

Human Capital Efficiency and Firm-Level Labour Productivity: Panel Evidence from Publicly Listed Firms in East Africa

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Abstract

Human capital is widely theorized as the foundation of firm-level productivity, yet evidence on how efficiently East African firms convert human capital investment into labour productivity remains scarce. This study examines the effect of human capital efficiency on labour productivity among publicly listed firms in Kenya, Uganda, Tanzania, and Rwanda, drawing on an 11-year panel of audited financial statements (2013–2023). Human capital efficiency was measured using the Modified Value-Added Intellectual Coefficient Model (MVAIC™), while labour productivity was derived from a value-added Cobb–Douglas production function within a Total Factor Productivity approach. Fixed-effects estimation, validated by a Hausman specification test, shows that human capital efficiency is positively and significantly associated with labour productivity ($\beta = 0.028$, $p < .001$), the largest coefficient among the intellectual capital components examined. The result is consistent with Human Capital Theory and the knowledge-based view of the firm in an emerging-market setting, suggesting that workforce capabilities operate as a comparatively immediate lever of productivity where innovation ecosystems remain nascent. The findings support continued investment in training, skills development, and knowledge management, and contribute firm-level evidence to a thin intellectual capital literature on Africa. The paper's design limits, discussed in limitation section, mean the results are best read as a within-firm association rather than a fully identified causal effect.

Keywords: Human Capital Efficiency; Labour Productivity; Intellectual Capital; MVAIC; Total Factor Productivity; East Africa; Listed Firms

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Introduction

Productivity has long been acknowledged as a central driver of economic development, shaping a nation's long-term growth trajectory and the well-being of its population. The centrality of productivity to growth was formally established in Solow's (1956) neoclassical growth model, in which Total Factor Productivity (TFP) accounted for residual growth beyond capital and labour inputs, and was later extended by endogenous growth theorists who introduced human capital and innovation as intrinsic drivers of productivity (Lucas, 1988; Romer, 1990). Of particular interest is labour productivity, which reflects the efficiency with which labour inputs are converted into economic output (Kuchina & Maistro, 2022). In a globalized and competitive economic environment, improvements in labour productivity are indispensable for firms seeking to enhance profitability, reduce costs, and expand market share (Sarwar et al., 2021), while at the aggregate level higher labour productivity supports increased wages, better working conditions, and a stronger fiscal base for public investment (Heshmati & Rashidghalam, 2016).

Labour productivity in East African economies has nonetheless remained persistently low, undermining firm-level competitiveness and slowing structural economic transformation. Data from the African Center for Economic Transformation show that East African countries have ranked among the weakest performers in Africa on labour productivity metrics for more than three decades (ACET, 2024). Purchasing power parity-adjusted GDP per hour worked stands at approximately USD 4.75 in Kenya, USD 3.53 in Uganda, USD 3.70 in Tanzania, and USD 3.45 in Rwanda, figures significantly below those recorded in emerging economies in Southeast Asia and Latin America (World Bank, 2023). Structural factors contribute to this underperformance, including pervasive informality (informal employment accounts for approximately 84–88% of employment in Uganda, 76% in Tanzania, and more than 90% in Rwanda; ILOSTAT, 2023) and continued dependence on low-productivity agricultural employment.

Structural headwinds are not the only candidate explanation, since firm value has increasingly come to rest on intangible rather than physical assets (Corrado et al., 2009), and among these, human capital, the knowledge, skills,

competencies, and experience embedded in a firm's workforce, is widely treated as the most consequential (Becker, 1964; Schultz, 1961). Much of the existing literature, however, addresses the existence, disclosure, or accumulation of human capital rather than the efficiency with which it is converted into output. The distinction has practical stakes rather than being a matter of definition alone. A firm can hold an adequate stock of skilled labour and still under-perform if that labour is poorly matched to tasks, weakly incentivized, or organizationally underutilized, in which case policy responses aimed at expanding human capital (more schooling, more hiring) would misdiagnose the constraint, whereas responses aimed at its deployment (training, task design, management practice) would not. It remains unclear, for East African firms specifically, whether the productivity shortfall documented above reflects an inadequate stock of human capital or inefficiency in how existing human capital is used. Empirical investigation of labour productivity's determinants remains heavily concentrated in high-income countries (Crass & Peters, 2014), with limited firm-level evidence from East Africa (Gatuyu, 2019).

The present study addresses these gaps by evaluating the effect of human capital efficiency (HCE) on labour productivity among publicly listed firms in four East African Community economies (Kenya, Uganda, Tanzania, and Rwanda) over the period 2013–2023. It makes three contributions. First, it provides rare longitudinal, firm-level evidence on the human capital–productivity relationship in a region where such evidence is scarce, using an 11-year panel of audited financial data. Second, it moves beyond stock-based conceptions of human capital by employing an efficiency measure derived from the Modified Value-Added Intellectual Coefficient

Model (MVAIC™), capturing how well firms convert human capital investment into value added (Nimtrakoon, 2015; Pulic, 1998), a measurement choice whose own limitations are examined directly in human capital efficiency and the MVAIC framework section rather than assumed away. Third, by embedding the analysis in a two-step Cobb–Douglas/TFP framework (Crass & Peters, 2014), the study isolates labour-specific productivity rather than relying on generalized accounting indicators of performance.

Literature Review

Theoretical Framework

The study is anchored in Human Capital Theory, complemented by the resource-based view, the knowledge-based view, and efficiency-wage theories of worker behaviour. Together these perspectives explain why productivity gains accrue not to firms that merely invest more in their workforce, but to those that convert that investment into value added more efficiently.

Human Capital Theory posits that the knowledge, competencies, and capabilities of workers are fundamental determinants of productivity, and that expenditures on education, training, and health constitute investments that yield future economic returns rather than current consumption (Becker, 1964; Mincer, 1974; Schultz, 1961). Within the firm, human capital is conceptualized as a productive input capable of yielding value through labour, skills, knowledge, and competencies, driving productivity, adaptability, and innovation across sectors (Heckman & Mosso, 2014; Kwon, 2009).

On the other hand, the Resource-Based View (RBV) extends this logic by arguing that sustained competitive advantage derives from resources that

are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Human capital satisfies these conditions because it is firm-specific, path-dependent, and socially complex, making it difficult for rivals to replicate (Bontis, 1998).

The Knowledge-Based View (KBV) sharpens the argument further, positing that knowledge is the most strategically significant resource of the firm and that firms exist to integrate the specialized knowledge held by individuals into productive activity (Grant, 1996). A central tenet of Grant's framework is that competitive advantage depends on integration mechanisms such as routines, coordination systems, incentive structures, and management practices that synthesize dispersed individual knowledge into collective output. The present study does not measure these integration mechanisms directly (for example, through indices of knowledge-management systems, organizational-structure quality, or cross-functional coordination), and we acknowledge that the link between KBV and the MVAIC™ ratio is therefore more attenuated than a direct test of knowledge integration would be. What the MVAIC ratio captures is the efficiency outcome of integration: when knowledge is well-coordinated, value added per unit of human-capital investment rises. In this sense, the ratio functions as an accounting-based proxy for the productivity of knowledge-integration processes, reflecting the net result of routines and coordination rather than the mechanisms themselves. This limitation should be borne in mind when interpreting the HCE coefficient reported below; a significant positive coefficient is consistent with KBV predictions, but it cannot definitively isolate superior integration mechanisms as the causal channel.

A further theoretical bridge between personnel expenditure and workforce productivity is provided by

efficiency-wage and gift-exchange theories. Akerlof (1982) models the employment relationship as a partial gift exchange in which workers reciprocate fair or above-market wages with above-minimum effort, while Yellen (1984) surveys mechanisms through which higher wages can reduce turnover, curb absenteeism, limit shirking, and attract higher-ability applicants. These models imply that the productivity payoff of personnel expenditure is mediated by worker behaviour such as attendance, retention, and discretionary effort rather than determined by expenditure alone. Extending this logic, employee-engagement research posits that psychological investment in work roles amplifies the conversion of human-capital stock into productive behaviour (Kahn, 1990).

Taken together, these perspectives suggest that the gap between what firms spend on labour and what they receive in productivity is shaped by relational and motivational factors that a pure stock measure of human capital would miss, but that an efficiency measure value added relative to personnel cost may partially capture. When compensation and working conditions elicit high engagement and low turnover, the same human-capital stock generates more value added, raising the efficiency ratio. Human capital efficiency, the construct at the centre of this study, synthesizes the above theoretical streams. Bontis and Fitz-enz (2002) characterise human capital as the intelligence, talent, and experience employees bring to an organisation, and argue that its value lies not in its existence but in how effectively it is mobilised toward organisational outcomes. Pulic (2000) operationalises this insight by conceptualising intellectual capital efficiency as the ratio of value added to the resources invested in generating it, a formulation that treats

efficiency, rather than the level of human capital investment, as the object of measurement. Taken together, Human Capital Theory, the RBV, the KBV, and efficiency-wage theory predict that productivity gains accrue not simply to firms that invest more in their workforce, but to those that convert that investment into value added more efficiently. That relationship is tested empirically below. It should be noted that Pulic's efficiency-ratio approach, though widely used, has also attracted sustained methodological scrutiny over how its component ratios are constructed from a shared value-added base (Ståhle et al., 2011), this critique bears directly on how the HCE coefficient reported in results section should be interpreted, and is addressed in human capital efficiency and the MVAIC framework section.

Human Capital and Human Capital Efficiency in Sub-Saharan Africa

The theoretical case for human capital efficiency is well established internationally, but the East African operating environment carries structural features that condition how readily human capital investment converts into productive deployment. The World Economic Forum's Global Human Capital Index placed Sub-Saharan Africa as the lowest-scoring world region, with an average human capital utilisation score in the low fifties out of a possible 100 (World Economic Forum, 2017), reflecting persistent deficits in educational attainment, healthcare access, and labour-market functioning. A substantial empirical literature links human capital accumulation to economic growth in the region: Gyimah-Brempong and Wilson (2004) find that both education and health human capital raise growth across Sub-Saharan African and OECD countries, a result corroborated by Ogundari and Awokuse (2018) and, in the specific context of higher education, by

Gyimah-Brempong et al. (2006). A related strand examines whether human capital translates into growth that is broadly shared rather than concentrated: Oyinlola and Adededeji (2019, 2020) show that human capital interacts with financial-sector development and capital flows to shape inclusive growth outcomes in Sub-Saharan Africa, while Raheem et al. (2018) find that the growth dividends of human capital development are conditioned by natural-resource dependence and institutional quality.

Two implications follow for the present study. First, this literature establishes that human capital matters for growth in Sub-Saharan Africa at the macroeconomic level, but it is framed almost entirely around the accumulation of human capital rather than the efficiency with which existing human capital is deployed within firms. Second, where growth effects are found to be contingent on institutional quality, financial development, or resource dependence, this points toward exactly the kind of structural friction (underinvestment in training, skills mismatches, and reliance on informal labour markets) that would be expected to depress human capital efficiency at the firm level even where the underlying stock of human capital is adequate. The distinction between the stock and the efficiency of human capital, largely unaddressed at firm level in the East African literature, motivates the efficiency-based measurement strategy adopted in methodology section.

Empirical Literature

A substantial international literature links human capital to productivity. Abdelgany and Saleih (2022), using a dynamic GMM estimator on panel data from 39 developing countries over 2000–2019, found that education positively and significantly affects labour productivity, with

education exerting a stronger influence than health. Gul et al. (2022), employing GMM techniques in Pakistan, reported that employee education, training, wages, and working hours are positively associated with labour productivity, with a one percent increase in training investment raising productivity by approximately 0.10 percent. Ismael (2009), analysing 574 Malaysian manufacturing and services enterprises, showed that effective labour deployment plays a significant role in output and labour productivity growth. Studies of emerging markets similarly identify human capital as a key determinant of productivity (Nadeem et al., 2017; Sarwar et al., 2021).

Applications of the MVAIC framework in other emerging markets help contextualise what might be expected in East Africa. In South Asia, MVAIC has been shown to significantly and positively determine firm performance in Bangladeshi listed banks, with human capital efficiency emerging as the dominant value-creation component (Chowdhury et al., 2023). In a cross-country study of Pakistani and Indian non-financial firms, HCE, structural capital efficiency, and capital employed efficiency all exerted significant positive effects on financial performance, underscoring that the MVAIC model travels well outside the financial sector (Abdelgany & Saleih, 2022). In ASEAN markets, ESG performance has been found to positively affect MVAIC-measured intellectual capital efficiency in Indonesia, Malaysia, Thailand, and the Philippines, with banks showing stronger effects than non-banks (Kasibi et al., 2023). Comparative work in the BRICS-adjacent textile industries of China and South Korea reveals that MVAIC is positively associated with earnings, profitability, and productivity, although the relative contribution of HCE varies by country and sectoral context (Kim & Lee,

2019). Across Sub-Saharan Africa more broadly, intellectual capital has been shown to exert a significant positive effect on the economic value added and return on assets of listed non-financial firms spanning eight countries (Chinanu & Akintoye, 2024), while Nigerian manufacturing firms exhibit positive and significant associations between human capital efficiency and financial stability (Okafor & Adeyemi, 2025). These emerging-market findings suggest that the human-capital-efficiency-productivity nexus is not unique to advanced economies, but that the magnitude and even the sign of the relationship can shift with institutional context, sector, and the performance proxy employed.

Within East Africa, the evidence is thinner and more mixed. In Kenya, Heshmati and Rashidghalam (2016) found that education and training had significant positive effects on productivity in both manufacturing and services, while Lukalo and Kiminyei (2018) identified education, capital intensity, and technology adoption as key productivity determinants. In Tanzania, Islam et al. (2015) showed that real wages significantly influenced manufacturing productivity, whereas Sansa (2020) found overall labour productivity statistically insignificant despite industrial growth, suggesting a mismatch between labour inputs and output efficiency. Evidence on human capital efficiency specifically is scarcer still, and notably less consistent in sign than the broader human capital literature above. Kasoga (2020) reported that HCE had a negative effect on firm performance in Tanzania, potentially reflecting inadequate investment in workforce skills while Nyambo and Nyamsogoro (2024) reported a positive relationship between HCE and the financial performance of Tanzanian insurers, and Omete (2016) observed high variability in HCE's influence across Kenyan commercial banks. That

inconsistency may say as much about measurement as about the underlying relationship. Because most of these studies proxy firm performance with profitability or financial sustainability rather than labour productivity, the mixed sign may reflect differences in what is being measured (an accounting outcome shaped by pricing, competition, and capital structure) as much as genuine variation in the underlying human capital effect, which is one reason the present study anchors its dependent variable in a production-function-based measure of labour productivity rather than an accounting ratio.

In Kenya, Keter et al. (2024), examining 39 NSE-listed firms across all sectors over 2010–2022, found that intellectual capital disclosure mediates the relationship between financial performance and firm value, suggesting that transparency about intangible assets is itself value-relevant in thin emerging capital markets. Kariuki (2024), in Kenyan banking, found that HCE positively contributed to bank stability, though with evidence of diminishing returns at higher levels. Sheikh and Wepukhulu (2019) found HCE to be the weakest intellectual capital component for the financial sustainability of Kenyan SACCOs. Similarly, Bangara et al. (2024), comparing Kenya and South Africa, reported that intellectual capital disclosure has a statistically significant effect on firm value in both markets, though the direction differs negative in Kenya and positive in South Africa highlighting how integrated-reporting maturity shapes the IC–value link. Muthoti et al. (2024) similarly documented a significant relationship between human capital disclosure and firm value among NSE-listed companies.

Three limitations of this literature motivate the present study. First, most East African studies are sector-specific (banking, insurance, SACCOs) or cross-

sectional, providing limited insight into economy-wide, long-run productivity dynamics. Second, performance is typically proxied by accounting profitability rather than labour productivity, obscuring the mechanism through which human capital operates. Third, existing studies rarely distinguish the stock of human capital from the efficiency of its deployment. The present study addresses these gaps using a multi-country, multi-sector panel, a labour-specific TFP outcome, and an efficiency-based measure of human capital.

Hypothesis Development

Human Capital Theory, the RBV, and the KBV jointly predict that firms which convert human capital investment into value added more efficiently will achieve superior labour productivity. The international empirical evidence broadly supports this prediction, although East African evidence is mixed and fragmentary, particularly where the outcome studied is profitability rather than productivity. Consistent with the conventional null-hypothesis testing framework, the study tested the following hypothesis:

H₀₁: *Human capital efficiency has no significant effect on labour productivity among publicly listed firms in East Africa.*

Methodology

The study adopts a quantitative, longitudinal correlational design grounded in the positivist paradigm, examining objectively measurable firm-level indicators with panel econometric techniques (Creswell & Creswell, 2018). The target population comprised the 120 companies listed on the securities exchanges of Kenya, Uganda, Tanzania, and Rwanda, selected for their advanced economic integration, relative political stability, and mandated publication of audited financial statements (Duho,

2022). Only firms continuously listed over 2013–2023 were retained, with cross-listed firms assigned to their headquarters country, producing a balanced panel of 29 firms observed over 11 years (318 firm-year observations). Secondary data extracted from integrated annual financial statements were harmonised for currency, accounting periods, and industry classification, cleaned for inconsistencies, outliers, and missing values, expressed in natural logarithms where continuous, and structured in long format for estimation in Stata. Labour productivity was measured through labour-specific Total Factor Productivity recovered as the residual of a value-added Cobb–Douglas production function (Solow, 1957; Syverson, 2011; Crass & Peters, 2014; Dettori et al., 2012), where value added was proxied by turnover, labour by employee count (excluding R&D staff), and capital by net fixed assets, with value-added TFP preferred to gross-output TFP (Akerberg et al., 2015; Basu & Fernald, 1997). Intellectual capital efficiency was measured using the Modified Value-Added Intellectual Coefficient (MVAIC™), extending Pulic (1998) to capture human, innovative, brand, organisational, and capital-employed components (Nimtrakoon, 2015; Stähle et al., 2011; Pulic, 2000; Odat & Bsoul, 2022). Modified value added was computed as $VA_m = OP + D + A + EC + ME + R\&D + OI$, and human capital efficiency as $HCE_m = VA_m/HC$, where HC comprises wages, training, professional development, and employee welfare (Jardon & Martinez-Cobas, 2021; Kwon, 2009; Bontis & Fitz-enz, 2002). Companion efficiencies for innovation, brand, organisational, and capital-employed capital were included so that the HCE effect is net of other intellectual capital components. The model controlled for firm size, proxied by the natural logarithm of total assets (Lucas,

1978; Melitz, 2003; Syverson, 2011), and leverage, proxied by total liabilities to total assets (Avarmaa et al., 2013; Myers, 1977; Nucci et al., 2005).

The second-stage model regressed labour-specific TFP on human capital efficiency and controls: $TFP_{it} = \beta_0 + \beta_1 LEV_{it} + \beta_2 SIZE_{it} + \beta_3 HCE_{it} + \mu_i + \varepsilon_{it}$. Both random-effects and fixed-effects estimators were fitted; fixed effects were preferred a priori because unobserved, time-invariant firm characteristics are plausibly correlated with intellectual capital efficiency, confirmed by a Hausman (1978) specification test. Diagnostics included Fisher-type ADF panel unit-root tests, Shapiro–Wilk and skewness–kurtosis normality tests, variance inflation factors, the Breusch–Pagan/Cook–Weisberg heteroskedasticity test, and the Ramsey RESET specification test. Stähle et al. (2011) note that VAIC™-type ratios are built from components of a common value-added base, so sub-indices can be mechanically related; because employee costs enter the numerator of modified value added while personnel expenditure forms the denominator of HCE, part of any correlation could be definitional. Two features limit this concern: the dependent variable is labour-specific TFP rather than value added itself, breaking the direct algebraic link, and HCE is estimated jointly with the four companion efficiency ratios rather than alone. Firm fixed effects absorb only time-invariant heterogeneity and do not rule out time-varying reverse influence, for example if more productive firms increase training and welfare spending for reasons outside the model. That qualification bears on how strongly a causal interpretation should be drawn, a point developed further in the conclusions.

Results

Descriptive Statistics

Table 1 presents descriptive statistics. Labour productivity has a mean of 7.427 (SD = 1.524) with values ranging from 3.570 to 10.792, reflecting substantial heterogeneity in firm-level efficiency consistent with differences in managerial practices, resource

endowments, and strategic positioning. Human capital efficiency averages 5.711 (SD = 1.021), indicating moderate variability and meaningful cross-firm differences in the efficiency of human capital deployment. Leverage displays wide dispersion (M = 0.588, SD = 0.643, maximum 7.156), pointing to a subset of highly leveraged firms, while firm size is comparatively homogeneous (M = 6.926, SD = 0.831).

Table 1. Descriptive statistics (N = 318 firm-year observations)

Variable	Obs	Mean	SD	Min	Max
Labour Productivity	318	7.427	1.524	3.570	10.792
Firm Leverage	318	0.588	0.643	0.046	7.156
Firm Size	318	6.926	0.831	4.701	8.707
Human Capital Efficiency	318	5.711	1.021	2.922	8.447

Note. Continuous variables are expressed in natural logarithms. Source: Authors' computations from audited financial statements (2013–2023).

Cross-country comparison (Table 2) reveals that Ugandan firms record the strongest labour productivity (M = 8.609) and the highest human capital efficiency (M = 6.166), followed by Kenya (labour productivity M = 7.698; human capital efficiency M = 5.441), while Tanzania (M = 5.975) and Rwanda (M = 5.251) lag on labour productivity. The co-movement of

human capital efficiency and labour productivity across countries is consistent with, though it does not on its own establish, the hypothesized relationship examined below; intercountry differences in leverage likewise point to the heterogeneity of resource configurations in the region.

Table 2. Descriptive statistics by country (means)

Variable	Kenya	Rwanda	Tanzania	Uganda
Labour Productivity	7.698	5.251	5.975	8.609
Human Capital Efficiency	5.441	5.473	5.674	6.166
Firm Leverage	0.497	0.704	0.580	0.546
Firm Size	6.893	6.981	7.009	6.907

Note. Country-level means over 2013–2023. Source: Authors' computations from audited financial statements.

Diagnostic Tests

Fisher-type ADF panel unit-root tests rejected the null of a unit root for all variables at the 1% level (for human capital efficiency, inverse $\chi^2(58) = 89.668$, $p = .005$; for labour productivity, inverse $\chi^2(58) = 228.347$, $p < .001$), confirming stationarity in levels. Variance inflation

factors were low (HCE VIF = 1.111; mean VIF = 1.524), ruling out damaging multicollinearity. Shapiro–Wilk tests failed to reject normality for labour productivity ($W = 0.980$, $p = .634$) and human capital efficiency ($W = 0.994$, $p = .241$), and joint skewness–kurtosis tests were likewise non-significant. The

Breusch–Pagan/Cook–Weisberg test found no heteroskedasticity ($\chi^2(1) = 2.92$, $p = .088$), and the Ramsey RESET test detected no omitted-variable or functional-form misspecification ($F(3, 308) = 1.99$, $p = .115$).

Correlation Analysis

Pairwise Pearson correlations (Table 3) show that labour productivity is most strongly associated with human capital efficiency ($r = .692$), followed by firm size ($r = .661$). The association with firm leverage is negative ($r = -.156$),

consistent with the constraining effect of debt burdens on capability-enhancing investment. Such bivariate patterns anticipate the regression results and are consistent with resource-based and knowledge-based expectations that productivity tracks employee capabilities, though correlation of this kind cannot itself distinguish that reading from reverse influence or omitted-variable confounding, which the fixed-effects specification below addresses only partially.

Table 3. Pairwise correlations

Variable	(1)	(2)	(3)	(4)
(1) Labour Productivity	1.000			
(2) Firm Leverage	−0.156	1.000		
(3) Firm Size	0.661	−0.200	1.000	
(4) Human Capital Efficiency	0.692	−0.104	0.472	1.000

Note. $p < .05$.

Model Selection and Regression Results

The Hausman specification test decisively rejected the null hypothesis that coefficient differences between the random- and fixed-effects estimators are non-systematic ($\chi^2(6) = 145.11$, $p < .001$), indicating correlation between the regressors and unobserved firm-specific effects and confirming the fixed-effects

model as the consistent estimator. The fixed-effects results are reported in Table 4. The model is highly significant ($F(6, 283) = 80.91$, $p < .001$), with a within-firm R^2 of 0.632, indicating that approximately 63% of within-firm variation in labour productivity is explained by the included regressors.

Table 4. Fixed-effects regression of labour productivity on intellectual capital efficiency components

Variable	Coef.	SE	t	p	95% CI
Firm Leverage	−0.021	0.014	−1.53	.126	[−0.048, 0.006]
Firm Size	0.080	0.002	5.09	<.001	[0.005, 0.011]
Human Capital Efficiency	0.028	0.003	11.12	<.001	[0.023, 0.033]
Labour Productivity	0.586	0.014	42.29	<.001	[0.559, 0.613]

Note. $N = 318$; groups = 29; R^2 within = 0.632, between = 0.824, overall = 0.808; $F(6, 283) = 80.91$, $p < .001$. Dependent variable: labour-specific total factor productivity. Source: Authors' estimations.

Human capital efficiency is associated with a strong, positive, and statistically significant increase in labour productivity ($\beta = 0.028$, $t = 11.12$, $p < .001$), the largest and most precisely

estimated coefficient among the intellectual capital components examined, subject to the causal-interpretation caveat set out in model specification and estimation

methodology section. The null hypothesis H_{01} is therefore rejected. Firm size is positive and significant, consistent with economies of scale, while leverage is negative but statistically insignificant once unobserved firm heterogeneity is controlled.

Discussion

The central finding, that human capital efficiency is positively associated with labour productivity within East African listed firms, points to the importance of employee skills, competencies, experience, and knowledge in driving productive performance. The magnitude and precision of the coefficient indicate that even marginal improvements in the efficiency of human capital deployment are associated with substantial differences in productivity. The result is consistent with Human Capital Theory's core proposition that workforce knowledge and capabilities are fundamental determinants of productivity (Becker, 1964; Schultz, 1961), and with the RBV and KBV, which position human capital as a strategic, rare, and difficult-to-imitate resource (Barney, 1991; Grant, 1996).

The finding also accords with a growing body of African and emerging-market evidence. Odhon'g and Omolo (2015) demonstrated that human capital significantly enhances productivity in African firms by improving workers' adaptability, creativity, and problem-solving abilities, while Ndiege and Muriithi (2021) identified human capital development as a key driver of firm performance in East Africa, particularly in knowledge-intensive sectors. Owusu and Oppong (2022) showed that training and continuous professional development significantly improve labour productivity in West African service firms, and Kingori (2025) reported that human capital

investments in Kenyan firms are positively associated with both productivity and innovation intensity. Internationally, the result echoes Abdelgany and Saleih (2022) and Gul et al. (2022), who document significant productivity returns to education and training in developing economies, studies that, notably, used dynamic GMM estimators precisely to address the endogeneity concern flagged for the present design in model specification and estimation methodology section.

At the same time, the East African context conditions the interpretation. Where technological adoption and innovation ecosystems remain uneven, as reflected in the insignificant coefficient on innovation capital efficiency in the same model, human capital appears to be the most immediate instrument for productivity enhancement among the intellectual capital components examined here, plausibly compensating for structural deficiencies by enabling firms to adapt production processes with the skills already available to them. The contrast with Kasoga's (2020) negative HCE finding for Tanzanian firms, and with Sheikh and Wepukhulu's (2019) weak HCE effect in SACCOs, suggests that the returns to human capital efficiency may be contingent on complementary organizational conditions; Dube and Ndlovu (2021) likewise report that returns to human capital are muted in poorly governed firms where skills are underutilized. The multi-country, multi-sector panel employed here, which nets out time-invariant firm heterogeneity, indicates that on average across East African listed firms the human capital efficiency association is positive. That average association should not be read as ruling out reverse influence: firms that are already more productive for other reasons may also be better placed to fund training and employee welfare,

which would bias the coefficient upward to the extent it is not absorbed by firm fixed effects, the same limitation noted in model specification and estimation methodology section and revisited in the next section.

Conclusions

The study evaluated the effect of human capital efficiency on labour productivity among publicly listed firms in Kenya, Uganda, Tanzania, and Rwanda over 2013–2023, using an MVAIC™-based efficiency measure and a labour-specific TFP outcome estimated within a fixed-effects panel framework. The results are consistent with human capital efficiency being an influential component of intellectual capital for labour productivity in the region: efficient deployment of human capital through training, skills development, knowledge accumulation, and effective utilization of employee capabilities is associated with materially higher productivity, net of firm size, leverage, and time-invariant firm characteristics.

Theoretically, the study extends Human Capital Theory and the knowledge-based view into an under-researched emerging-market setting, showing that their predictions hold within firms over time even in economies characterized by informality and institutional variability.

Implications

Managerially, the findings imply that firms have reason to treat workforce development (strategic talent deployment, continuous training, and knowledge management) as a plausible pathway to productivity improvement, and to treat personnel expenditure as a productive investment rather than a purely discretionary cost, while recognizing that the present design cannot fully rule out that more

productive firms simply spend more on their workforce as a consequence rather than a cause of that productivity. For policymakers, the results are consistent with a case for incentivizing firm-level training, strengthening technical and higher-education linkages with industry, and improving disclosure requirements around intangible investments so that human capital formation is more visible to investors and regulators.

Limitations

The study has limitations that frame an agenda for future research. First, the analysis is confined to listed firms, which are larger and more formalized than the typical East African enterprise, so generalization to the informal sector should be made cautiously. Second, the cost-based personnel-expenditure proxy for human capital, while practical and consistently available from audited statements across the sample, does not capture qualitative dimensions of human capital such as motivation, creativity, or leadership. Third, as discussed in human capital efficiency and the MVAIC framework section, the MVAIC efficiency ratios share components of a common value-added base, a construction that has drawn sustained methodological criticism (Stähle et al., 2011); although the use of a production-function-based TFP outcome and the joint estimation of companion efficiency ratios limit this concern, they do not eliminate it, and the HCE coefficient is best read as an effect net of, rather than fully independent from, its own accounting construction. Fourth, fixed effects absorb time-invariant heterogeneity but not time-varying reverse causality: firms that become more productive for reasons outside the model may respond by increasing training and welfare spending, which would bias the HCE coefficient upward.

Future Studies

Future research could extend the analysis to unlisted and informal firms, incorporate survey-based measures of workforce quality, examine sectoral heterogeneity in the returns to human capital efficiency, and apply dynamic panel GMM or instrumental-variable methods, following the identification strategy used by Abdelgany and Saleih (2022) and Gul et al. (2022) in comparable settings, to better separate the causal effect of human capital efficiency from reverse influence and shared value-added construction.

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