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The Impact of National Intellectual Capital (NIC) on Financial Inclusion (FI): Evidence from Emerging Markets

Maimoona Sadiq (Corresponding Author)
Ph.D. Scholar, Department of Management Sciences, Islamia College University Peshawar. Email: maimoona_iiui@yahoo.com

Hamid Ullah (Ph.D)
Assistant Professor, Department of Management Sciences, Islamia College University Peshawar. Email: hamidullah@icp.edu.pk

Abstract
The purpose of this study is to examine the impact of national intellectual capital (NIC) on Financial Inclusion (FI). For this purpose, 2SLS methodology was employed to generate novel indices for NIC and financial inclusion and then the impact was observed. The findings suggest that national intellectual capital significantly enhances financial inclusion specifically affecting the availability and accessibility perspectives. The observed control variables of the study indicated that GDP positively impacts financial inclusion, however inflation negatively affects affordability and penetration perspectives of financial inclusion. Gender income inequality, population density, urbanization and gender equality has been considered an essential indicator of financial inclusion with geographical and income disparities persuading access to financial services. This research emphasizes the significance of NIC in fostering sustainable development and evidence-based strategies to improve financial inclusion exclusively in emerging nations. To augment financial inclusion, legislators are encouraged to prioritize factors like gender equality, urbanization and inflation control while regulators should develop robust strategies and frameworks to support the underserved.

Keywords: National Intellectual Capital, Human Capital, Structural Capital, Relational Capital, Financial Inclusion

Introduction

The significant impacts of financial inclusion on social and economic systems made it an important concern for the policymakers all around the world (Ali et al., 2021). Generally, financial inclusion denotes the accessibility of financial services and products to every individual within society (Yeyouomo et al., 2023). Various scholars are still unable to agree on a precise definition of financial inclusion (Bekele, 2023). However, researchers agreed upon the terms such as formal financial services and accessibility while explaining the term financial inclusion. World Bank refers to financial inclusion as the accessibility of financial products

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

and services to the individuals such as loans, investments and money transfers (World Bank, 2022). United Nations also highlights its essential role in attaining the 2030 sustainable development goals (Zeqiraj et al., 2022). According to CGAP, financial inclusion also refers to the ability of businesses and individuals to use a broad range of financial services, not just an ease of access to financial products. Thus, financial inclusion highlights the importance of ensuring individuals to have the access to and usage of financial resources to fulfill their financial needs (Noor et al., 2022).

The World Bank (2022) indicates that 1.7 billion adults globally are unbanked specifically in developing countries such as Nigeria, Pakistan, Bangladesh, China, and India (Asyik et al., 2022). Compared to the developing economies, developed economies however have shown considerable progress in financial inclusion and this disparity exists largely due to insufficient intellectual capital (Bakar et. al., 2020; Chazi et al., 2018). Comprising skills, expertise and ingenuity, intellectual capital is crucial for fostering prosperity and achieving long-term development goals (Mukaro et al., 2023).

Intellectual capital comprehends an individual's expertise, knowledge, proficiency, experience, and capability to generate novel ideas (Mukaro, et. al., 2023). In this era, economies operate on the basis of knowledge in which intangible resources have provided not only financial and non-financial support but also provided the economies with long term benefits. Research development, human capital, creativity, environment, and quality are only a few of the many factors that make up intangible assets or intellectual capital (Asyik et al., 2022). In a knowledge-based economy, human, relational and structural capital substantially impacts macroeconomic performance and financial inclusion (Hidayat & Sari, 2022).

Ahangar (2011) maintains that intellectual capital includes a variety of elements, including design methods, general knowledge, innovations, and tech-related components. Generally, the combination of financial development and human capital improves economic performance significantly. Relational capital and structural capital are part of intellectual capital similar to human capital and also have a good likelihood of predicting financial inclusion. Improved access to financial services may be the outcome of structural capital, which includes administrative procedures, facilities, and databases; human capital, which includes the skills, knowledge, and understanding of staff members; and relational capital, which includes interaction with customers, suppliers, and other interested parties (Hidayat & Sari, 2022). While using this approach, intellectual capital may provide valuation to the company, increasing productivity and allowing it to provide more financial goods and services. Researchers suggest that economies does not depend on intellectual resources just for economic growth but also these resources must be managed at macro level to tackle with the growth difficulties and support innovation (Jaya & Soewarno, 2021). Jaya and Soewarno (2021) established that intellectual capital can also be produced to support government plans particularly financial inclusion.

Current studies on financial inclusion and intellectual capital have been observed to focus only on particular countries or firms which eliminates the generalizability

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

of conclusions (Hamidah et al., 2020; Martini et al., 2022). Moreover, the methods or indices employed in previous studies for assessing intellectual capital may not be used at national level due to their data insufficiency or because of their subjective evaluations (Rahman & Liu, 2023; Ting et al., 2023). Therefore, there exists a need to create a comprehensive index to assess national intellectual capital that is capable of examining the influence of the aggregate and individual components' of national intellectual capital on financial inclusion. Thus, a study using the 3SLS methodology to generate a complete index of national intellectual capital while accounting for its components could yield significant insights into improving financial inclusion in emerging economies.

Literature Review

Financial inclusion can be defined as the access of financial services to every individual of the society especially those from the marginalized regions. These services include providing less costly and useful facilities of savings, credit, insurance and payment. Previous definitions of financial inclusion stressed the accessibility of these services to marginalized or underserved groups (Leyshon & Thrift, 1995; Dev, 2006), however it has been extended to encompass additional notions. Modern definitions include not only the accessibility, availability, usage and quality of financial services but also stresses upon the need to mitigate or remove obstacles to inclusion (Allen et al., 2016). Financial inclusion is recognized as a means to alleviate poverty, enhance economic growth and boost individual well-being through the investment in education, health and local economies (Kuada, 2019). It is a multifaceted concept which requires for widespread adoption and significant interaction with financial products and services.

Financial inclusion was first proposed in the 1990s to address the exclusion of economically underprivileged people in isolated regions of developed nations from formal banking institutions due to geographic or racial biases. Despite collateral and continuous income, these individuals were denied formal loans. Community development banks and credit unions initially offered long-term loans at market rates to encourage housing and business developments and wealth creation (Reis, 2020; Leyshon and Thrift, 1995). Financial inclusion often exists within the broader context of social inclusion or exclusion. Early definitions by Leyshon and Thrift (1995) highlight systemic factors like accessibility, pricing and negative experiences that impede certain individuals from participating in formal financial systems.

Conventional research highlights a diverse range of financial services designed to incorporate excluded populations into formal financial institutions. Theoretical frameworks in financial development literature stresses that enhanced financial access promotes economic growth, alleviates poverty and diminishes income inequality (Demirgüç-Kunt et al., 2008). Mathematical models substantiate the significance of financial inclusion in poverty alleviation, demonstrating that access to credit facilitates investments in intellectual capital (Demirgüç-Kunt et al., 2022), businesses, stabilizes consumption, and offers a safety net during financial crises (Galor & Zeira, 1993; Demirgüç-Kunt et al., 2022).

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

National intellectual capital (NIC) denotes a country's aggregate intangible assets that facilitate economic and social advancement. NIC includes knowledge, wisdom, competence, and innovation within a nation, serving as a catalyst for competitiveness and sustainable development (Lin & Edvinsson, 2012). The concept became prominent through Stewart's (1991) work, which emphasized intellectual capital as an essential asset for organizations. Bontis (2004) extended this concept to the national level, highlighting the contributions of individuals, enterprises, and institutions in creating national wealth. NIC is often defined by three key factors including human, relational as well as structural capital. These components collaborate to offer countries a competitive edge and support their social and economic objectives.

Luthy (1998) established a comprehensive framework and classified intellectual capital into two main categories i.e. structural capital which includes market and institutional capital and human capital which comprises of renewal and process capital. Based on their economic value, Brennan (2006) classified performance sources as intangible, financial and physical. Later on, research focused on strengthening national intellectual capital valuation systems. Kita and Šimberová (2018) refined the definition of intellectual capital to encompass human, structural and consumer capital while researchers Andriushchenko et al. (2020) and Nitsenko et al. (2020) underlined the significance of human and technological components of the intellectual capital. Alekseeva et al. (2020) classified intellectual capital into three main categories comprising human capital, relational capital and structural capital. The researcher further explained that the human capital consists of understanding, capabilities and interactions among the individual in a society, the relational capital encompass interactions with suppliers, customers and regulators whereas the structural capital includes licenses, patents, competence and intellectual property.

Human capital (HC) refers to the expertise, abilities, and professional competence possessed by individuals within a society or region. It encompasses interpersonal skills as well as the ability to innovate and problem-solving. HC serves as the foundation for national development by enabling the individuals to effectively contribute to economic systems (Oliveira et al., 2010). Within a knowledge economy, its progress is crucial for fostering creativity, adaptability, and productivity. In contrast, relational capital emphasizes the interactions and networks connecting people, organizations and systems to external stakeholders such as suppliers, consumers and governments. The exchange of knowledge and resources across diverse systems is facilitated by trust, reputation and collaboration. Relational capital is crucial for building relationships, securing resources and encouraging innovation which boosts the economies (Alekseeva et al., 2020). Furthermore, structural capital (SC) incorporates the systems, procedures, intellectual property and organizational structures that provides a holistic framework to effectively operationalize human and relational capital. SC includes patents, databases, licensing and organizational culture through which information is generated and disseminated. It provides the essential infrastructure to enable innovation, improve efficiency and foster

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

sustainable economic growth (Kita & Šimberová, 2018). Given the preceding literature, the following hypothesis is proposed;

H_1: Human capital, structural capital and relational capital are the key indicators of NIC index.

Previous research has thoroughly examined the elements that influence financial inclusion. The majority of these researches focused on the association amid financial inclusion and macroeconomic indices. Ozili (2020) discovered that the economy's financial position and financial literacy influence the level of financial innovation, financial sector stability, scarcity and quantity of financial inclusion. In a multi-national investigation, Beck et al. (2009) determined a combination of several bank related characteristics instrumental in facilitating the convenience of banking services. The study discovered that indices of banking usage and access had a favorable influence on economic growth. In Sarma's (2008) study, an ample financial inclusion index was employed. The index primarily concentrated on the following components of financial inclusion: the utilization of the bank's structure, the extent to which the banks are accessible as well as availability of financial services. In their study, Sarma & Pais (2011) examined the impact of socioeconomic and macroeconomic factors on the level of financial inclusion. It can be observed that previous scholars have not examined the direct correlation between financial inclusion and national intellectual capital. Ali et al., (2021) established that countries with intellectual capital like extensive interactions, competent human resources, and organizational infrastructure will be able to mediate financial inclusion, notably in obtaining formal financial services. Both financial inclusion (accessibility) and the human capital aspect of the intellectual capital are important components of a sound financial system. The favorable economic climate creates additional prospects for both financial inclusion and intellectual capital as the financial institution gains financial value from intellectual capital, and financial inclusion gains by giving its customers access to credit.

The connection between national intellectual capital and financial inclusion can further be validated through the Knowledge Economy Theory. The theory underscores the critical role of human capital, innovation and knowledge in modern economies. This correlation suggests that the intellectual capital of a country acts as a catalyst for the adoption of inclusive financial practices. The expansion of a nation's intellectual capital through educational pursuits, research endeavors, and technology breakthroughs plays a significant role in fostering the development of novel financial tools and strategies. As NIC expands, individuals and organizations are increasingly empowered to access and utilize financial services consequently enhancing financial inclusion. Technological developments and enhanced communication, supported by structural and relational capital, further foster inclusion. Consequently, this phenomenon enables a broader range of individuals within society to avail themselves of financial services, so promoting their engagement in economic activities and mitigating inequalities.

While previous studies have observed the impact of financial literacy and knowledge on financial inclusion (Bianco et al., 2022; Liu et al., 2021a), the

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

current research uses the Knowledge Economy Theory as an innovative paradigm to investigate the correlation between NIC and financial inclusion. This investigation seeks to enhance comprehension of how knowledge-driven economies might attain more financial inclusion through the integration of NIC. Thus, the literature review indicates a gap in empirical research which suggests for directly investigating the influence of intellectual capital on the level of financial inclusion worldwide. In the light of above-mentioned discussions, the following hypotheses are proposed;

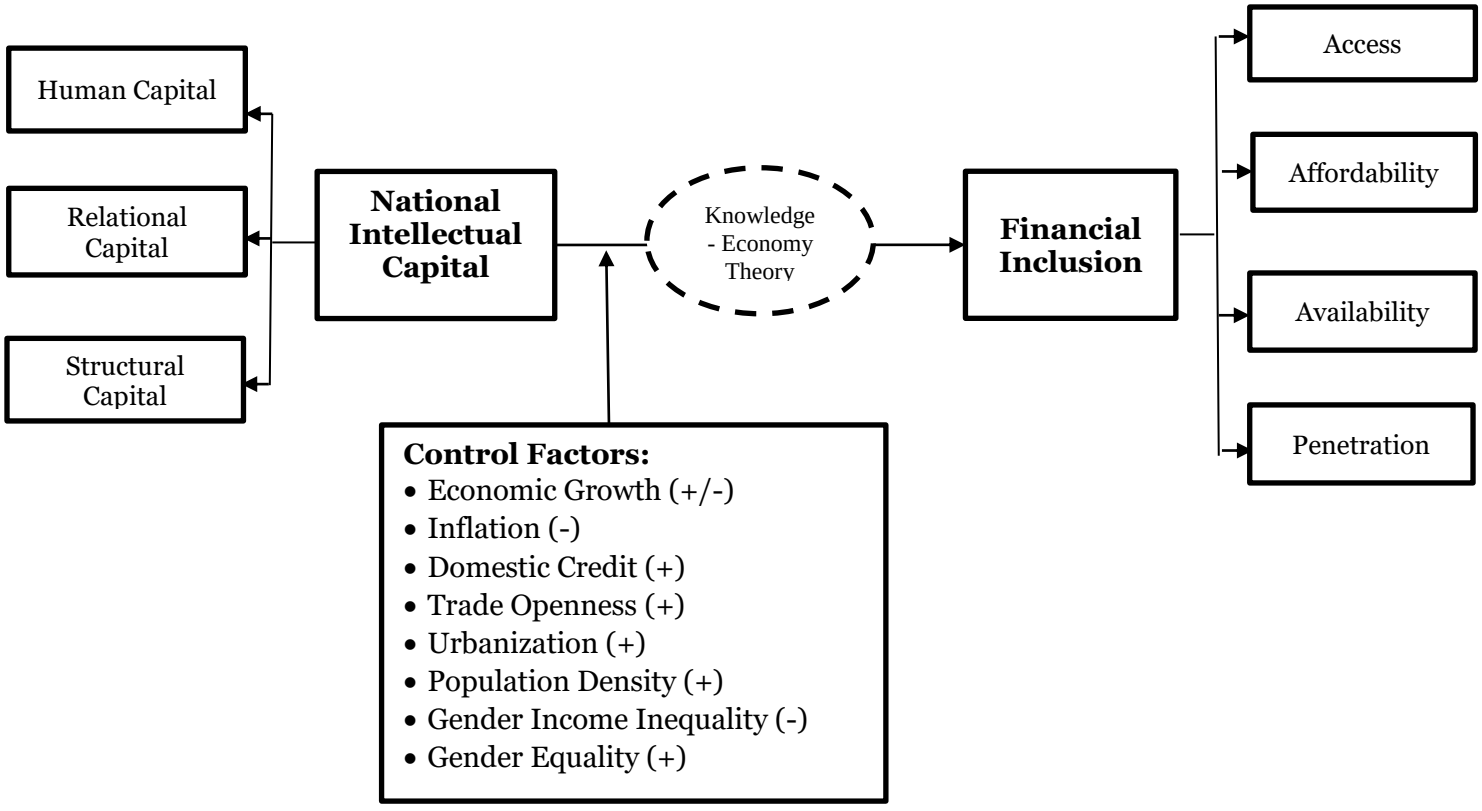
H_2: National intellectual capital and financial inclusion are significantly and positively related.

H_3: Human capital and financial inclusion are significantly and positively related.

H_4: Structural capital and financial inclusion are significantly and positively related.

H_5: Relational capital and financial inclusion are significantly and positively related.

Theoretical Framework



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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

Methodology

Study Design and Sample Profile

This research investigates the impact of national intellectual capital on financial inclusion by establishing indices for both variables and investigating their relationship through a deductive methodology and a positivist research philosophy (Bryman, 2012; Park, 2020). Data were gathered from secondary sources comprising developing economies from 2010 to 2023, specifically targeting countries with Human Development Index (HDI) scores below 0.80. The hypotheses were systematically tested using longitudinal balanced-panel data employing a mono-method quantitative approach (Cooper & Schindler, 2011). Principal Component Analysis (PCA) in SPSS version 23 was utilized for ensuring validity, reliability and model adequacy. Structural Equation Modeling (SEM) in Smart PLS version 4 was employed to observe the correlations among variables under investigation. This thorough approach facilitates a rigorous examination of the variables' relationships.

Empirical Model

The study uses 3SLS technique to scrutinize the correlation amid National Intellectual Capital and Financial Inclusion. A statistical method for estimating regression model parameters is the Three stage least square (3SLS). Typically, the structural equation regression looks like this:

$$Y_i = X_i\beta_i + \mu_i \quad \text{.....(i)}$$

where
$\mathbf{Y_i}$ is the vector of endogenous variables
$\mathbf{X_i}$ is the matrix of explanatory variables
$\boldsymbol{\beta_i}$ is the vector of coefficients
$\boldsymbol{\mu_i}$ is the error term
In the first stage, we addressed endogeneity by estimating potentially endogenous independent variables (X_1, X_2, X_3, ..., X_k) using instrumental variables (IVs). The first stage involves estimating the following equations for each potentially endogenous variable.

$$X_j = \delta j_0 + \delta j_1 W_1 + \delta j_2 W_2 + \cdots + \delta j_p W_p + \mu_{ij} \quad \text{.....(ii)}$$

In the second stage, we used the estimated values of the potentially endogenous variables from the first stage to estimate the coefficients. In the third stage, we used the estimated coefficients from the second stage to estimate the error terms (μ_i) in the equations. This helps correcting any remaining endogeneity in the system.
The way 3SLS handles the error term and parameter estimates is what makes it

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

special. When an independent variable and the error term have a correlation, this is known as endogeneity. When addressing moderators, this can be particularly crucial as they may have correlations with both the predictor and explained variables. The 3SLS approach considers interdependence between equations and uses instrumental variables to get consistent parameter estimates in order to overcome endogeneity problems in simultaneous equation systems.

Keeping in view, the latest knowledge-based economy and novel business traits, the current study creates a new detailed national intellectual capital index that is suitable for every economy and investigates its connection with financial inclusion. Data is collected from the period 2010 to 2023 globally. South Asia, Southeast Asia, Atlantic, the Middle East, North Africa, and Eastern European and North American Countries were the other seven regions into which the current research was conducted. Prior to empirical estimation, the whole data was converted in the form of a natural logarithm for eliminating any potential internal discrepancies. The generalized empirical model is:

$$FI_{it} = \alpha + \beta_1 NICI_{it} + \beta_2 X_{it} + \acute{\omega}_{it}$$

where FI represents financial inclusion and is the dependent variable of the study, NICI represents the index for national intellectual capital whereas X denotes the control variables.

PCA is a highly employed technique for statistical analysis and dimensionality reduction. It is employed to reduce a large dataset into a smaller one that preserves the majority of the information from the larger set. The overall index is computed as:

$$NICI = \sum_{I=1}^{3} W_i M_i$$

where NICI is the overall national intellectual capital index, M_i may represent one of the aforementioned metrics, whereas W_i denotes the allocated weight.

The study uses the three-stage least squares (3SLS) regression strategy to accord with and analyze endogenous variables and explore the interrelationships. Therefore, in situations where there are imperfect instruments available, this technique is justifiable and adequate for solving the simultaneous equations model. Additionally, it is more appropriate and effective than 2SLS since it collects all data in comprehensive systems of equations. With the probable reverse effect of potential interconnected variables controlled, this 3SLS technique enables us to analyze the impact of national intellectual capital on financial inclusion and financial inclusion on national intellectual capital. Endogenous variables frequently exhibit reciprocal interactions with other variables in the system, whereby they both impact and are influenced by them. It is possible to examine how national intellectual capital affects financial inclusion and vice versa while taking into consideration their interdependencies by using 3SLS to control for these reverse effects. The empirical equation is formulated as follows.

$$NICI_{it} = \beta_0 + \beta_1 FI_{it} + \beta_2 Ctrl_{it} + \in_1 \quad \ldots\ldots (1)$$
$$FI_{it} = \beta_0 + \beta_1 NICI_{it} + \beta_2 Ctrl_{it} + \in_2 \quad \ldots\ldots (2)$$

Variable measurements: Prior studies on the topic of financial inclusion used a variety of metrics. Depending on the availability of data, different countries rate financial inclusion differently. There are regional variations in the variables used to measure access to financial services. However, a collection of parameters and their statistics may be found in many data repositories. Researchers regularly use the World Bank database to study financial inclusion among these sources. Four key aspects of financial inclusion, accessibility, affordability, availability, and penetration, have been used in our study. For the independent variable national intellectual capital, **t**his study creates a new detailed index for analyzing its three distinct components i.e. human capital, relational capital, and structural capital. Additionally, control factors including GDP or economic growth, inflation, domestic credit to private sector, gender income inequality, trade openness, gender equality, urban population to total population ratio, and population density are taken into account.

Based on the research methodology, regression model can be formulated as:

$$FI_{it} = \beta_o + \beta_1 NIC_{it} + \beta_5\, Ctrl_{it} + \epsilon_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (3)$$

Where NIC is the independent variable and Ctrl represents the control variables of the study.

Results and Discussion

This section analyzes different econometric models used to investigate the correlation between National Intellectual Capital (NIC) and financial inclusion, as discussed in the previous sections.

Descriptive Statistics

Table 1 represents the results of descriptive statistics. The table embodies the total number of observations, the minimum (min) and maximum (max) data values and the mean, and standard deviation (SD) of all the study variables. The results of the independent variables revealed that the mean score of aggregate NIC is 0.41, its standard deviation is 0.692 and the minimum and maximum values are −3.456 and 2.112, respectively. Moreover, the mean and standard deviation of the human capital (Hcap) perspective of NIC is 0.255 and 0.207 whereas the minimum and maximum values are 0.797 and 1.893 respectively. The mean value of the social capital (Scap) perspective of NIC is 0.064 and the standard deviation, minimum and maximum scores are 1.059, -2.065 and 4.54 respectively. Similarly, the mean, standard deviation, minimum and maximum scores of the Relational Capital (Rcap) perspective of NIC are 0.204, 0.854, -3.474 and 2.263 respectively. The results of the NIC and all of its components (i.e. Hcap, Scap and Rcap) are consistent with the results of the study conducted by Vo and Tran (2022).

The descriptive statistics of dependent variable indicates that the mean value of aggregate financial inclusion (Finclusion) is 0.287 and SD is I 0.413, the min value is -0.75 and max value is 2.662. The mean and standard deviation values for one of the dimensions of financial inclusion i.e. affordability is 0.455 and 0.867

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

respectively and the min and max values are -1.336 and 2.649 respectively. Mean and SD scores for the availability (Availib) dimension of financial inclusion are 0.295 and 0.606 respectively and the min and max values are -0.908 and 3.079 respectively. For the accessibility (Accessib) dimension of financial inclusion, the mean score is 0.255, SD value is 0.669, the min and max scores are -1.058 and 5.211 respectively. Furthermore, for the penetration (Penetrat) dimension of financial inclusion, the mean value is 0.435, the SD score is 0.823, the min score is -1.654 and the max score is 2.747. The results are also consistent with the results of the studies conducted by Ozili, (2022) and Nguyen (2021).

Lastly, all of the study's instrumental and control variables' descriptive statistics are also presented in Table 1. The mean values of the control variables, log of gdp (Lgdp), inflation as log of cpi (Linf), Gini index for gender income inequality (Lgini), log of credit to private sector by bank (Ldcps), population density (Lpopd), urban population to total population ratio (Luopo), log of total trade (Lto) and gender equality rating (GEqual) are 2.779, 1.152, 0.344, 1, 1.898, 1.721, 1.594 and 1.131 respectively. The standard deviation of these control variables are 1.794, 1.009, 0.647, 0.842, 0.635, 0.267, 0.709, and 0.493 respectively. The minimum values for the variables log of gdp (Lgdp), inflation as log of cpi (Linf), Gini index for gender income inequality (Lgini), log of credit to private sector by bank (Ldcps), population density (Lpopd), urban population to total population ratio (Luopo), log of total trade openness (Lto) and gender equality rating (GEqual) are 0, -4.111, 0, 0, 0, 0, 0, and 0 respectively. Moreover the results also indicated that 5.287, 6.325, 1.754, 2.459, 4.33, 2.004, 2.833 and 1.811 were the maximum values for the control variables of the study i.e. log of gdp (Lgdp), inflation as log of cpi (Linf), Gini index for gender income inequality (Lgini), log of credit to private sector by bank (Ldcps), population density (Lpopd), urban population to total population ratio (Luopo), log of total trade (Lto) and gender equality rating (GEqual). The mean values for the instrumental variables of the study including the log of umemployment (Luemp), log of patents (Lpat) and female to male earnings ratio (Fmearning) were observed to be 0.572, 1.369 and 0.704 respectively. Their standard deviation scores were 0.46, 1.715 and 0.186 respectively. The minimum values of the instrumental variables log of umemployment (Luemp), log of patents (Lpat) and female to male earnings ratio (Fmearning) were 0, 0 and 0.073 and their maximum values were observed to be 1.565, 6.532 and 1.065 respectively.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Independent Variables					
Nic	3458	.041	.692	-3.456	2.112
Hcap	3458	.255	.207	-.797	1.893
Scap	3458	.064	1.059	-2.065	4.54
Rcap	3458	.204	.854	-3.474	2.263
Dependent					

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ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

Variables					
Finclusion	3458	.287	.413	-.75	2.662
affordabilty	3458	.455	.867	-1.336	2.649
Availib	3458	.295	.606	-.908	3.079
Accessib	3458	.255	.669	-1.058	5.211
Penetrat	3458	.435	.823	-1.654	2.747
Control Variables					
Lgdp	3458	2.779	1.794	0	5.287
Linf	3458	1.152	1.009	-4.111	6.325
Lgini	3458	.344	.647	0	1.754
Ldcps	3458	1	.842	0	2.459
GEqual	3458	1.131	.493	0	1.811
Lto	3458	1.594	.709	0	2.833
Lpopd	3458	1.898	.635	0	4.33
Luopo	3458	1.721	.267	0	2.004
Instrumental Variables:					
Luemp	3458	.572	.46	0	1.565
Lpat	3458	1.369	1.715	0	6.532
Fmearning	3458	.704	.186	.073	1.065

Pearson's Correlation Matrix

The Pearson correlation matrix is employed for identifying linear relationships between the variables under observation. Table 2a and Table 2b summarizes scores of Pearson Correlation Test. This test is also used to identify the direction of the relationship between the study variables. The correlation matrix can also be employed for testing multicollinearity among predictor variables. Multicollinearity refers to significant correlation amid independent variables of study (Wooldridge, 2012).

The correlations matrix in Table 2a indicates that all the three perspectives or dimensions of National Intellectual Capital (nic) are significantly correlated with NIC where the relational capital (rcap) is highly significant (p-value < 0.01) with a correlation score of 0.828, social capital (scap) moderately significant with a correlation score of 0.484 and human capital is less significant with correlation value of 0.195. The significant correlation between the three dimensions and NIC is not an indication of multicollinearity rather the aggregate NIC was observed using the same three dimensions. Moreover, the three dimensions (human, social and relational) and the aggregate NIC have not been used simultaneously in a single regression equation or analysis. Therefore, it cannot be considered as an indication of the existence of multicollinearity between these variables. The correlation matrix also represent the correlation scores between the human capital (hcap), social capital (scap) and relational capital (rcap) indicating an insignificant (p-value > 0.05) correlation value between hcap and scap being 0.034 and between hcap and rcap being 0.013. The results also suggest a significantly weak relationship between scap and rcap with a correlation score of 0.053. These

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

findings validates the first hypothesis of our study that "*Human capital, structural capital and relational capital are the key indicators of NIC index*". These results are also consistent with the results of the study conducted by Vo and Tran (2022).

Considering the results of the correlation between the dependent variable (finclusion) and the independent variables (i.e. nic, hcap, scap, rcap) of the study, it can be observed that there does exist a significantly strong with p-value less than 1% level and a positive association amid financial inclusion and national intellectual capital with a correlation score of 0.910. While observing the correlation values between the independent dimensions of NIC and financial inclusion, it can be observed that the variables human capital (hcap), social capital (scap) and relational capital (rcap) are significantly correlated with financial inclusion with correlation scores of 0.07, 0.040 and 0.140 respectively. Ilahiyah, et. al, (2021) found similar results in their study.

Analyzing the correlation scores between the control and instrumental variables of the study in Table 2b, it can be observed that there does exist a significant relationship between these variables but it is not strong enough to create the problem of multicollinearity. Only the relationship between the variables log of the GDP (lgdp) and log of unemployment (luemp) with a significant (p-value < 0.05) correlation value of 0.674 designates an average relationship amongst these variables. Similarly the relationship between variables log of the GDP (lgdp) and log of credit to private sector by banks (ldcps) shows an average to high relationship between these variables with a score of 0.720. This may be an indication for the problem of multicollinearity between these two variables which can further be verified using the VIF test.

It can be concluded that although some of the relationships between study variables were significant yet they were not strong enough to indicate the existence of multicollinearity. This is because of their weak scores and that the aggregate NIC has not been used simultaneously in the same regression equation along with its various dimension including human, social and relational capital.

Table 2a: Pearson's Correlation between Dependent and Independent Variables

Variables	(1)	(2)	(3)	(4)	(5)
(1) finclusion	1.000				
(2) nic	0.910 (0.000)	1.000			
(3) hcap	0.07 (0.037)	0.195 (0.000)	1.000		
(4) scap	0.040 (0.071)	0.484 (0.000)	0.034 (0.081)	1.000	
(5) rcap	0.140 (0.000)	0.828 (0.000)	0.013 (0.502)	0.053 (0.006)	1.000

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

Table 2b: Pearson Correlation between Control Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) lgdp	1.000										
(2) linf	0.006	1.000									
	(.769)										
(3) luemp	0.674	0.311	1.000								
	(.000)	(.000)									
(4) lgini	0.355	0.051	0.341	1.000							
	(.000)	(.009)	(.000)								
(5) ldcps	0.720	0.214	0.662	0.423	1.000						
	(.000)	(.000)	(.000)	(.000)							
(6) fmearning	0.054	0.021	0.036	0.015	0.029	1.000					
	(.003)	(.319)	(.046)	(.400)	(.104)						
(7) lpat	0.159	-0.060	0.115	0.047	0.106	-0.022	1.000				
	(.000)	(.002)	(.000)	(.006)	(.000)	(.229)					
(8) lpopd	0.054	-0.048	0.030	0.020	0.050	-0.088	0.064	1.000			
	(.002)	(.014)	(.082)	(.242)	(.004)	(.000)	(.000)				
(9) luopo	0.069	-0.013	0.053	-0.002	0.049	-0.068	0.252	0.151	1.000		
	(.000)	(.494)	(.002)	(.922)	(.004)	(.000)	(.000)	(.000)			
(10) GEqual	0.104	0.036	0.082	0.026	0.060	0.149	0.272	-0.118	0.134	1.000	
	(.000)	(.067)	(.000)	(0.124)	(.000)	(.000)	(.000)	(.000)	(.000)		
(11) lto	0.145	0.036	0.115	0.046	0.117	-0.008	0.208	-0.051	0.283	0.136	1.00
	(.000)	(.063)	(.000)	(.007)	(.000)	(.639)	(.000)	(.003)	(.000)	(.000)	

Regression Analysis Assumptions

This study employed panel data regression analysis to assess the influence of national intellectual capital on financial inclusion in developing economies. Certain assumptions had to be satisfied before the regression analysis could begin. The tests encompassed Variance Inflation Factor analysis for multicollinearity, Breusch-pagan or Cook-Weisberg test for heteroscedasticity, Wooldridge test for autocorrelation, and Ramsey reset test for omitted variable biasness. The results of these tests are discussed below.

Multicollinearity: Multicollinearity in a regression model causes many problems that can affect findings reliability and interpretability. Standard errors for estimated coefficients are inflated, causing concern (Daoud, 2017). Inflation widens confidence ranges, complicating coefficient statistical significance assessments. Thus, identifying true relationships between independent factors and the dependent variable becomes harder.

Table 3 illustrates the results of the variance inflation factor test. The Variance Inflation Factor (VIF) results demonstrate the absence of multicollinearity among the independent variables in the model. The results determines that there does not exist multicollinearity among the independent variables. A VIF number beyond 10 is typically seen as a sign of multicollinearity, but values below 5 indicate negligible or no issues (Hair et al., 2012). In this model, the Variance Inflation Factor (VIF) for each variable is as follows: Ldcps (1.307), Lgdp (1.182), Lto (1.142), Luopo (1.133), Lgini (1.111), Nic (1.091), Linf (1.078), GEqual (1.054), and Lpopd (1.029). All values are much below the critical threshold, with the maximum recorded at

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

1.307 for Ldcps (domestic credit to the private sector). This signifies that Ldcps exhibits the highest association with other independent variables; nonetheless, the degree remains minimal and non-problematic. Likewise, Lgdp (1.182), Lto (1.142), and Luopo (1.133) demonstrate low VIF values, indicating that these variables are not significantly associated with others. Further confirmation of these findings is provided by the 1/VIF values. The tolerances values for all the variables is significantly over the critical level for concern. The average VIF of 1.125 support these findings, suggesting that, on average, the independent variables in the model demonstrate only negligible association with each other therefore multicollinearity is not an issue.

Table 3: Variance Inflation Factor

	VIF	1/VIF
Ldcps	1.307	.765
Lgdp	1.182	.846
Lto	1.142	.875
Luopo	1.133	.882
Lgini	1.111	.9
Nic	1.091	.916
Linf	1.078	.927
GEqual	1.054	.949
Lpopd	1.029	.971
Mean VIF	1.125	.

Heteroscedasticity

In a regression model, heteroscedasticity occurs when the variance of the error component fluctuates from observation to observation. The dispersion of errors varies according to the values of dependent variable. This is problematic since regression analysis assumes that errors be uniformly distributed, irrespective of the outcomes. The violation of this assumption may result in unreliable outcomes (Gujarati, 2012; Wooldridge, 2010).

This study employs breusch-pagan/cook-weisberg test on study variables to test for heteroscedasticity because of its superior applicability to larger and more intricate models (Uyanto, 2022).

The test statistic for this test, as illustrated in Table 4 is $\chi^2(1) = 2.44$ and the p-value is 0.0838 which is above the commonly utilized significance threshold of 0.05, So, we are unable to reject the null hypothesis that is heteroscedasticity is not a concern in this research.

Omitted Variable Biasness

Omitted variable bias occurs in regression analysis when relevant factors that affect the dependent variable are not included in the model (Cinelli & Hazlett,

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

2020). The excluded variables exhibits correlation with one or more of the included independent variables. This bias compromises the reliability of the findings and may lead to incorrect interpretations (Gujarati, 2012; Wooldridge, 2013). Ramsey RESET test is used to identify potential specification problems (Andreas, & Günther, 2019). The Ramsey RESET test results, presented in Table 4, suggest that the regression model is accurately described and devoid of omitted variables. The test statistic, F(3,3725) = 2.16, and the corresponding p-value of 0.0915 indicate that the model does not demonstrate substantial evidence of misspecification at a conventional significance threshold of 0.05.

First-Order Autocorrelation

The term "autocorrelation" or serial correlation implies the correlation of error terms within a regression model. This designates that regression model error terms are not independent (Gujarati & Porter, 2009). Autocorrelation may lead to biased estimates and inflated standard errors, ultimately affecting the accuracy of the results (Baltagi, 2008). The null hypothesis posits that the regression model exhibits no first-order autocorrelation, indicating that the error terms are uncorrelated among observations. The results for the autocorrelation test is presented in Table 4. It can be observed that the F-statistic, F(1, 3034) = 2.359, with 1 degree of freedom. The resultant p-value is 0.08, which exceeds the standard threshold value of 0.05. Consequently, the null hypothesis cannot be rejected.

Table 4: Breusch-Pagan / Cook-Weisberg Test, Ramsey RESET Test and Wooldridge Test

Test	Null Hypothesis	Test Statistic	p-value
Breusch-Pagan / Cook-Weisberg	Constant variance Homoskedicity	$\chi^2(1) = 2.44$	0.0838
Ramsey RESET	Model has no omitted variables	F(3, 3725) = 2.16	0.0915
Wooldridge	No first-order autocorrelation	F(1, 3034) = 2.359	0.08

Panel Data Model Selection

The selection of appropriate regression models and the validation of their assumptions are essential components of reliable econometric analysis. Diagnostic assessments, such the Breusch-Pagan Lagrange Multiplier (BP-LM), Fisher test, and Hausman test, are crucial for evaluating the appropriateness of pooled OLS, random effects (RE), or fixed effects (FE) models in panel data analysis. Table 5 presents the test statistics for BP-LM test (value = 56.565, p = 0.000), which confirms the existence of panel effects, supporting RE over pooled OLS, while the Fisher test (value = 76.56, p = 0.000) stresses the necessity of the FE model to

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

address unobserved entity-specific aspects. The Hausman test (value = 98.456, p = 0.000) reinforces the fixed effects model by examining correlations between individual-specific effects and explanatory factors. The Two-Stage Least Squares (2SLS) method for causal inference employs instrumental variables, evaluated for relevance and validity through the Kleibergen-Paap statistic (value = 23.765, p = 0.000), Sargan test (value = 1.54, p = 0.154), Basmann test (value = 1.76, p = 0.106), and Hansen J test (value = 1.23, p = 0.207). These findings validate the robustness and exogeneity of the instruments, guaranteeing accurate estimations. The findings collectively highlight the preference for panel data models and the effectiveness of the instrumental variable approach in substantiating links in financial inclusion analysis.

Fixed Effect and 2SLS Model results

The results in Table 5 reveals a substantial and affirmative correlation between National Intellectual Capital (NIC) and financial inclusion across various econometric models. The Fixed Effects (FE) model, exhibiting the highest coefficient (0.099, $p<0.01$), is preferred according to the Hausman test, underscoring the necessity of considering unobservable country-specific factors such as culture and institutional quality for accurate estimations. This correlation is validated by the Random Effects (RE) and OLS models even though their coefficients are marginally lower. The Two-Stage Least Squares (2SLS) model eliminates endogeneity issues revealing a significantly high and a strong positive relationship (i.e. 0.044 with $p<0.05$) between NIC and financial inclusion. The findings are consistent with Schultz's (1961) human capital theory and Bontis's (1998) structural capital framework indicating that education, financial literacy, institutional quality and trust are critical for improving financial inclusion. Structural improvements, such as digital banking and mobile payment systems helps reduce the transaction costs as well as widens the access to financial services. On the contrary, relational capital promotes trust and involvement within financial institutions. The results validates the hypothesis of the study that NIC significantly improves financial inclusion.

With consistent results across both the Fixed Effects (FE) and Two- Stage Least Squares (2SLS) models, the research also demonstrates a strong relationships between various control factors and financial inclusion. Economic growth, shown by GDP (Lgdp), exhibits a robust positive and statistically significant impact, with coefficients of 0.023 ($p < 0.01$) in both models. A 1% increase in GDP results in a 0.023% improvement in financial inclusion, indicating the influence of economic expansion on enhancing financial infrastructure, elevating income levels, and expanding access to financial services. These findings correspond with previous research (Ifediora, et. al., 2022) highlighting the economic foundations of financial inclusion.

Inflation (Linf) adversely affects financial inclusion, exhibiting coefficients of -0.016 ($p < 0.01$) in the fixed effects model and -0.032 ($p < 0.01$) in the two-stage least squares model. These findings highlight the adverse consequences of inflation, which diminishes purchasing power and undermines confidence in

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

financial systems, discouraging involvement from both individuals and institutions. Income inequality (Lgini) demonstrates a substantial negative relationship with financial inclusion in FE model scoring -0.1 and p-value significant at 1%, however its impact becomes statistically negligible in the 2SLS model (-0.011, $p > 0.1$). This suggests that mitigating economic gaps is essential for improving access to financial institutions, but other factors may influence this association when accounting for endogeneity.

Access to credit (Ldcps) exerts a positive influence, evidenced by substantial coefficients in both models (FE= 0.15, $p < 0.01$; 2SLS= 0.025, $p < 0.1$). This underscores the significance of specialized credit markets in facilitating household and business participation in financial systems. Urbanization, as shown by the urban population ratio (Luopo), exhibits a significant positive impact in the fixed effects model (10.988, $p < 0.01$), although this effect becomes negligible in the two-stage least squares model, implying that unobserved structural factors affect the connection. Population density (Lpopd) and trade openness (Lto) exhibit no significant effects in either model, highlighting the intricate and context-dependent nature of these variables' influence on financial inclusion.

Gender equality (GEqual) consistently improves financial inclusion, evidenced by substantial coefficients in both models (FE: 0.209, $p < 0.01$; 2SLS: 0.112, $p < 0.01$), underscoring the imperative to advance gender parity for equitable financial access. The lagged dependent variable (L.finclusion) demonstrates a strong positive effect, showing the enduring nature of financial inclusion across time. These findings highlight the necessity of policies that tackle structural, macroeconomic, and social determinants to maintain and enhance financial inclusion.

Table 5: Panel Data Estimation

	(OLS) finclusion	**(FE) finclusion**	**(RE) finclusion**	**(2SLS) finclusion**
Nic	.041**	.099***	.041**	.044**
	(.017)	(.025)	(.017)	(.017)
Lgdp	.016*	.023***	.016*	.023**
	(.01)	(.008)	(.01)	(.01)
Linf	-.025***	-.016**	-.025***	-.032***
	(.009)	(.008)	(.009)	(.01)
Lgini	-.005	-.10***	-.005	-.011
	(.014)	(.012)	(.014)	(.014)
Ldcps	.016	.15***	.016	.025*
	(.014)	(.012)	(.014)	(.015)
Lpopd	.024	.02	.024	.006
	(.015)	(.059)	(.015)	(.016)
Luopo	.043	10.988***	.043	.014
	(.041)	(.605)	(.041)	(.053)

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

Gequal	.144***	.209***	.144***	.112***
	(.025)	(.04)	(.025)	(.031)
Lto	-.002	.011	-.002	-.01
	(.019)	(.035)	(.019)	(.02)
L.finclusion	.338***	.185***	.338***	.554***
	(.022)	(.025)	(.022)	(.088)
_cons	.008	19.33***	.008	-.053
	(.082)	(1.041)	(.082)	(.106)
Observations	3458	3458	3458	3468
BP-LM Test	56.565(.00)			
Fisher Test	76.56(.000)			
Hausman Test		98.456(.000)		
Kleibergen-Paap (KP) statistic				23.765(.000)
Sargan (score) chi2(2)				1.54(0.154)
Basmann chi2(2)				1.76(0.106)
Hansen J Test				1.23(.207)

Standard errors are in parentheses
*** *p<.01*, ** *p<.05*, * *p<.1*

Robustness Check for Regression Model

The overall impact of NIC on financial inclusion was analyzed for robustness, with findings presented in Table 6. NIC has a substantial positive influence on financial inclusion as well as its four dimensions i.e. affordability, availability, accessibility, and penetration. According to the results, NIC demonstrates positive impact on financial inclusion with score being highly significant ($p<0.01$) at .081. Considering the various components of financial inclusion, the most significant score can be perceived in availability of financial services (0.331, sig at 1%) and their accessibility (0.295, p-value less than 1%), demonstrating that NIC significantly contributes to improving availability and usage of these services. NIC also improves affordability ($\beta = 0.155$, $p < 0.01$) and penetration ($\beta = 0.074$, $p < 0.01$), but the impact on penetration is quite minor. These findings affirm the persistent and substantial impact of NIC on financial inclusion, underscoring its essential role in promoting equitable access to financial services. The findings highlight that improving NIC can greatly promote financial inclusion in all of its components. The findings are further supported by Mishra (2021) and Xu et al. (2020) who reported comparable results. Thus the results supports the second hypothesis of our study i.e. "*National intellectual capital and financial inclusion are significantly and positively related*".

Robustness testing demonstrate a considerable positive correlation between human capital and financial inclusion across all dimensions, underscoring its transformative function in enhancing financial ecosystems. The results in Table 6

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

designate that a unit rise in human capital is linked with significant improvements in affordability (0.294, $p < 0.05$), availability (0.513, sig at 1%), accessibility (0.178, sig at 1%) and penetration (0.184, sig at 1%) of financial services. Human Capital Theory explains how investments in education and skill development improve cognitive abilities, allowing individuals to understand and effectively use financial services. The results are further validated by the study of Oyinlola and Adedeji (2019). Thus the 3rd hypothesis of study is accepted that *"Human Capital and Financial Inclusion are significantly and positively related"*.

Structural capital exerts a substantial positive effect on financial inclusion by affecting affordability (0.088, sig at 10% level), availability (0.188 and p-value < 0.05), accessibility (0.188, sig at 1%), and penetration (0.118 with p-value < 0.01). These findings underscore the importance of resilient infrastructure, digital platforms, and institutional frameworks in mitigating operational obstacles and transaction expenses, thus broadening access to financial services for underprivileged groups. Nonetheless, structural capital demonstrates a smaller impact on affordability (coefficient: 0.088, $p < 0.1$), indicating that market competition and regulatory measures are more pivotal in cost efficiency. Andrieş et al., (2018) found similar results in his study. So, the 4th hypothesis of our study is proved i.e. *"Structural Capital and Financial Inclusion are significantly and positively related"*.

Relational capital has a statistically significant positive effect on financial inclusion in terms of affordability (0.158) with p-value<0.01, availability (0.21) with p-value < 0.01, accessibility (0.173) with p-value less than 0.01 and penetration (0.108) with a p-value less than 0.01. These findings underscore the significance of trust, social networks, and human interactions in enhanced attainment of financial services. Comparable findings were reported by Bongomin, et al., (2018). Trust-based connections diminish operational inefficiencies, decrease transaction costs, and promote collaboration, allowing financial institutions to deliver customized solutions to underserved communities. Thus the results supports the 5th hypothesis of our study i.e. *"Relational Capital and Financial Inclusion are significantly and positively related"*.

Economic growth, indicated by GDP, demonstrates a positive and statistically significant effect on financial inclusion. For the aggregate financial inclusion this value is 0.022, significant at 5% level, and for the penetration and affordability the values are 0.028 and 0.022 significant at 1% and 5% respectively. This indicates that GDP promotes increased access to and consumption of financial services, primarily by improving financial infrastructure. Nevertheless, the impact of GDP on availability (coefficient: 0.017) is statistically insignificant. This outcome supports existing literature indicating a substantial correlation between economic growth, national income, and increased financial inclusion (Emara & El Said, 2021).

Inflation adversely affects financial inclusion, exhibiting an overall coefficient of -0.015 ($p < 0.05$). It significantly reduces affordability (-0.024, $p < 0.01$) and penetration (-0.027, $p < 0.01$), indicating a decline in purchasing power and diminished appeal of financial services. Accessibility (-0.011) and availability

ISSN Online: 3007-3154
ISSN Print: 3007-3146

Vol. 3 No. 1 (January) (2025)

(0.001) are marginally impacted, exhibiting little statistical significance. These findings align with research indicating that inflation erodes financial institutions by destabilizing the economy and deterring involvement (Bianchi & Melosi, 2022).

Gender income disparity, as quantified by the Gini index, exhibits minimal impact on financial inclusion, shown by negligible aggregate value of -0.011 and p-value greater than 10%. The impact is significant in the penetration dimension (-0.024, $p < 0.05$) but minimal for affordability (-0.013) and non-existent for availability (0,00). This indicates that comprehensive gender-specific strategies and indicators may be necessary to tackle inequities obstructing financial inclusion (Demir et al., 2022).

Domestic lending to private sector (Ldcps) exhibits a positive nonetheless insignificant correlation with financial inclusion (0.012, p-value greater than 10%). Although coefficients for particular dimensions are slightly positive (0.015 for affordability, 0.018 for penetration), the findings indicate that credit expansion alone does not significantly improve financial inclusion. Research (Feghali et. al., 2021) underscores the significance of targeted initiatives such as microfinance and digital lending to provide financial advantages to marginalized populations.

Population density exhibits a significant correlation with financial inclusion, evidenced by a strong coefficient of 0.027 ($p < 0.01$). It significantly affects affordability (0.028), availability (0.099), accessibility (0.043) and penetration (0.058) (all sig at 5%). Increased population density enhances the accessibility of financial services through improved infrastructure and institutional concentration in metropolitan regions (Azimi, 2022).

Urbanization, defined as the proportion of the urban population to the overall population, significantly enhances financial inclusion. The coefficients are significant across dimensions: 5.342 ($p < 0.01$) for affordability, 11.548 ($p < 0.01$) for availability, 14.271 ($p < 0.01$) for accessibility, and 10.745 ($p < 0.01$) for penetration. These findings underscore the significance of urbanization in improving infrastructure and diversifying financial products (Liu et. al., 2021b).

Gender equality (GEqual) substantially improves financial inclusion, with an aggregate coefficient of 0.208 ($p < 0.01$). It significantly affects affordability (0.156, $p < 0.01$), availability (0.285, $p < 0.01$), accessibility (0.246, p-value less than 0.01), and penetration (0.143) with p-value less than 1%. These findings emphasize the necessity of tackling gender-based obstacles to enhance women's access to financial services (Le Quoc, 2024).

Trade openness demonstrates no statistically significant effect on financial inclusion, with an aggregate coefficient of -0.009 ($p > 0.1$). The coefficients for affordability (0.008), availability (0.016), accessibility (-0.022), and penetration (-0.038) are insignificant, indicating that the impact of trade on financial inclusion may rely on supplementary institutional and regulatory elements.

Lagged financial inclusion exhibits significant negative correlation, with a beta of -0.175 and p-value less than 1%. Factors including affordability, availability, accessibility and penetration with -0.048, -0.236, -0.27 and -0.145 betas and significance at 1% demonstrates diminishing impacts. This path dependency underscores the difficulties of maintaining financial inclusion over time without

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

ongoing innovation and regulatory assistance (Demirgüç-Kunt, et. al., 2018).
The model accounts for 20.2% of the variance in overall financial inclusion, with R-squared values of 19% for affordability, 13.9% for availability, 15.9% for accessibility, and 17.1% for penetration. The results demonstrate that although control variables together affect financial inclusion, their influence differs along its dimensions.

Table 6: Robustness Check of Regression Model

	(1) finclusion	(2) affordability	(3) availib	(4) accessib	(5) penetrat
Nic	.081***	.155***	.331***	.295***	.074***
	(.018)	(.027)	(.036)	(.039)	(.026)
Hcap	.111***	.294**	.513**	.178***	.184**
	(.011)	(.124)	(.251)	(.049)	(.074)
Scap	.146***	.088*	.188**	.188***	.118***
	(.046)	(.052)	(.073)	(.063)	(.037)
Rcap	.079***	.158***	.21***	.173***	.108***
	(.019)	(.02)	(.031)	(.028)	(.024)
Lgdp	.022**	.022**	.017	.022	.028***
	(.009)	(.01)	(.012)	(.014)	(.009)
Linf	-.015**	-.024***	.001	-.011	-.027***
	(.008)	(.007)	(.011)	(.013)	(.008)
Lgini	-.011	-.013	0	-.009	-.024*
	(.011)	(.013)	(.017)	(.018)	(.013)
Ldcps	.012	.015	-.001	.016	.018
	(.013)	(.015)	(.02)	(.02)	(.016)
Lpopd	.027***	.028**	.099**	.043**	.058**
	(.01)	(.012)	(.047)	(.017)	(.027)
Luopo	10.476***	5.342***	11.548***	14.271***	10.745***
	(.992)	(.749)	(1.187)	(1.504)	(1.114)
GEqual	.208***	.156***	.285***	.246***	.143***
	(.047)	(.042)	(.061)	(.081)	(.047)
Lto	-.009	.008	.016	-.022	-.038
	(.051)	(.042)	(.064)	(.074)	(.047)
L.finclusion	-.175***	-.048***	-.236***	-.27***	-.145***
	(.023)	(.014)	(.028)	(.036)	(.025)
_cons	-18.41***	-9.488***	-20.273***	-25.04***	-18.839***
	(1.731)	(1.313)	(2.082)	(2.605)	(1.944)
Observations	3481	3481	3481	3481	3481
R-squared	.202	.19	.139	.159	.171

Robust standard errors are in parentheses

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 1 (January) (2025)

*** p<.01, ** p<.05, * p<.1

Conclusion

This research aims to examine the influence of National Intellectual Capital (NIC), which encompasses human, structural and relational capital, on financial inclusion. This study delineates principal factors affecting various aspects of financial inclusion (i.e. affordability, availability, accessibility, and penetration) while emphasizing the transformative impact of National Intellectual Capital (NIC). For this purpose, the study utilized 3SLS technique to construct new indexes of National Intellectual Capital and Financial Inclusion.

The results indicate that National Intellectual Capital (NIC) which consists of human, structural and relational capital, significantly enhances financial inclusion especially regarding the availability and accessibility perspectives of financial inclusion. These results aligns with the Knowledge Economy Theory which posits that intangible assets like knowledge, creativity and human expertise are essential drivers for social and economic transformation. NIC integrates human capital (skills and knowledge), structural capital (processes and systems) and relational capital (networks and relationships) to help make financial services more accessible, usable and affordable. The control factors including GDP constantly shows a positive and strong connection with financial inclusion, indicating that increased national revenue improves financial infrastructure and accessibility. Conversely, inflation negatively impacts affordability and market penetration underscoring its detrimental effect on purchasing power and involvement in financial systems. Gender income inequality shows minimal statistical significance but negatively affects penetration suggesting that income disparities obstruct equitable financial access. Similarly, domestic credit to the private sector does not significantly influence financial inclusion highlighting the necessity for targeted credit strategies to reach marginalized communities. Population density and urbanization increase availability and accessibility thereby rendering metropolitan regions crucial to financial inclusion. Gender equality has a considerable positive impact on all aspects, highlighting the importance of closing gender gaps for inclusive financial systems. While trade openness boosts economic growth it does not affect financial inclusion thus requiring complementary policies and institutions for equitable financial access.

Implications, Recommendations and Future Research Direction

The research overcomes shortcomings in prior studies, which are sometimes restricted in scope and generalizability, by creating a complete NIC index and utilizing modern approaches like 3SLS. The study highlights NIC's ability to promote sustainable development and evidence-based policies, underscoring its crucial role in expanding financial inclusion, especially in emerging nations.

This necessitates comprehensive research into NIC's contribution to financial inclusion, integrating Knowledge Economy Theory. Policymakers must prioritize gender equality, urbanization, and inflation control while fortifying NIC to improve

ISSN Online: 3007-3154
ISSN Print: 3007-3146

Vol. 3 No. 1 (January) (2025)

financial accessibility. Regulators are urged to establish supportive frameworks designed to assist marginalized communities through customized credit mechanisms and comprehensive monitoring systems. Collaborative efforts among these entities can promote equitable economic advancement by cultivating inclusive financial networks.

In order to acquire more comprehensive insights, future research could expand the scope by analyzing the specific contributions of digital technologies, as well as structural and relational capital. Furthermore, undertaking longitudinal studies and examining cultural elements will enhance understanding of the dynamic influence of National Intellectual Capital (NIC) and the geographical regions in which it varies.

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