FINANCIAL WELLBEING

The OECD (2018) defined financial literacy (FILT) as a set of the necessary awareness, knowledge, skills, attitudes, and behaviors to make wise financial decisions to achieve financial wellbeing (FWG). When people become financially literate, they are aware of financial services that are available to them and improve their welfare with the access to the formal financial services. FILT will increase people's willingness to join the formal financial sector (Ozili 2020).

Previous studies have identified FILT as a significant predictor of FWG (Bongomin et al. 2018; Rahman et al. 2021; Mahdzan et al. 2023). This means that an individual who possesses good financial knowledge and skills are better in managing their finance, and hence will improve their FWG (Selvia et al. 2021). Aziz and Naima (2021) found that lower level of FILT is one of the barriers of lower utilization of digital financial services. The low-income and low-education group may be less likely to benefit from the FILT because they need to be taught on how to access and use financial services (Lyons et al. 2019).

In addition, the causality problems of FILT have been examined in the studies of Bucher-Koenen and Lusardi (2011) and Behrman et al. (2012). The instrumental variables approach was used in both studies to address the endogeneity problems. Bucher-Koenen and Lusardi (2011) raises the possibility that FILT could influence financial retirement or vice versa. The instrumental variable of financial knowledge was tested and found that FILT positively and significantly affect financial retirement. On the other hand, Behrman et al.'s (2012) study found that the possibility of whether FILT and schooling affect wealth accumulation has been raised. The study showed evidence that FILT has a positive and significant impact on wealth accumulation.

In this study, the FILT refers to the knowledge and skills in managing personal finance, budgeting and investing, and being aware of financial services available in market, and the benefits of financial services in improving their financial condition. Hence, this study hypothesizes that:

H_2 The FILT of the poor households in Malaysian Borneo has a significant positive impact on FWG.

RELATIOSNHIP BETWEEN DIGITAL LITERACY AND FINANCIAL WELLBEING

Digital literacy (DILT) is an important knowledge in the modern digital economy. It is a set of basic knowledge and skills needed to use digital media, process, and retrieve information (UNESCO 2011). It is a fundamental requirement for the use of digital financial services.

Lyons et al. (2021) show that digital literacy stimulates the usage of digital financial services such as online banking and mobile money and it has significant influence on individual's behavior. The three dimensions of mobile technology access, mobile phone proficiency, and mobile money proficiency are used to measure DILT by Kass-Hana et al. (2021).

The explosive growth of digital financial services required this set of knowledge and skills about using digital devices such as mobile phone and the internet to operate digital financial services (Lyons & Kass-Hanna 2021). A higher level of DILT allows greater autonomy and confidence when using digital financial services.

In this study, the DILT refers to the knowledge and skills of an individual in operating digital devices; accessing, finding, and creating information through digital technologies; and using digital financial services safely. Hence, this study hypothesizes that:

H_3 The DILT of the poor households in Malaysian Borneo has a significant positive impact on FWG.

RELATIONSHIP BETWEEN DIGITAL FINANCIAL SERVICE INFRASTRUCTURE, DIGITAL FINANCIAL INCLUSION AND FINANCIAL WELLBEING

Digital financial service infrastructure (INF) is a core part to determine the efficiency of financial services that can be provided. It functions as a platform that enables financial transactions to be completed throughout an economy. A well-designed infrastructure for digital financial services such as interoperable systems and digital ID system can make digital financial services performed effectively (Ozili 2018) and reduce the inclusion gap (D'Silva et al. 2019), which ultimately enhance their financial wellbeing (FWG) (Lee et al. 2020). Rewilak (2017) shows that regardless of how deep the financial sector is, the poor group may not benefit from financial services due to a lack of infrastructure. Demirgüc-Kunt et al. (2017) highlight the importance of financial services infrastructure to support small financial transactions economically and ensure a safe, stable, and reliable financial system. Lyons et al. (2019) show that the increase in financial services usage is larger in urban areas than in rural areas due to better access to the financial service infrastructure to effectively operate.

In this study, the INF refers to the distribution system of digital financial services. This includes the channel and access point of digital financial services, information and communication technologies (ICT) infrastructure such as internet connectivity, and devices that facilitate the use of digital financial services. Hence, this study hypothesizes that:

H_4 The INF has a significant positive impact on FWG of poor households in Malaysian Borneo.
H_5 The INF has a significant positive impact on the DFIC of poor households in Malaysian Borneo.

RELATIONSHIP BETWEEN FINANCIAL SERVICE PROVIDERS, DIGITAL FINANCIAL INCLUSION, AND FINANCIAL WELLBEING

Financial service providers (FSP) plays a dominant role in promoting and supporting financial wellbeing (FWG) by offering financial services that enable individuals to better manage their finances. Ozili (2020) reported that FSP acts as the special agent in the financial system and is expected to understand the financial needs of the excluded populations, innovate financial services, and work to integrate informal financial services into the formal financial system.

Muir et al. (2017) and Selvia et al. (2021) highlight that FSP who provide access and make suitable and affordable financial services available in a timely, smooth, and safe that meet financial needs and wants of individual has positive impacts on FWG. Moreover, Demirgüc-Kunt et al. (2017) reported that the quality of financial institutions is one of the factors to financial inclusion. In this study, the FSP includes banks and non-bank financial institutions that offer a broad range of financial services to the poor through digital channels, such as savings, payments, loans, and insurance. Hence, this study hypothesizes that:

H_6 The FSP has a significant positive impact on FWG of poor households in Malaysian Borneo.
H_7 The FSP has a significant positive impact on the DFIC of poor households in Malaysian Borneo.

RELATIONSHIP BETWEEN DIGITAL FINANCIAL INCLUSION AND FINANCIAL WELLBEING

Digital financial services have the potential to achieve higher level of financial wellbeing (FWG) (OECD 2016). It provides alternative ways to address constraints such as physical accessibility of the financial system and transaction cost which traditional financial infrastructure is not in place. Digital financial services such as e-wallets assist in achieving digital financial inclusion (DFIC) (Thathsarani et al. 2021).

DFIC refers to the excluded and underserved population's access to and use of affordable digital financial services (CGAP 2015). Aziz and Naima (2021) examine the DFIC with social, cultural, and economic factors and found that the DFIC enables vulnerable groups, such as low-income people, women, people with disabilities, and the underemployed, to use financial technology to improve their socioeconomic wellbeing through connectivity, e-services, and opportunities to use financial services. Furthermore, Zhou and Wang (2021) study the impacts of digital inclusive finance on poverty reduction with DIF index of Peking University. The findings show that an inclusive digital finance alleviates the medical, education, and income poverty in China. Digital financial services facilitate financial inclusion by expanding to nonfinancial sectors (The World Bank 2014) and contribute to poverty alleviation (United Nations 2016). In this study, DFIC refers to the use and accessibility of digital financial services. Hence, this study hypothesizes that:

H_8 DFIC has a significant positive impact on the FWG of poor households in Malaysian Borneo.

DFIC has a vital role in connecting the financial service system and the poor in this digital age. However, in literature, there is a lack of investigation on the mediating effect of DFIC (Aziz & Naima 2021; Zhou & Wang 2021).

Being included in the financial system, poor groups can use the digital financial services to enhance their FWG. A well-developed INF such as internet connections, devices, operating software systems, and applications ensures smooth and safe access to online banking, mobile banking, and e-wallets, and the role of FSP in offering financial services that meet the financial needs of poor groups increases their participation in the financial system and enhances their FWG (Demirgüc-Kunt et al. 2017; Lyons et al. 2019). Past studies such as Nandru et al. (2017) and Selvia et al. (2021) found the mediating effects of financial inclusion between factors (e.g., financial literacy) and FWG. Hence, this study hypothesizes that:

H_{9a} The DFIC mediates the relationship between INF and FWG of poor households in Malaysian Borneo.
H_{9b} The DFIC mediates the relationship between FSP and FWG of poor households in Malaysian Borneo.

This study will substantiate the existing literature on financial wellbeing. It is observed that research on financial wellbeing has predominantly focused on psychological factors (e.g., financial behavior, locus of control, financial stress, and financial literacy), while research on financial inclusion has mainly addressed dimensions of traditional financial services (e.g., accessibility, outreach, and availability). The role of digital financial inclusion in relation to financial wellbeing remains a debate. This study attempts to fill the research gap by proposing a research model that includes dimensions of FBR, FILT, DILT, INF, and FSP, with the mediating role of DFIC, influencing FWG of poor households whose income falls below the PLI in Malaysian Borneo. This focus is particularly important in the increasingly complex digital economy. Moreover, the empirical comparison between Sabah and Sarawak will provide practitioners with insights into the development of financial services and policies to the regions.

Table 1 provides the explanation for the acronym uses in the rest of the paper.

TABLE 1. List of acronym

Acronym	Explanation
FBR	Financial Behaviour
FILT	Financial Literacy
DILT	Digital Literacy
INF	Digital Financial Service Infrastructure
FSP	Financial Service Providers
DFIC	Digital Financial Inclusion
FWG	Financial Wellbeing

Based on the above discussion, this study proposes that household-level factors (financial behavior, financial literacy, and digital literacy) and financial service system factors (digital financial service infrastructure and financial service providers) influence the financial wellbeing of poor households in Malaysian Borneo. Additionally, digital financial inclusion acts as a mediator between the financial service system factors and financial wellbeing. The research framework is illustrated in Figure 1.

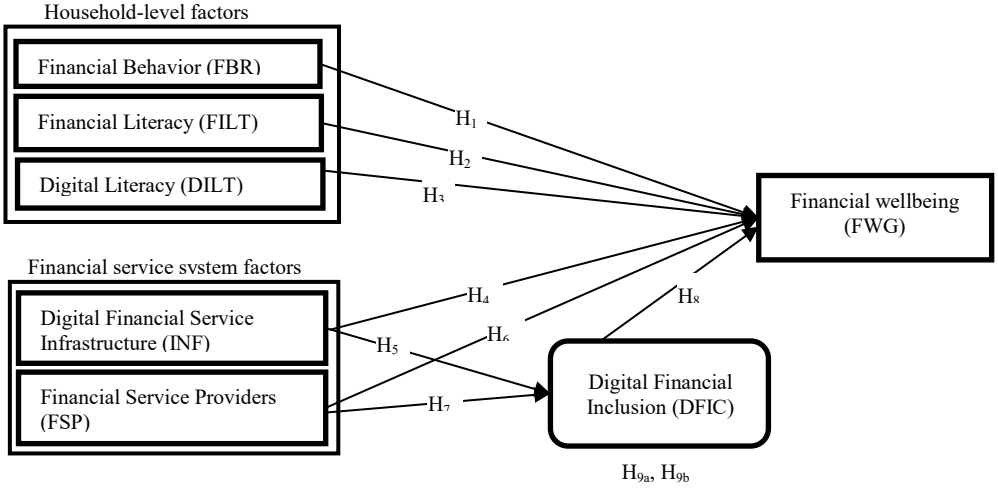

FIGURE 1. Conceptual framework of study

METHODOLOGY

The methodology section describes the sampling for this study, the survey instrument used, the measurement of variables, and the demographic analysis.

SAMPLING

Data of this study were gathered using a cross-sectional survey from the poor households in Malaysian Borneo, which are Sabah and Sarawak. The poor households in this study refer to the households whose monthly income is below the national poverty line in Malaysia, which is RM2,208 (DOSM 2021).

This study uses non-probability sampling to choose respondents based on a specific criteria. The self-administered questionnaires were physically distributed to specific target respondents during May to August 2023. The number of respondents was stratified according to the number of absolute poverty incidence (DOSM 2021). The incidence of absolute poverty was 25.3% and 12.9% for Sabah and Sarawak, respectively. The number of households that fell below the PLI when the research was conducted was 244,404 for Sabah and Sarawak. Considering the population of more than 1 million, with a 5% margin error and a 95% confidence level, the minimum size required is 384 (Krejcie & Morgan 1970). The minimum sample size required for Sabah and Sarawak is 254 and130, respectively. A total of 405 completed questionnaires were received, with 247 (60.99%) and 158 (39.01%) responses for Sabah and Sarawak, respectively, which considered to meet the requirements at a satisfactory level. The respondents participated voluntarily in this survey, and the objectives of the survey were informed before they answered the questionnaire. The respondents understand that the digital financial services in this study refer to online banking/mobile banking/e-wallet.

Partial least squares modeling was used to analyze the data of the study. This technique allows researchers to apply it for theory development, suitable for the explorative study, and flexibility in handling non-normal data (Sarstedt et al. 2017). This study aims to explain the key variable (i.e., financial wellbeing), and PLS-SEM is a suitable technique.

The measurement and structural models were tested with a two-step approach that was suggested by Anderson and Gerbing (1988). The reliability and validity of the instruments was tested in the measurement model. The hypotheses developed for the study were tested in the structural model.

To gain a further understanding of variations between Sabah and Sarawak, the multigroup analysis (PLS-MGA) will be conducted. Multigroup analysis has been broadly used for group comparison which to examine differences between categorical variables (Hair et al. 2018). The sample data will be divided into two groups, which is Sabah and Sarawak. Following the suggestion of Henseler et al. (2016), before the multigroup analysis, the measurement invariance of composites (MICOM) is required, which involved three-step process, that is, configural invariance test, compositional invariance test, and composite equality to determine if the multigroup analysis was warranted.

SURVEY INSTRUMENT

TABLE 2. The questionnaire's structure and sources

Construct	Questions	Source
FBR	5	AKPK (2018)
FILT	6	RinggitPlus (2020)
DILT	5	Kass-Hanna et al. (2021)
INF	4	Vaid et al. (2020)
FSP	5	Vaid et al. (2020)
DFIC	6	Global Findex Questionnaire (2017)
FWG	5	AKPK (2018)

Table 2 shows the structure and sources of questionnaire. In this study, the research model consists of seven latent variables: FBR, FILT, DILT, INF, FSP, DFIC, and FWG. This study uses a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) to measure the agreement level of the target respondents for each of the items in the questionnaire (Appendix A). The questionnaire for this study was developed by adapting from past studies and modified into the context of this study.

MEASUREMENT OF VARIABLES

FBR was measured using five items derived from the AKPK Financial Behavior Survey 2018, which covered the aspects such as spending behavior, savings, and credit management. FILT was measured using six items adapted from RinggitPlus (2020), which covered the aspects such as financial planning and awareness about the financial products and services. DILT was measured using five items that derived from Kass-Hanna et al. (2021), covering aspects of knowledge and skills in operating the digital devices. INF was measured using four items adapted from Vaid et al. (2020), which covered aspects of infrastructure that enable the access of digital financial services. FSP was measured using five items derived from Vaid et al. (2020), which covered aspects such as the role of financial services providers in providing information and offering financial services that meet respondents' needs. DFIC was measured using six items

derived from Global Findex Questionnaire (2017) covering aspects of accessibility and usage of digital financial services. Lastly, FWG was measured using five items that was adapted from AKPK Financial Behavior Survey 2018, covering aspects such as respondents' satisfaction on their wealth conditions and ability to meet their financial commitments.

DEMOGRAPHIC ANALYSIS

TABLE 3. Demographic background (N=405)

Variables	Frequency	(%)	Variables	Frequency	(%)
Gender			*Monthly Household Income*		
Male	64	15.80	<RM500	58	14.32
Female	341	84.20	RM501-RM1000	75	18.52
Age			RM1001-RM1500	76	18.77
18-24	57	14.07	RM1501-RM2208	196	48.40
25-34	89	21.98	*Education Level*		
35-44	123	30.37	No formal education	21	5.18
45-54	75	18.52	Primary school	36	8.89
55-60	39	9.63	Secondary school	176	43.46
>60	22	5.43	Diploma	90	22.22
Ethnicity			Bachelor degree	80	19.75
Bajau	9	2.22	Master Degree/PhD	2	0.49
Bidayuh	2	0.49	*Employment*		
Bisaya	7	1.73	Government	186	45.93
Bugis	5	1.23	Private	47	11.60
Chinese	5	1.23	Retiree	6	1.48
Dusun	10	2.47	Self-employed	79	19.51
Iban	56	13.83	Unemployed	87	21.48
Kadazan	21	5.19	*State*		
Kedayan	4	0.99	Sabah	247	60.99
Malay	272	67.16	Sarawak	158	39.01
Melanau	11	2.72			
Sambas	1	0.25	*Residential Area*		
Sino	1	0.25	Rural	290	71.60
Tidung	1	0.40	Urban	115	28.40

Table 3 shows the demographic analysis of this study. This study was dominated by female (84.20%) respondents, while the remaining are male (15.80%) respondents. Most of the respondents are in the age range of 35–44 years old (30.37%), followed by the age range of 25–34 (21.98%), 45–54 (18.52%), 18–24 (14.07%), 55–60 (9.63%), and above 60 years (5.43%). More than half of the respondents are Malays (67.16%), followed by Iban (13.83%), and the remaining are minority ethnics such as Kadazan, Melanau, Dusun, Bajau, Bisaya, and others (19.70%). Their monthly household income is between RM1501 and RM2208 (48.40%), followed by RM1001 to RM1500 (18.77%), RM501 to RM1000 (18.52%), and below RM500 (14.32%). In addition, 43.46% of the respondents finished study at secondary school, 22.22% graduated with a diploma, 19.75% are bachelor degree holders, 8.89% finished study at primary school, 5.18% have not received formal education, and 0.49% are postgraduates. About half of the respondents are government servants (45.93%), unemployed including housewives (21.48%), self-employed (19.51%), working in private sector (11.60%), and retiree (1.48%). Including unemployed, specifically housewives, is crucial because they play a significant role in households financial decisions (Anjani et al. 2024). Furthermore, most of the respondents were Sabahan (60.99%), followed by Sarawakian (39.01%). The majority of them resided in rural areas (71.60%), and the remaining lived in urban areas (28.40%).

RESULTS AND DISCUSSION

To access the research model developed, this study used the partial least squares structural equation model (PLS-SEM).

MEASUREMENT MODEL

Table 4 shows the construct's reliability and convergent validity for the samples to assess whether there is a high correlation between the multiple indicators of the same construct (Hair et al. 2019). Both Cronbach's alpha and AVEs are greater than the threshold values, which are 0.7 and 0.5 for all the constructs in all the samples, respectively. Meanwhile, the loadings of more than 0.5 show that the constructs for all the samples are acceptable.

In addition, the discriminant validity is assessed by HTMT criterion (Franke & Sarstedt 2019). The HTMT values for each of the constructs in this study are less than 0.85, as shown in Table 5. This indicates high understanding levels of the latent variables among the respondents; there are no overlapping items for the constructs from the respondents' point of view.

TABLE 4. Measurement model

	Loadings			Cronbach's alpha			AVE		
Construct & Items	Complete	Sabah	Sarawak	Complete	Sabah	Sarawak	Complete	Sabah	Sarawak
Financial Behaviour				0.798	0.784	0.818	0.556	0.536	0.579
FBR1	0.681	0.635	0.737						
FBR2	0.696	0.685	0.755						
FBR3	0.836	0.847	0.793						
FBR4	0.816	0.825	0.791						
FBR5	0.681	0.642	0.725						
Financial Literacy				0.894	0.891	0.889	0.650	0.640	0.642
FILT1	0.767	0.737	0.773						
FILT2	0.823	0.781	0.868						
FILT3	0.856	0.834	0.867						
FILT4	0.727	0.755	0.676						
FILT5	0.830	0.849	0.797						
FILT6	0.828	0.837	0.812						
Digital Literacy				0.895	0.879	0.859	0.710	0.673	0.655
DILT1	0.669	0.695	0.538						
DILT2	0.878	0.842	0.852						
DILT3	0.851	0.816	0.863						
DILT4	0.893	0.863	0.865						
DILT5	0.899	0.872	0.876						
Digital Financial Service Infrastructure				0.806	0.766	0.779	0.634	0.592	0.601
INF1	0.751	0.701	0.731						
INF2	0.863	0.857	0.813						
INF3	0.829	0.819	0.800						
INF4	0.733	0.686	0.754						
Financial Service Providers				0.871	0.830	0.902	0.664	0.601	0.722
FSP1	0.858	0.811	0.904						
FSP2	0.855	0.805	0.907						
FSP3	0.641	0.578	0.724						
FSP4	0.862	0.838	0.871						
FSP5	0.835	0.814	0.828						
Digital Financial Inclusion				0.885	0.862	0.862	0.636	0.597	0.597
DFIC1	0.820	0.800	0.806						
DFIC2	0.643	0.591	0.818						
DFIC3	0.845	0.828	0.830						
DFIC4	0.856	0.842	0.879						
DFIC5	0.832	0.823	0.862						
DFIC6	0.770	0.718	0.798						
Financial Wellbeing				0.793	0.790	0.797	0.550	0.550	0.551
FWG1	0.682	0.689	0.675						
FWG2	0.806	0.815	0.78						
FWG3	0.863	0.856	0.855						
FWG4	0.716	0.740	0.691						
FWG5	0.618	0.576	0.696						

Note: CR = Composite Reliability, AVE = Average Extracted Variance

TABLE 5. Discriminant validity

Complete	1	2	3	4	5	6	7
DFIC							
DILT	0.666						
FBR	0.368	0.392					
FILT	0.353	0.519	0.647				
FSP	0.661	0.640	0.383	0.409			
FWG	0.662	0.456	0.571	0.429	0.492		
INF	0.698	0.777	0.290	0.303	0.784	0.471	
Sabah							
DFIC							
DILT	0.591						
FBR	0.402	0.416					
FILT	0.327	0.607	0.552				
FSP	0.603	0.567	0.309	0.346			
FWG	0.741	0.437	0.513	0.325	0.461		
INF	0.709	0.682	0.258	0.285	0.834	0.463	
Sarawak							
DFIC							
DILT	0.667						

FBR	0.295	0.309				
FILT	0.295	0.323	0.782			
FSP	0.656	0.614	0.443	0.408		
FWG	0.542	0.541	0.670	0.613	0.546	
INF	0.568	0.742	0.272	0.215	0.653	0.502

TABLE 6. Full collinearity testing

	DFIC -> FWG	DILT -> FWG	FBR -> FWG	FILT -> FWG	FSP -> DFIC	FSP -> FWG	INF -> DFIC	INF -> FWG
Complete	1.963	2.316	1.494	1.685	1.804	2.142	1.804	2.442
Sabah	1.831	2.040	1.384	1.643	1.824	1.987	1.824	2.352
Sarawak	1.888	2.047	1.853	1.897	1.445	2.036	1.445	1.839

To investigate the issue of common method bias due to the single source data collected, the full collinearity test was conducted (Kock 2015). The VIF for all the variables in all the samples is in the range of 1.384–2.442, which is ≤ 3.3. This indicates that there are no multicollinearity issues in this dataset (Hair et al. 2019).

STRUCTURAL MODEL

Table 7 shows the results of the hypothesis testing for the study. The results reveal that the FWG is significantly and positively affected by FBR ($\beta_{Complete}$=0.256, p<0.01; β_{Sabah}=0.214, p<0.01; $\beta_{Sarawak}$=0.261, p<0.01), FILT ($\beta_{Complete}$=0.279, p<0.05; β_{Sabah}=0.208, p<0.05; $\beta_{Sarawak}$=0.235, p<0.01), and DFIC ($\beta_{Complete}$=0.426, p<0.01; β_{Sabah}=0.513, p<0.01; $\beta_{Sarawak}$=0.201, p<0.05). The H_1 H_2, and H_8 were supported.

Furthermore, INF ($\beta_{Complete}$=0.378, p<0.01; β_{Sabah}=0.222, p<0.01; $\beta_{Sarawak}$=0.440, p<0.01) and FSP ($\beta_{Complete}$=0.343, p<0.01; β_{Sabah}=0.229, p<0.01; $\beta_{Sarawak}$=0.479, p<0.01) were found significantly related to DFIC. Thus, the H_5 and H_7 were supported.

In addition, the results also reveal that DFIC significantly and fully mediated the influence of INF on FWG ($\beta_{Complete}$=0.161, p<0.01; β_{Sabah}=0.226, p<0.01, $\beta_{Sarawak}$=0.085, p<0.05) and FSP on FWG for all the samples ($\beta_{Complete}$=0.146, p<0.01; β_{Sabah}=0.117, p<0.01; $\beta_{Sarawak}$=0.096, p<0.05). Hence, the H_{9a} and H_{9b} are supported.

The adjusted R^2 for FWG and DFIC were also evaluated. The six independent variable constructs explained FWG about 56.1% for complete, 59.2% for Sabah, and 69.7% for Sarawak sample sets. The two independent constructs explained DFIC about 52.1% for complete, 45.9% for Sabah, and 47.7% for Sarawak sample sets. Furthermore, the predictive relevance (Q^2) indicated a moderate predictive power ($0.15 \leq Q^2 \leq 0.35$) of the independent variables on FWG for complete ($Q^2_{complete}$=0.286) and Sabah (Q^2_{Sabah}=0.218) sample sets, but strong predictive power ($Q^2 \geq 0.35$) for Sarawak sample set ($Q^2_{Sarawak}$=0.413) (Hair et al. 2013). Meanwhile, the predictive power for DFIC was strong for complete ($Q^2_{complete}$=0.408) and Sarawak ($Q^2_{Sarawak}$=0.367) sample sets, while moderate for Sabah (Q^2_{Sabah}=0.321) sample set.

TABLE 7. Hypotheses testing

	Complete				Sabah				Sarawak			
Direct Relationship	Std. Beta	Std. Error	t-value	p-value	Std. Beta	Std. Error	t-value	p-value	Std. Beta	Std. Error	t-value	p-value
H_1: FBR -> FWG	0.256	0.057	4.471	0.000	0.214	0.064	3.343	0.000	0.261	0.112	2.333	0.010
H_2: FILT -> FWG	0.279	0.056	1.417	0.045	0.208	0.068	2.116	0.030	0.235	0.089	2.636	0.004
H_3: DILT -> FWG	-0.028	0.075	0.369	0.356	0.022	0.087	0.249	0.402	0.093	0.105	0.883	0.189
H_4: INF -> FWG	0.021	0.072	0.296	0.384	-0.042	0.084	0.495	0.310	0.129	0.106	1.221	0.111
H_5: INF -> DFIC	0.378	0.059	6.407	0.000	0.222	0.087	2.554	0.005	0.440	0.078	5.660	0.000
H_6: FSP -> FWG	0.064	0.076	0.839	0.201	0.073	0.091	0.802	0.211	0.066	0.110	0.602	0.274
H_7: FSP -> DFIC	0.343	0.064	5.389	0.000	0.229	0.081	2.827	0.002	0.479	0.089	5.401	0.000
H_8: DFIC -> FWG	0.426	0.066	6.490	0.000	0.513	0.072	7.147	0.000	0.201	0.110	1.831	0.034
Mediation analysis												
H_{9a}: INF -> DFIC -> FWG	0.161	0.035	4.613	0.000	0.226	0.051	4.460	0.000	0.085	0.031	1.421	0.048
H_{9b}: FSP -> DFIC -> FWG	0.146	0.035	4.212	0.000	0.117	0.043	2.727	0.003	0.096	0.054	1.774	0.038

Note: 95% confidence interval and a 5,000 bootstrapping

MULTIGROUP ANALYSIS (PLS-MGA)

To gain a further understanding of variations between Sabah and Sarawak and avoid overgeneralization within the examined population, the multigroup analysis is conducted. The sample data was divided into two groups (Sabah= 247, Sarawak=158). Table 8 presents the partial measurement invariance that was established based on the recommendation by Henseler et al. (2016). This study adopted MICOM. There are three steps involved: (1) the configural invariance assessment. The measurement model assessment and adjustments for all the constructs are identical, as executed in the

earlier stage. (2) The compositional invariance assessment. The results of permutation multigroup analysis show that the c for all constructs are exceed the 5% quantile of C_u, suggesting that the compositional invariance was established. (3) The equal mean and equal variances assessment. The results show unequal mean and equal variance for all the constructs; hence, only partial measurement invariances are established. Henseler et al. (2016) explain that construct variances are achieved where the original mean differences fell within the 95% confidence intervals. Therefore, the study proceeds with the subsequent multigroup analysis.

Table 9 indicates that there is a significant difference between Sabah and Sarawak. Sabah shows stronger path coefficient of FSP to FWG and DFIC to FWG. Meanwhile, Sarawak has a stronger path coefficient of FBR to FWG, DILT to FWG, INF to FWG, INF to FDIC, and FSP to DFIC. However, the path coefficient of FILT to FWG is not supported.

TABLE 9. Multigroup analysis results

Hypotheses	Path coefficient (Sabah)	Path coefficient (Sarawak)	p-value (Sabah)	p-value (Sarawak)	Supported
FBR -> FWG	0.214	0.261	0.000	0.010	Yes
FILT -> FWG	0.008	0.235	0.454	0.004	No
DILT -> FWG	0.022	0.093	0.402	0.189	Yes
INF -> FWG	0.042	0.129	0.310	0.111	Yes
INF -> DFIC	0.222	0.440	0.000	0.005	Yes
FSP -> FWG	0.073	0.066	0.211	0.274	Yes
FSP -> DFIC	0.229	0.479	0.002	0.000	Yes
DFIC -> FWG	0.513	0.201	0.000	0.034	Yes

ROBUSTNESS CHECK

To ensure the robustness of the findings, we compared two models that consisted of different sets of independent variables, as shown in Table 10.

TABLE 10. Robustness check

	Model 1			Model 2		
	Std Beta	Std Error	p-value	Std Beta	Std Error	p-value
FBR	0.386	0.058	0.000	0.358	0.057	0.000
FILT	0.083	0.062	0.186	0.083	0.062	0.181
DILT	0.188	0.038	0.000	0.057	0.048	0.240
INF	-	-	-	0.111	0.051	0.029
FSP	-	-	-	0.132	0.052	0.011
Akaike's Information Criterion (AIC)			767.602			751.203
Bayesian Information Criterion (BIC)			787.621			779.230
Consistent AIC (CAIC)			792.621			786.230
Adjusted R^2			0.266			0.299
R^2			0.272			0.308

Model 1 has been adjusted for robustness check, where the independent variables are FBR, FILT, and DILT, while Model 2 is the model in this study, which are FBR, FILT, DILT, INF, and FSP. The AIC, BIC, and CAIC show lower values in Model 2 than in Model 1, indicating that Model 2 is performed better than Model 1. This suggests that the findings of this study are robust.

TABLE 8. Measurement invariance testing

Construct	Configural invariance	Compositional invariance				Equal mean			Equal variance			
		c = 1	5% quantile of C_u	Permutation p-value	Compositional invariance	Differences	95% confidence interval	Permutation p-value	Differences	95% confidence interval	Permutation p-value	Measurement Invariance
FWG	Yes	0.999	0.990	0.854	Yes	0.192	[-0.161; 0.171]	0.035	0.280	[-0.246; 0.252]	0.033	Partial
FBR	Yes	0.988	0.984	0.098	Yes	0.268	[-0.160; 0.163]	0.006	-0.054	[-0.226; 0.236]	0.356	Partial
FILT	Yes	0.995	0.986	0.363	Yes	0.398	[-0.160; 0.173]	0.000	0.117	[-0.340; 0.314]	0.320	Partial
DILT	Yes	0.997	0.994	0.255	Yes	0.988	[-0.171; 0.169]	0.000	-0.104	[-0.204; 0.214]	0.213	Partial
DFIC	Yes	0.999	0.997	0.556	Yes	0.656	[-0.160; 0.175]	0.000	0.028	[-0.253; 0.275]	0.440	Partial
INF	Yes	0.997	0.993	0.333	Yes	0.877	[-0.174; 0.168]	0.000	-0.101	[-0.231; 0.236]	0.237	Partial
FSP	Yes	1.000	0.995	0.970	Yes	0.618	[-0.165; 0.166]	0.000	-0.182	[-0.269; 0.279]	0.126	Partial

Note: 95% confidence interval and a 1,000 permutations.

DISCUSSION

This study finds that FBR is found significantly and positively determines the FWG. This is consistent with the past studies (Rahman et al. 2021; Mahdzan et al. 2023). This may imply that the FWG of the poor households in Malaysian Borneo can be improved by having a right FBR. Households that have budgeting, keep track of their spending, always save before spending, and plan for the future would promise a higher FWG.

Furthermore, FILT is one of the important factors that determine FWG. Poor households who have FILT understand the importance of saving, financial planning, and budgeting. They also have awareness of the types, fees, and charges of financial services that are offered in the market. By having this knowledge enables them to access, use, and benefit from financial services. The studies such as Bongomin et al. (2018), Ozili (2020), Rahman et al. (2021), and Mahdzan et al. (2023) demonstrated consistent results.

DILT is found surprisingly insignificant to the FWG among the poor households in Malaysian Borneo. This study contradicts findings from past studies that show the importance of DILT in the usage of digital financial services that would enhance FWG (Lyons et al. 2021; Lyons & Kass-Hanna 2021). This may suggest that the poor households in Malaysian Borneo perceived that digital knowledge and skills such as technology access and devices proficiency is not an important determinant to enhance their FWG. The survey by MCMC (2021) showed that the top three internet activities are text messaging, social networking, and voice calls, while accessing banking activities falls under the bottom three.

In addition, INF and FSP are also found not significantly related to FWG, but both factors significantly and positively explain DFIC. A well-functioning and complete INF ensures the efficiency of the delivery of financial services. A channel, access point of financial services, and ICT infrastructure are needed to enable individuals to access and use digital financial services. Having electronic devices (such as computers, tablets, and mobile phones), internet connectivity, a user-friendly website and applications of digital financial services, and a reliable financial system are important for individuals to use digital financial services effectively and safely. Otherwise, the benefits of digital financial services could not reach the poor groups, regardless of how deep the financial sector is (Rewilak 2017). Ozili (2018), Demirgüc-Kunt et al. (2017), D'Silva et al. (2019), and Lyons et al. (2019) support the findings of this study. Meanwhile, FSP plays intermediation role in meeting the needs and wants of poor households and enable them to participate into the financial system (Demirgüc-Kunt et al. 2017). The digitalization of financial services enables FSP to customize financial services that allow this group to benefit from the financial system. This is corroborated by Muir et al. (2017), Ozili (2020), and Selvia et al. (2021).

This study argues that the impacts of INF and FSP on FWG are not direct. This can be explained by the mediation effect of DFIC. This implies that the presence of DFIC allows INF and FSP to play their role in enhancing the FWG of poor households in Malaysian Borneo. DFIC factors such as accessibility, affordability, and reliability of the financial services stimulate poor households to use and benefit from the financial services offered (Muir et al. 2017; Selvia et al. 2021). Being included in the digital financial system allows poor households to use online banking, mobile banking, and e-wallets to access and benefit from financial services such as savings, borrowing, making payments, buying insurance, and investing, which can significantly improve their FWG (Demirgüc-Kunt et al. 2017; Lyons et al. 2019) and lift them out of poverty. This is consistent with past studies that show that FWG needs DFIC (D' Silvia et al. 2019; Rewilak 2019; Lee et al. 2020; Lyons et al. 2019).

Lastly, the results of multigroup analysis show that there are significant differences in the relationship of FBR-FWG, DILT-FWG, INF-FWG, INF-DFIC, FSP-FWG, FSP-DFIC, and DFIC-FWG between Sabah and Sarawak, except FILT-FWG. The findings demonstrate that the impacts of the constructs are higher for Sarawak than Sabah. Despite the national and state-level policies aimed at fostering a digital economy, Fang et al. (2022) show that the Sabah population faces inequality in accessing digital tools and infrastructure, which may hinder their ability to engage with technology and digital platform. This could potentially limit their ability to benefit from digital financial services and poses challenges to achieve financial inclusion.

IMPLICATIONS

This study enriches the existing literatures by examining both household-level and financial system factors and the mediating relationships of digital financial inclusion on financial wellbeing for poor households in Malaysian Borneo. The PLS multigroup analysis shed light on the differences in the paths to financial wellbeing of poor households in Sabah and Sarawak.

It is essential toenhance the financial education of poor households, as an individual's financial literacy shapes their financial behavior. This can be achieved through financial education programs such as financial planning, financial management, wealth management, and valuation of risk-return that can be offered by government agencies and nonprofit organizations through local community workshops and seminars. This develops their financial knowledge and skills.

Furthermore, the role of financial service providers is crucial to enhance financial wellbeing among the poor households. A reliable financial service providers are likely to increase their participation in financial system and enhance the financial wellbeing of poor households. Financial institutions can create a more tailored digital financial services that meet the financial needs of poor households in Malaysia Borneo by taking into consideration the cultural competency.

In addition, digital financial service infrastructure is an important medium to enhance the financial wellbeing of poor

households. As digital financial services need to be completed online, expanding and upgrading internet connectivity infrastructure, such as a network of broadband cables, and installing additional telecommunication towers are necessary to provide a wider and more stable internet connection. Malaysian Borneo is still facing poor internet connections in both urban and rural areas. The restricted bandwidth (Boon 2022) caused dissatisfaction with internet connectivity, such as poor, slow, and unstable connection and some even with no access to the internet (Johari 2020), especially in rural areas (Jacobs & Subramaniam 2020).

Moreover, digital financial inclusion is a way to enhance financial wellbeing and help poor households to escape from the poverty. Technology-based digital financial services offer a more effective way to better serve this group. To promote digital financial inclusion, policymakers and financial institutions must work together to create an environment that motivates individuals to participate in the digital financial system, taking into consideration the above discussion.

Lastly, Sabah could enhance policies and strategies aiming at improving financial wellbeing and accelerating digitalization. This includes considering the investment in the digital infrastructure to enhance networking reliability and accessibility. Moreover, collaborations between government, community, and nongovernment organizations are needed to understand the specific financial needs of this group and provide workshops and educational programs to equip them financial and digital skills that enable them to better manage their finance.

CONCLUSION

Achieving financial inclusion is always on the agenda of the government's policies to enhance the financial wellbeing of Malaysians. This study, targeted at Malaysian Borneo's poor households who live at income levels lower than the poverty line, is important because they need more specific support in achieving financial wellbeing. Digital financial inclusion is a cornerstone of a thriving digital economy as it provides wider accessibility to financial services and act as a bridge to the vulnerable groups, particularly poor households.

This study explores determinants of financial wellbeing and conducts PLS multigroup analysis that consider household-level factors (financial behavior, financial literacy, and digital literacy) and the mediation effect of digital financial inclusion on the influence of the financial service system (digital financial service infrastructure and financial service providers) in enhancing financial wellbeing for Sabah and Sarawak.

The findings show that financial behavior, financial literacy, and digital financial inclusion significantly explain the financial wellbeing of poor households in Sabah and Sarawak, except digital literacy. Meanwhile, digital financial inclusion has significant mediating effects on financial service provider and digital financial services infrastructure in enhancing financial wellbeing. The findings also show that the impacts of these relationships are higher for Sarawak than for Sabah.

This study is significant for Sabah and Sarawak as we are in the transition to a digital economy to become an inclusive, prosperous, and resilient nation. The model of this study can serve as the integrated framework of financial wellbeing in the digital age for future studies in the relevant fields.

This study focuses on Malaysian Borneo only; future researchers can broaden the scope of the study to include poor households from west Malaysia and explore comparison across Malaysia.

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APPENDIX

APPENDIX A. List of questionnaire items

Construct & Items
Financial Behaviour
I record all my spending.
I spend money according to my budget.
I save before spending.
I plan my finances for retirement.
I pay my loan instalments on time.
Financial Literacy
I know the importance to save money for the future.
I know the importance of financial planning for my future.
I know the importance of recording my expenses.
I think carefully before deciding to buy something.
I have adequate awareness about the financial products and services.
I have adequate awareness about the interest rates charged.
Digital Literacy
I aware the security of a website before making online transactions.
I know how to open a digital financial services apps and complete a transaction successfully.
I know how to correct an error, or reverses or cancels a transaction successfully when doing digital financial services transactions.
I have experience in transferring/receiving money using digital financial services.
I have experience checking my account balance using digital financial services.
Digital Financial Service Infrastructure
I have a device to access to the digital financial account.
Accessing financial services through DuitNow/QRPay, online/mobile banking is easy.
FaceID/TouchID/digital authentication that linked to financial services accounts for transaction authentication is convenient.
It is easy to reach the bank through a call center or LiveChat on digital financial services.
Financial Service Providers
Provide necessary information about products and services.
Offer financial products and services digitally that meet my needs.
Charge lower lending rate than informal financial services.
It is convenient to use digital financial services offered.
Digital financial services offered save my effort of going to banks/physical stores.
Digital Financial Inclusion
I can access digital financial services.
I can borrow through digital financial services at affordable price.
I can make a payment by using digital financial services with lower cost.
I can buy insurance plan through digital financial services.
I can do investment with digital financial services.
I use digital financial services at least once a month.
Financial Wellbeing
I can accumulate wealth by accessing to financial services.
I am able to meet my family financial commitments.
My living standards is improved with the financial services.
My income always cover my living costs.
I do not need to borrow to buy essential goods.