# Developing Digital Capital Index: Case study of Hardcore Poor Household in Perlis

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## Abstract

This paper aims to construct a Digital Capital Index (DCI) among the hardcore poverty population in Perlis. This study utilize data from face-to-face surveys conducted with 315 households participating in the Keluarga Malaysia Hardcore Poverty Eradication Programme (BMTKM) across three parliamentary constituencies—Kangar, Arau, and Padang Besar—the study employs Principal Component Analysis (PCA) to develop the DCI, while crosstab analysis is used to examine the relationship between the index with income and various occupational groups among head of household. Results reveal that the average score for digital capital index among the hardcore poor in Perlis is a moderate level. Further analysis shows that gender and rural residency significantly influence digital capital levels. The findings underscore the need for targeted government interventions, such as localized digital literacy programs and improved digital infrastructure, to bridge the digital divide and enhance economic opportunities for the hardcore poor. The study contributes to policy discussions on poverty reduction by demonstrating the critical role of digital capital in alleviating poverty and economic disparities.

**Keywords**: poverty, hard core poor, digital capital index, internet accessibility, Perlis.

## 1.0 Introduction

There is growing concern that the digital transformation is not always consistent with the principles of sustainable development goals, in which one of them is targeting "no poverty" as the first pillar. The benefits of digital development depend largely on how digital technologies are used and the challenges posed by digitalization. It may, for instance, create serious unequal access to and limited Internet capacity for effective use of affordable digital technology, which can result in an inequitable distribution of benefits and possibly widening income gap (Barrantes, 2010; World Bank, 2019a). This is because some peoples are succeeded in adopting and adapting the wide spreading digital technology, while those who are financially or technically poor may be left behind, creating a new class of digital poor. Digitally poor people are not just people with low income, but also those without proper access to technologies as well as those technology-illiterate. Previous studies also indicate that not everyone is able to share the benefit equally from emerging technology, such as for global, Akanbi and Akanbi (2012) for Nigeria as well as Myovella et al. (2020) for OECD and sub-Saharan African countries. Those studies show that when it comes to the adoption, availability and efficiency

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of digital services, there are still significant inequalities within and across countries. Myovella et al. (2020), for example, state that digitalization has been a positive contribution to OECD economies but has limited impact on the sub-Saharan African countries. Thereby this persistent digital divide will exacerbate inequalities, be unsuccessful in lifting people from poverty and offer fewer economic opportunities for the poor.

Based on records obtained by Bernama from the Perlis State Development Office, Implementation Coordination Unit, Prime Minister's Department (ICU JPM), there are 682 Heads of Households (KIR) registered as hardcore poor in Perlis as of July 31 2024. The term "hard core poor" refers to households with incomes less than 50% of the national poverty line. The national poverty line income in 2024 is RM2,208, implying that hardcore poor households earn RM1,169 per month or less. It is unclear how these household manage to pay for their daily necessities.

The Malaysian government is intensifying its efforts to eradicate hardcore poverty by 2025 through several initiatives, most notably the Keluarga Malaysia Hardcore Poverty Eradication Programme (BMTKM). This programme, a key part of the 12th Malaysia Plan, aims to eliminate poverty by focusing on tailored, community-specific interventions instead of a "one-size-fits-all" approach. These interventions include income generation, capacity building, entrepreneurial development, and creating job opportunities, with a strong emphasis on collaboration between federal, state, and local authorities.

Key challenges in this endeavor include the urban-rural divide in digital infrastructure, which affects access to resources and opportunities, especially among the hardcore poor in rural areas. Government initiatives like JENDELA are addressing digital access issues by expanding broadband coverage, while financial support programs such as Bantuan Prihatin Rakyat (BPR) aim to provide digital financial inclusion. To further support economic inclusion, initiatives like e-Rezeki and e-Usahawan focus on improving digital skills, while programs such as Go-e-Commerce aim to foster entrepreneurship among the hardcore poor. However, challenges like limited access to digital infrastructure and affordable devices continue to hinder progress. Solutions such as community-based digital centers and localized digital literacy programs are recommended to enhance digital inclusion.

Therefore, this paper will assess the skill of the hardcore poor in using telecommunication devices, internet accessibility and the motive of internet usage by developing the digital capital index and how this index influence the level of income and occupation of the hardcore poor in Perlis.

## 2.0 Literature review

Recent literature emphasizes the growing role of digital capital in poverty alleviation, especially in rural and underserved areas. Digital capital refers to access to and the ability to utilize digital technologies, which can enhance individuals' economic opportunities and income. Studies suggest that digital financial inclusion, mobile technology, and access to ICT (Information and Communication Technology) significantly contribute to reducing multidimensional poverty by providing more accessible financial services and market participation.

In China, research highlights the positive effects of digital financial inclusion on reducing rural poverty through spill over effects, especially in regions with higher levels of digital penetration. Digital tools enable better access to financial products and services, helping people escape poverty traps by increasing savings, investments, and economic resilience (Feng & Zhang, 2024). Similarly, a study on African communities demonstrates how digital transformation, particularly through mobile phones and digital platforms, boosts market participation and supports income generation in agriculture, thus helping lift communities out of poverty (Ismail, 2023).

Furthermore, research in Ethiopia and other regions shows that mobile technology adoption improves access to agricultural information and credit, directly influencing rural poverty reduction by enhancing productivity and financial stability (Gebremariam, 2020). Overall, the consensus is that expanding digital infrastructure and digital literacy in underprivileged regions can be a crucial tool for poverty reduction, especially when aligned with local economic needs and conditions (ElMassah & Mohieldin, 2020).

By strengthening digital capital, especially among low-income individuals, governments and policymakers can improve access to essential services, foster entrepreneurship, and create more sustainable pathways out of poverty.

## 3.0 Methodology

### 3.1 Data

This study relies on primary data gathered through a survey, which involved conducting face-to-face interviews with respondents. The participants were extreme poor individuals from Perlis who were part of the BMT program. The sampling frame was drawn from the e-Kasih data provided by the Perlis Implementation Coordination Unit (ICU). A total of 315 head-of-household (KIR) samples, all of whom were engaged in income-generating activities, were analyzed. The study focuses on three parliamentary areas in Perlis: Kangar, Arau, and Padang Besar (Table 1).

Table 1: Sample size and study area

| Parliamentary | Sample |
|---|---|
| Kangar | 101 (32 %) |
| Arau | 122 (39 %) |
| Padang Besar | 92 (29 %) |

### 3.2 Formation of Digital Capital Index

In terms of human capital, Malaysia is strengthening its digital literacy and STEM workforce through government programs like eRezeki and eUsahawan, though there is still a gap in advanced digital skills. Initiatives such as MyDigital WorkForce aim to address these gaps by providing upskilling opportunities. The adoption of digital services is robust, with e-government platforms, e-commerce, and fintech showing significant growth. The pandemic has accelerated the use of telemedicine and e-learning, though disparities remain in access between urban and rural areas.

Malaysia's innovation ecosystem is vibrant, with tech hubs and a growing startup scene in cities like Kuala Lumpur and Cyberjaya. Government programs and venture capital funds support tech startups, though R&D investment needs further growth. Policies and regulations, such as the Cybersecurity Strategy 2020–2024 and the Personal Data Protection Act 2010, are in place to bolster digital security and protect personal data, while Malaysia engages in international digital trade agreements to promote cross-border digital services.

Digital inclusion remains a focus, with efforts to improve accessibility and affordability of digital tools and reduce the gender and socio-economic digital gap. While trust in digital technologies is growing, concerns about cybersecurity and data privacy persist. Malaysians are generally open to technological change, with high engagement in social media and digital communication. Addressing these areas will be crucial for enhancing Malaysia's Digital Capital Index, ensuring continued growth and inclusivity in the digital economy.

Principal component analysis (PCA) is a widely used method for dimensionality reduction and pattern identification in complex datasets. It simplifies the original dataset by transforming correlated variables into a set of uncorrelated variables (principal components) that capture the maximum variance in the data. This technique is particularly effective in studies involving socio-economic data, such as assessing digital capital among poverty-stricken populations, where multiple factors like access, usage, and skills need to be condensed into a few explanatory components (Abdi & Williams, 2010; Jolliffe, 2002).

In your study of digital capital among hard core poor populations, PCA can help simplify the many indicators of digital engagement (e.g., access to technology, internet usage, motive of internet usage) into a smaller number of components. PCA would help reduce the complexity of the digital capital indicators among hard core poor households, identifying key components that contribute most to variations in digital capital. This approach is effective for creating a digital capital index that captures the primary factors affecting digital engagement within this population.

## 4.0 Results and Discussions

The respondent profile in Table 2 reveals a demographic predominantly composed of males, who make up 75.9% of the heads of households, with females accounting for 24.1%. The age distribution shows a concentration in the 41-50 age group (41.0%), followed by those aged 51-60 (29.5%). Younger respondents (21-30) and older individuals (61-70) are minimally represented. In terms of marital status, a significant majority are married (80.3%), with only a small proportion being single (1.9%), divorced (7.6%), or widowed/widower (10.2%).

Table 2: Profile of Respondent (N=315)

| Respondent's Profile | Frequency | Percentage |
|---|---|---|
| **Gender (Head of Household)** | | |
| Male | 239 | 75.9 |
| Female | 76 | 24.1 |
| **Age** | | |
| 21-30 | 8 | 2.5 |
| 31-40 | 76 | 24.1 |
| 41-50 | 129 | 41.0 |

| | | |
|---|---|---|
| 51-60 | 93 | 29.5 |
| 61-70 | 9 | 2.9 |
| **Marital Status** | | |
| Single | 6 | 1.9 |
| Married | 253 | 80.3 |
| Divorced | 24 | 7.6 |
| Widows/widowers | 32 | 10.2 |
| **Education level** | | |
| Non-schooling | 20 | 6.3 |
| UPSR/Grade 5 Assessment | 46 | 14.6 |
| SRP/PMR/LCE | 88 | 27.9 |
| SPM/SPMV/SMA/MCE | 137 | 43.5 |
| STU/STAM/STPM/Higher Certificate V/Diploma | 19 | 6.0 |
| Bachelor's degree and above | 3 | 1.0 |
| **Occupation** | | |
| Farmers | 53 | 16.8 |
| Fishermen | 7 | 2.2 |
| Traditional food/drink/cake vendors | 46 | 14.6 |
| Labour/village work/cutting grass/planters | 75 | 23.8 |
| Home builders/mechanics/tailors/technicians/wireman | 40 | 12.7 |
| Driver Lorry/bus/co-drivers | 22 | 7.0 |
| Civil servants/cashiers | 12 | 3.8 |
| **Parliamentary** | | |
| Kangar | 101 | 32.1 |
| Arau | 122 | 38.7 |
| Padang Besar | 92 | 29.2 |

Education levels are largely centered around secondary education, with 43.5% having completed SPM/SPMV/SMA/MCE. There is a noticeable drop in those with higher education qualifications, with only 6.0% holding STU/STAM/STPM/Higher Certificates and a mere 1.0% having a bachelor's degree or above. Occupation-wise, the majority of respondents are engaged in labor-intensive jobs, including village work (23.8%), farming (16.8%), and traditional food/drink/cake vending (14.6%). Professional and clerical roles are less common, with only a few in positions such as civil servants or drivers.

Geographically, the respondents are fairly evenly distributed across the three parliamentary constituencies, with Arau representing the highest percentage (38.7%), followed by Kangar (32.1%) and Padang Besar (29.2%). This profile highlights a predominantly older, married male demographic with lower educational attainment and a strong presence in manual and trade occupations.

Table 3 presents the scale for interpreting the digital capital index (DCI), categorizing the values into four distinct scales: low, moderate, upper moderate, and high. A DCI score between 0 and 0.25 signifies a low level of digital capital, indicating that individuals or communities within this range have limited access to digital tools and technologies, resulting in a significant digital divide. Barriers such as inadequate infrastructure, lack of digital literacy, and poor internet connectivity are common in this category (Mustafa & Hassan, 2023).

Table 3: The Scale of Digital Capital Index (DCI)

| Index value | Scale |
|---|---|
| $0 \leq DCI < 0.25$ | Low |
| $0.25 \leq DCI < 0.5$ | Moderate |
| $0.5 \leq DCI < 0.75$ | Above Moderate |
| $0.75 < DCI \leq 1$ | High |

A score of 0.25 to 0.5 represents a moderate level of digital capital, where access to digital devices and internet connectivity is present but may be inconsistent or insufficient. Individuals in this range typically possess basic digital skills, but the integration of digital tools into daily life remains limited due to geographic or economic constraints (Lim et al., 2023).

When the DCI score is between 0.5 and 0.75, it reflects an above moderate level of digital capital, where digital technologies are more deeply integrated into daily activities, such as education, work, and communication. Although access to digital resources is generally reliable, there may still be inequalities in digital literacy or access, particularly among the hard core poor (Chin et al., 2024).

Finally, a DCI score of 0.75 to 1 indicates a high level of digital capital, where individuals or populations have extensive access to digital devices and the internet. In this category, digital literacy is high, and technology plays an integral role in multiple sectors, such as work, education, and social interactions. These populations are likely to be digitally fluent, experiencing fewer barriers to accessing and using ICT effectively (Tan & Wong, 2023). This scale provides valuable insights for policymakers and researchers, helping them identify areas that require investment in digital infrastructure and education to bridge the digital divide.

Table 4 provides insights into three dimensions related to Information and Communication Technology (ICT) usage: Telecommunication Devices**,** Internet Accessibility**,** and the Motive of ICT Usage, each with its respective mean score and standard deviation. The Telecommunication Devices dimension has a mean score of 0.59, indicating that access to or usage of devices such as smartphones, computers (laptop/desktop), and tablet is moderate among the population surveyed. The standard deviation of 0.17 suggests that access to these devices is relatively uniform across the sample, with limited variation. This reflects broader trends in Southeast Asia, where mobile phone penetration is high, but certain socio-economic barriers still restrict full access to advanced technologies (Lee et al., 2023).

Table 4: Score Mean of Digital Capital Indexes

| **Dimension** | **Score Mean** | **Std. Deviation** |
|---|---|---|
| Telecommunication devices Index | 0.59 | 0.17 |
| Internet Accessibility Index | 0.03 | 0.13 |
| Motive of Internet usage Index | 0.56 | 0.22 |

In contrast, internet accessibility shows a notably low mean score of 0.03, highlighting very limited internet access within the surveyed population. The standard deviation of 0.13 implies minimal variability, meaning that poor internet access is a widespread issue, likely due to infrastructural challenges or economic limitations. This situation is consistent with findings that rural and economically disadvantaged communities like hard core poor often face significant barriers to reliable internet connectivity (Rashid et al., 2023).

The third dimension, motive of internet usage, shows a mean score of 0.56, reflecting the various reasons people use ICT, ranging from entertainment, information, education, work, spending, health to services. The higher standard deviation of 0.22 indicates greater variability in the motives behind ICT use, suggesting that different demographic groups might use technology for very different purposes. This aligns with studies showing that younger generations tend to use ICT more for entertainment and social networking, while older groups may focus more on practical applications like communication or work (Tan & Yee, 2023).

Table 5 provides an analysis of the Digital Capital Index (DCI) across various occupations and income levels. The findings show that 229 of the head of household in all categories of occupation had an above moderate of digital capital index with mean income, RM 1255.

Table 5: Digital Capital Index (DCI), income and occupation of head of household

| Digital Capital Index (Telecommunication Device Index) | | Mean (RM) | Median (RM) | N | Std. Deviation |
|---|---|---|---|---|---|
| High | Home builders/mechanics/tailors/technicians/wireman | 1000 | 1000 | 1 | |
| | Total | 1000 | 1000 | 1 | |
| Above Moderate | Farmers | 1670 | 1125 | 46 | 2800 |
| | Fishermen | 1096 | 1000 | 7 | 331 |
| | Traditional food/drink/cake vendors | 972 | 1000 | 42 | 525 |
| | Labour/village work/cutting grass/planters | 1027 | 900 | 69 | 555 |
| | Home builders/mechanics/tailors/technicians/wireman | 1325 | 1300 | 35 | 627 |
| | Driver Lorry/bus/co-drivers | 1461 | 1500 | 19 | 402 |
| | Civil servants/cashiers | 1552 | 1500 | 11 | 588 |
| | Total | 1255 | 1100 | 229 | 1361 |
| Moderate | Farmers | 836 | 800 | 7 | 259 |
| | Traditional food/drink/cake vendors | 450 | 450 | 4 | 173 |
| | Labour/village work/cutting grass/planters | 633 | 590 | 4 | 270 |
| | Home builders/mechanics/tailors/technicians/wireman | 967 | 800 | 3 | 473 |
| | Driver Lorry/bus/co-drivers | 1367 | 1200 | 3 | 379 |
| | Total | 818 | 800 | 21 | 393 |
| Low | Labour/village work/cutting grass/planters | 1325 | 1325 | 2 | 460 |
| | Home builders/mechanics/tailors/technicians/wireman | 1200 | 1200 | 1 | |
| | Total | 1283 | 1200 | 3 | 333 |

Overall, the findings reflect that digital capital has become an essential factor in various occupational groups and contributes to higher income for poor households in Perlis.

## 5.0 Conclusion

This study has developed a Digital Capital Index (DCI) to measure digital inclusion among hardcore poor households participating in the Keluarga Malaysia Hardcore Poverty Eradication Program (BMTKM) in Perlis. Through rigorous analysis of data from 315 head of households across three parliamentary constituencies—Kangar, Arau, and Padang Besar—using Principal Component Analysis (PCA), we constructed a comprehensive index reflecting various aspects of digital devices, internet accessibility and motive of internet usage. The findings indicate a moderate level of digital capital among the hardcore poor, with average DCI scores suggesting that while some access to digital technologies is present, significant gaps remain.

The results highlight that digital capital is a crucial determinant of economic outcomes for the hardcore poor in Perlis. Occupations and income levels are strongly linked to digital capital, with higher digital capital correlating with increased income. For instance, individuals in skilled trades such as home builders and technicians have higher digital capital scores and better income outcomes compared to those in lower-skilled occupations. This underscores the importance of digital capital in enhancing economic opportunities for disadvantaged groups. This study also reveals disparities based on gender and rural residency, indicating that women and rural residents face greater challenges in accessing digital resources. These insights call for targeted interventions to address these gaps, such as localized digital literacy programs and improved infrastructure, to better support these groups.

Overall, this research contributes to the broader discourse on poverty alleviation by illustrating the significant role of digital capital in reducing economic disparities. It emphasizes the need for policies that integrate digital skills development and infrastructure improvement as essential components of poverty reduction strategies. These findings align with recent literature suggesting that digital capital can bridge gaps in economic opportunity and foster resilience among vulnerable population. By leveraging digital technologies effectively, the hardcore poor in Perlis can achieve better economic outcomes and move towards a more equitable society.

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