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Innovation capability and firm competitiveness in Ethiopian industrial parks: The moderating role of human capital

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ABSTRACT

This research examines the innovation capability and firm competitiveness in Ethiopian industrial parks. Extant empirical literature has demonstrated the crucial role of innovation capability for competitiveness. However, only a few studies have examined the interplay between human capital and innovation capacity in terms of the competitive performance of firms. To this end, this study examines how innovation capability in Ethiopian industrial parks affects firm competitiveness by considering the moderating role of human capital. By adopting a quantitative approach, cross-sectional survey data was collected from 81 active manufacturing firms by targeting firm managers. Partial least squares structural equation modeling (PLS-SEM) using SmartPLS 4 was employed to analyze the data and test the study hypotheses. The results reveal that human capital does not moderate the relationship between innovation capability and firm competitiveness but rather partially mediates it. The findings highlighted that the development of firm human capital quality—creativity and innovative skills—is essential for enhanced firm innovation capacity and competitiveness. Therefore, firms aspiring to develop their competitiveness—operational capability, dynamic capability, and market performance—need to focus not only on developing innovation capacity but also on developing their human capital competencies for innovation. The study helps organizations develop effective innovation capacity development strategies to ensure greater firm competitiveness.

Contribution/ Originality: The role of human capital in the development of firm innovation capacity and competitiveness, particularly in the contexts of developing countries, has attracted few empirical investigations. Therefore, this study provides rich understanding and vital insights for practice for manufacturing firms in developing innovation capacity to enhance competitiveness.

1. INTRODUCTION

Globalization fosters increased competition, with countries, regions, and firms engaging in virtually all human endeavors to achieve economic growth and competitiveness. Competitiveness stimulates economic growth by enhancing firm productivity, innovation, research and development (R&D), and product quality [1]. Innovation has become an engine of economic development in a highly competitive global economy [2, 3]. A nation's capacity for innovation, including its technological prowess and human capital, influences its ability to grow economically [4, 5]. Innovation has been a fundamental basis of competitiveness as it triggers new or much improved ideas, methods, structures, and products, which are potent drivers of organizational vibrancy and economic growth [6].

The emergence of a 'knowledge society,' where the creation and commercialization of new knowledge underpins both national and firm-level success, was facilitated by innovation [7].

Building innovation capabilities and human capital is, however, no longer a luxury, even for the poorest countries of the world, as the very basic socioeconomic problems like poverty, food insecurity, and unemployment can hardly be tackled in a sustainable way without innovation and human capital development [8-10]. Fostering and supporting innovation is considered core to human progress in solving the multitude of challenges facing human beings. The United nations (UN) has included innovation in their 2030 Sustainable Development Goals (SDG) agenda [11, 12]. As a source of inspiration and imagination, a company's human capital has a significant impact on enterprise innovation. For a company to be innovative and function well, developing its human capital to the highest standard is important [13] because employees' superior knowledge and capabilities determine the enterprises' ability to compete in highly competitive markets.

Human capital has a significant positive impact on organizational innovation [14], eco-innovation [15], inbound open innovation [16], and innovation performance [17]. To maximize human capital accumulation, a firm needs to be concerned about absorptive capacity, training transfer, and employee motivation, as well as ways to engage and attract new talent [18]. However, in an increasingly complex and turbulent environment, attracting, retaining, and developing human capital has been quite a challenge. This has been especially apparent in Africa in general and Ethiopia in particular, where human capital development lags behind and is unable to support innovation, technology, and knowledge transfer, affecting the continent's long-term growth prospects and competitiveness [19]. GDP per capita, openness, and education policy variables significantly affected Ethiopia's human capital development [20].

Development of human capital is essential for enhancement of creative capabilities and innovation [21]. An organization can develop its human capital by creating a conducive environment for learning in order to boost innovation capability and performance [22]. The development of industrial parks in Ethiopia, beyond economic benefits, is hoped to enhance human capital development by facilitating knowledge, technology, and skill transfer, which are crucial inputs for innovation, by attracting multinational firms and promoting networking and joint ventures. Therefore, it is imperative to investigate how human capital affects firm's capacity for innovation. Although human capital has been found to have significant influence in determining innovation performance [23], its relation with innovation capability vis-a-vis firm competitiveness has not been adequately studied, particularly in the contexts of manufacturing firms in developing countries. A few related studies depicted a mixed result. Some studies showed that human capital has a significant indirect effect on competitiveness [24] and organizational performance [25-28]. Innovation, or innovation capability mediates the relationships. As opposed to this, very limited studies demonstrate the mediating role of human capital in the relationship between innovation and firm performance [29]. It is evident that the mediating and moderating role of humans in the relationship between innovation capability and firm competitiveness has received little empirical investigation. Particularly, the moderating effect of human capital in the relationship has been explored. Therefore, this study examines the moderating effect of human capital in relationship between innovation capability and firm competitiveness. This study makes a theoretical contribution by developing and strengthening the limited existing empirical literature in the area. Practically, it also helps organizations develop effective strategies to develop human capital's innovative skills and firms' innovation capacity.

2. LITERATURE REVIEW

2.1. Innovation Capability

A firm's ability to regularly convert concepts and knowledge into new systems, procedures, and products that benefit the business is known as innovation capability [30]. Innovation capability consists of multiple capabilities. Businesses with a variety of capabilities can combine their capabilities and resources to develop innovation

successfully. The primary emphasis of innovation capability is the company's ability to modify its offerings, which is strongly related to organizational performance [31, 32]. Various studies have classified innovation capacities into distinct components. Lawson and Samson [30] and Saunila and Ukko [33] identified seven components of innovation capabilities. The former identified organizational structures, idea management, creativity, organizational intelligence, competency base, technology management, and culture. The later came up with creativity, motivation, leadership, communication, idea generation and evaluation, new products, and new processes as components of innovation capability. On the other hand, other authors indicated two dimensions of innovation capability: cooperation and information transfer [34], innovation novelty, and market characteristics [32].

Technological innovation capabilities have been assessed from three approaches: asset, process, and function [35]. Each approach consists of various elements indicating innovation capability. Innovation capabilities are contingent upon the context, according to various scholars. Industry type, region, firm size, and innovation type are important variables determining innovation capabilities [36]. Although literature demonstrates various dimensions and components of innovation capability [30, 32, 33, 35], this study identified five dimensions of innovation capability relevant to the specific context of manufacturing firms in Ethiopian industrial parks through a pilot study involving interviews with five firm leaders. These are innovation activity, absorptive capacity, organizational capability, innovative culture, and managerial capability.

2.1.1. Innovation Activities

Innovation activities refer to all developmental, financial, and commercial activities undertaken by a firm in pursuit of innovation [37]. It includes all processes involved in coming up with new ideas, developing new technologies, producing and promoting a new or improved product, or improving a manufacturing process [7]. Innovation activities include product innovation, process innovation, R&D, acquisition of technology and instruments, employee training, sources of information and cooperation, and intellectual property rights.

2.1.2. Absorptive Capacity

Cohen and Levinthal [38] described absorptive capacity as "the ability to recognize the value of new information, assimilate it, and apply it to commercial ends." Based on their view, absorptive capacity tends to develop cumulatively and builds upon prior knowledge. The firm needs to relate the knowledge it wants to use to its existing body of knowledge for its capacity to grow. The idea was eventually expanded into four capabilities: transformation, exploitation, assimilation, and acquisition. Researchers determined that knowledge transformation and exploitation represented actual absorptive ability, while acquisition and assimilation skills represented potential absorptive capacity [39]. Majority of studies use the four parameters in empirical investigation [40]. The company's past investments, knowledge base, and the degree, pace, and direction of its knowledge acquisition are all considered components of its acquisition capability. Assimilation capability pertains to the routines and processes of the organization that allow it to evaluate, decipher, comprehend, and acquire new information. The transformation capability refers to the business's ability to incorporate, remove, reorganize new knowledge for internal use. The ability of the company to utilize the new knowledge and genuinely alter its procedures and practices is referred to as the exploitation capability [41].

2.1.3. Organizational Capability

Organization capabilities are the strategic, intangible resources that an organization uses to carry out its business plan, complete tasks, and satisfy its clients. These capacities cannot be created by a single endeavor or by adopting an outside model. Instead, the organization obtains and refines them internally through various interactions to meet its needs. These may consist of abilities, knowledge, information, activities, systems, technologies, skills, procedures, processes, and special adaptive characteristics [42]. Firm's ability to align

components of organizational capability differentiates it from competitors. Organizational capabilities are a driving force in gaining competitive advantage, adapting to change, and improving business performance.

2.1.4. Innovative Culture

An organization's culture plays a significant role. A culture that encourages creativity, risk-taking, and learning fosters innovation [43]. Leaders should promote an environment where employees feel empowered to share ideas and experiment. Flexibility and the presence of multifunctional teams are important indicators for the development of an innovative culture [43].

2.1.5. Managerial Capability

Managers and leaders exhibit skills, behavior, and practices related to innovation to foster and drive innovation within an organization. It involves creating an organizational culture that values creativity, embraces change, and supports continuous improvement. Leadership, strategic thinking, problem solving, and people relationships [44] are considered managerial capability traits in microforms.

2.2. Human Capital

The human capital theory states that employee's level of education and experience determine their income, and investment in human capital ensures competitiveness and sustainability in a complex business environment [45]. Increasing globalization, saturation of the job market, and an increasing trend toward a knowledge economy are among the notable forces that increased attention for human capital and made it a strategic tool for competitiveness [17, 46]. Human capital is a unique strategic resource [15] that can create value for individuals and the firm as a whole. Human capital focuses on developing employees' unique capabilities further in order to ensure and sustain enterprise competitiveness [13, 47]. It encapsulates an organization-wide business-development goal rather than a limited human resources function. Human capital significantly determines a firm's ability for innovation [22] as it supports the absorptive capacity of firms to acquire new knowledge and, at the same time, allows firms to develop new knowledge [48]. Knowledge and skills that are easily transferable are considered general human capital, whereas specific firm knowledge and skills that are less transferable and give firms a competitive advantage over the others are considered specific human capital. As the fastest-growing asset, human capital contributes 70 and 41 percent of national wealth in high-income countries and in low-income countries, respectively [49]. In sub-Saharan Africa, education and health were found to be critical elements of human capital that determine growth [50]. Therefore, building human capital is vital, as firm human capital quality is a key driver of economic development and determines short-term and long-term economic activities [51]. Human capital has been measured mainly from three approaches: the cost-based approach, the lifetime income-based approach, and the indicators-based approach. The first two approaches are monetary estimates of human capital values and they are dominantly used in developed economies where capital market is perfect. The indicator-based approach estimates human capital based on educational output indicators. These include educational attainment, logical and analytical reasoning skills, scientific and technological knowledge, skills, and cognitive performance. Although the use of this approach as proxies for human capital measurement in developed countries is limited, it is still relevant and widely used in measuring human capital in developing countries. Education, skills, abilities, experience, and training are considered core common elements of human capital measures [52].

2.3. Firm Competitiveness

Competitiveness is a multifaceted concept [53-55] with diverse meaning. The conceptualization and analysis of the term at macro, meso, and micro, or firm level gave rise to the variation in the concept. Origins of the concept of competitiveness are traced back to the economics of foreign trade and its contribution to international and national

economic benefits [56]. In the 1980s and 1990s, competitiveness was associated with lower labor costs, favorable home country policies, and productivity as the catalysts of competitiveness and prosperity [56]. These ideals underwent major shifts, resulting in a broader concept of firm competitiveness today. Competitiveness increasingly includes variables like innovativeness, quality, ethical standing, social responsibility, and the working conditions of employees [57]. *Firm competitiveness was* described *as, "the capability of a firm to sustainably fulfill its dual purpose of meeting customer demand at profit" [55]. According to the authors, firms can gain competitiveness in two ways. By offering quality products that customers highly value in comparison with products provided by rival firms and through continuous adaptation to changing social and business environments.* Firm competitiveness is simply referring to the capability of a firm to do better in terms of profitability, sales, or market share than benchmark companies.

A number of factors, which are varied and depend on the context, types of industry, level of development, scope of competition, or forms of business may affect competitiveness. For instance, in the European Union, R&D expenditure, intellectual property, and high technology share in exports were the main indicators of competitiveness, which led to differences in economic performances among member countries [53, 58]. However, in emerging economies like Turkey and Thailand, expenditure in R&D has little influence on firm competitiveness; rather, factors such as firm size, international sales, liquidity, and growth determine competitiveness [59, 60]. Generally, labor productivity, exports, dynamic production capability, market capabilities, innovation, and firm strategy are major sources of competitiveness [55, 56].

Despite the limited empirical evidence, Ethiopia's relative size and weak presence in export markets have impacted firm competitiveness, specifically in the manufacturing sector. Low rates of product, process, and marketing innovation, high costs of technology, lack of technically competent personnel that absorb new technology and innovation, culture, inadequate finance, low export orientation, low patents, low-value and low-technology products, and weak inter-sectoral and intra-sectoral linkages were the main challenges that affect competitiveness [61, 62] in the manufacturing sector in Ethiopia. Industrial parks were established to address some of these challenges by promoting industrial-led economic growth through innovation and technology transfer [63, 64]. However, evidence is lacking regarding the nature of firm innovation activity, human capital development, and competitiveness in industrial parks in Ethiopia.

2.4. Review of Empirical Literature and Hypothesis Development

Empirical literature demonstrates a significant positive association between innovation and firm competitiveness [65, 66]. Sustainable innovation improves firm performance by enhancing its competitiveness [67]. Similarly, innovation capability has a significant effect on firm performance [27, 28]. Since innovation capability is a significant predictor of organizational innovation performance, we argue that firm capacity for innovation would exert a direct influence on firm competitiveness. Literature has also overwhelmingly established significant impacts of human capital on firm competitiveness [68-71]. Human capital is considered a source of competitive advantage. Based on this, we proposed the following hypotheses:

H_1: Firm innovation capability determines competitiveness significantly.

H_2: Human capital has a significant direct impact on firm competitiveness.

On the other hand, numerous empirical studies indicate that human capital has a significant impact on innovation capability [72] and organizational innovation development [16, 17, 21]. Human capital development affects firm creativity, innovation capabilities, and performance. Human capital also has an indirect influence on innovation [22, 23]. However, empirical understanding of the impact of innovation capability on human capital remains limited and requires further investigation. Hence, we can argue that a firm's effort to develop capabilities for innovation will have a significant impact on developing innovative human capital skills.

H_3: Firm innovation capability will directly affect human capital competencies for innovation.

When it comes to the relationship between human capital, innovation capability, and firm competitiveness, studies depict a mixed picture. Some studies have identified the mediating role of human capital in the relationship between innovation and firm competitive advantage [24, 29]. While some other investigations, like those by Obeidat, et al. [25] indicate the mediating role of innovation in the relationship between human capital and firm competitiveness. Similarly, it has been shown that innovation capability also mediates the relationship between human capital and organizational performance [27, 28]. It is evident that the existing empirical literature has not sufficiently addressed the relationships. In particular, the empirical understanding of the mediating and moderating role of human capital in the relationship between innovation capability and firm competitiveness is lacking. To this end, we proposed the following two hypotheses. Figure 1 also illustrates graphically the hypothesized interaction between exogenous and endogenous latent variables.

H_4: Innovation capability has a significant indirect effect on firm competitiveness through human capital.

H_5: Human capital will significantly moderate the relationship between innovation capability and firm competitiveness.

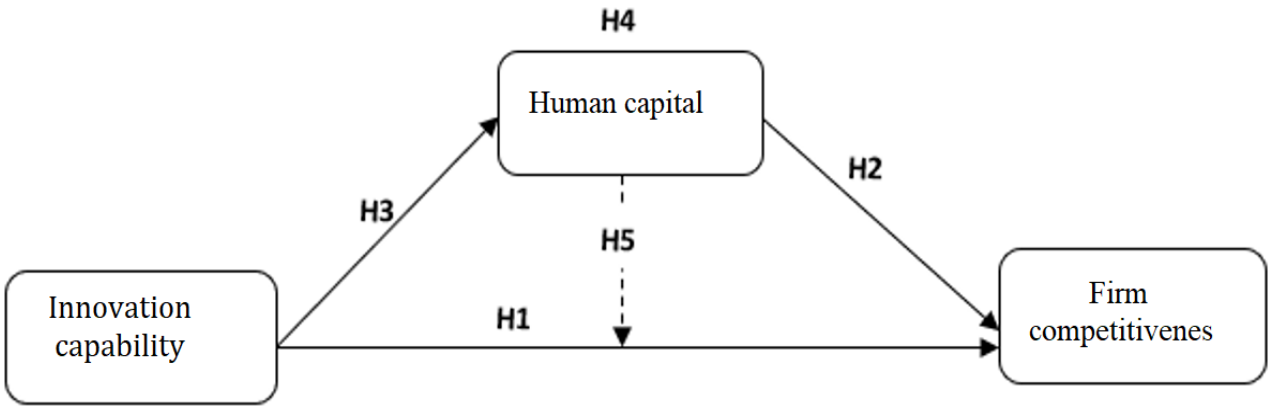

Figure 1. Conceptual model of the study.

3. METHODOLOGY

3.1. Population and Sample

There are twelve government-owned industrial parks (IPs) in Ethiopia. Conflict caused some industrial parks in the northern part of the country to suspend operations during the study's execution. These IPs were not included in the study. In addition, a few industrial parks, which were relatively new and housed very few firms, were also not included in the study. Hence, this study targeted only 81 manufacturing firms operating in six industrial parks: Addis Village, Hawasa IP, Bole Lemi IP, Adama IP, Kilinto IP, and ICT Park. Hence, 81 firms represent a sample of the study. The primary activities of these firms include the production of garments and textiles, leather goods, information technology (IT), and electronic materials such as mobile phones.

3.2. Measures

To evaluate the human capital construct, six items were adapted from earlier empirical studies published in highly reputable journals [16, 73, 74]. The items assess mainly five human capital elements: training, education, experience, abilities, and skills. Innovation capability, on the other hand, was measured using five dimensions (absorptive capacity, organizational capability, innovation activity, innovative culture, and managerial capability). Items used to measure the dimensions were adapted from the Oslo manual [37] and other reputable journals. Firm competitiveness was measured using the firm competitiveness index (FCI) developed by Chikán, et al. [55]. The index comprises three dimensions: operational capabilities (4 items), dynamic capabilities (5 items), and market performance (3 items). A five-point Likert scale from 1 strongly disagree to 5 strongly agree was employed as a measurement.

Exploratory factor analysis (EFA) was used to validate the instruments. Based on the EFA analysis for the innovation capability construct yielded a Kaiser-Meyer-Olkin (KMO) value was 0.888, which is higher than the threshold value of 0.50 value needed for sampling adequacy, indicating the sampling adequacy of the scale for factor analysis.

Moreover, Bartlett's test of sphericity ($X^2 = 4610.666$; df = 378, p = 0.000) was statistically found significant ($p < 0.001$). it was found that all the indicators had a communality extraction value greater than 0.5. this means that the five components created by the principal component analysis (PCA) using varimax rotation, which converged after 8 iterations, were able to explain 73.88 percent of the variance.

The EFA for human capital construct produced a KMO value of 0.848, higher than the recommended 0.5 cut point, and Bartlett's test of sphericity ($X^2 = 712.631$; df = 28, p = 0.000), indicating the sampling adequacy and significance of the scale used.

All items had KMO extraction values ranging from 0.509 to 0.800. The 8 items using varimax rotation converged on a single component, which explained 65.75 percent of the variance. Similarly, a KMO value of 0.827 indicates good sampling adequacy, and a significant Bartlett's test of sphericity ($X^2 = 1261.98$; df = 66, p = 0.000) was computed for 12 items in the firm competitiveness construct. The varimax rotation with Kaiser normalization generated three components with eigenvalues >= 1 and confirmed an earlier classification by the developer. The three components explained 68.87 percent of the variance.

3.3. Methods of Data Collection and Analysis

Cross-sectional survey data was collected from 81 firms through questionnaires by targeting one top-level manager from each firm. The survey questionnaires were distributed in person to each firm. Although managers or vice managers were the main target, a limited number of human resource managers and operation managers participated in the survey, in some cases through delegation and in other cases when the head manager or vice manager were not available. Specific protocols, close follow-up, and interval reminders through email, short text messages, phone calls, and physical visits were employed to maximize the response rate since the sample size was small (N = 81).

Finally, all firms filled out and returned the questionnaires. Then the data was coded and entered into the data management software, statistical package for social sciences (SPSS 26). Then the data was inspected visually and using descriptive tables to check for erroneous and out-of-range values. After this, outliers, normality, and reliability of the data were assessed using different tools, and satisfactory results were obtained. Finally, variance-based partial least squares structural equation modeling (PLS-SEM) using SmartPLS 4 was employed to test the hypotheses.

4. RESULTS

4.1. Evaluation of Measurement Model

Partial least squares structural equation modelling based on the principal component-based estimation approach was used to evaluate measurement and structural model [75]. Since innovation capability and firm competitiveness are higher-order factors, a two-stage approach was used to develop and estimate first-order and second-order measurement models [76]. The latent variable scores were used as indicators of the reflective higher-order constructs.

To estimate and establish the quality of constructs in first-order measurement model (Figure 2), factor loadings, indicator collinearity, construct reliability, and validity were evaluated based on the procedures recommended by Hair Jr, et al. [77].

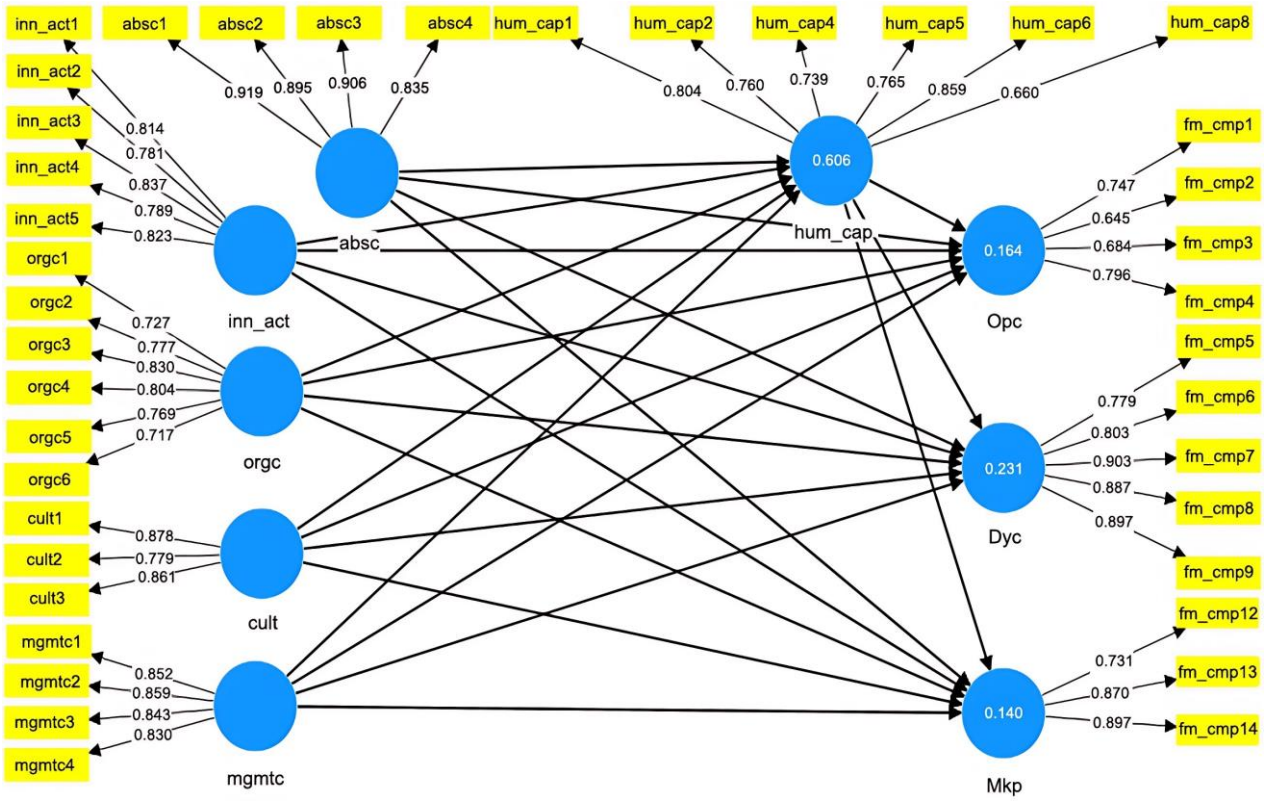

Figure 2. Measurement model.

Note: Dyc (Dynamic capability), Mkp (Market performance), Opc(Operational capability), Absc (Absorptitve capacity), Inn_act(Innovation activity), Orgc (Organizational capability), Cult(Innovative culture), Mgmtc (Management capability), Hum_cap(Human capital).

Factor loading values for all indicators in Figure 2 except (fm_cmp2 = 0.645, fm_cmp2 = 0.684, and hum_cap8 = 0.660) are higher than the threshold value 0.7, indicating desirable indicator loadings and the item's reliability. Factor's loading values above 0.6 are acceptable [77, 78]. The bootstrapping analysis result indicated that all indicators' loadings were statistically significant. The variance inflation factor (VIF) indicated no significant issues with multicollinearity, as the VIF value for each indicator was less than 5 [79].

4.1.1. Construct Reliability and Validity

Construct reliability was evaluated through Cronbach's alpha and composite reliability (CR). Both alpha and CR values in Table 1 surpassed 0.70, confirming internal consistency and reliability of the scale used [78]. Convergent validity of the measurement model was assessed using average variance extracted (AVE). The AVE value for each indicator in Table 1 is higher than 0.5. This indicates that the indicators converge on the factors and corroborates the presence of convergent validity (CV) in the data. Discriminant validity (DV) was assessed using Fornell-Larcker criteria (Table 1) and Heterotriat-Monotriat ratio (HTMT) (Table 2). The diagonal and italicized bold values in Table 1, which represent discriminant validity based on Fornell-Larcker criteria, were all higher than the correlation coefficients between variables underneath in each column, indicating no significant discriminant validity issue in the measurement model.

Table 1. Discriminant validity, convergent validity (AVE) and reliability.

Variables	Discriminant validity - Fornell and Larcker									CV	Reliability	
	Dyc	Mkp	Opc	absc	cult	hum_cap	inn_act	mdmtc	orgc	AVE	Alpha	CR
Dyc	0.856									0.732	0.908	0.931
Mkp	0.709	0.838								0.699	0.785	0.874
Opc	0.470	0.640	0.722							0.519	0.690	0.811
Absc	0.386	0.302	0.335	0.890						0.791	0.912	0.938
Cult	0.271	0.165	0.246	0.745	0.843					0.707	0.796	0.878
hum_cap	0.173	0.189	0.245	0.538	0.438	0.768				0.588	0.859	0.895
inn_act	0.156	0.182	0.308	0.761	0.685	0.583	0.811			0.655	0.869	0.904
mgmtc	0.223	0.218	0.348	0.701	0.513	0.755	0.696	0.846		0.716	0.868	0.910
Orgc	0.327	0.311	0.355	0.715	0.617	0.553	0.728	0.590	0.772	0.595	0.864	0.898

Note: Diagonal and italicized elements are the square roots of the AVE – DV. Below the diagonal, elements are the correlations between the constructs.

The Heterotriat-Monotriat ratio (HTMT) values in Table 2 are lower than the recommended cutoff value of 0.9, indicating no significant discriminant validity issues in the data using HTMT ratio, which is a more robust and preferred approach to evaluating discriminant validity in PLS-SEM [80].

Table 2. Discriminant validity based on HTMT ratio.

Discriminant validity - HTMT ratio									
	Dyc	**Mkp**	**Opc**	**absc**	**cult**	**hum_cap**	**inn_act**	**mdmtc**	**orgc**
Dyc									
Mkp	0.845								
Opc	0.598	0.849							
Absc	0.424	0.356	0.422						
Cult	0.319	0.208	0.338	0.874					
hum_cap	0.241	0.243	0.326	0.613	0.537				
inn_act	0.198	0.253	0.4	0.861	0.821	0.677			
mgmtc	0.251	0.265	0.452	0.787	0.615	0.878	0.803		
Orgc	0.368	0.379	0.459	0.808	0.747	0.643	0.846	0.685	

4.2. Structural Model Assessment

Structural model assessment involves evaluation of multicollinearity, path coefficient, explanatory power (R^2 and f^2), and the predictive relevance of Q^2. In addition, PLS predict, cross-validated predictive ability test (CVPAT), and model selection criteria were used to assess the predictive power of the structural model [75, 77]. To assess full collinearity, the three latent variables of the study—human capital, innovation capability, and firm competitiveness—were correlated against 'age' (a random dependent variable), which was not hypothesized in the study. The result produced a VIF value of 1.052, 1.134, and 1.153 for firm competitiveness, innovation capability, and human capital, respectively, which are lower than the conservative recommended VIF value of 2 [81]. This confirms collinearity could not affect model estimation. Moreover, correlation explained only 20.1% of the variance, which is lower than 50%, indicating no issue of common method bias in the data.

The evaluation of path coefficients of hypothesized direct relationships indicates that firm competitiveness (b = 0.440, t = 4.542, p = 0.000) and human capital (b = 0.688, t = 10.171, p = 0.000) are significantly impacted directly by innovation capability. Comparably, firm competitiveness is significantly and positively influenced by human capital (b = 0.433, t = 4. 887, p = 0.000). These results lend support to hypotheses H1, H2, and H3 (see Table 3).

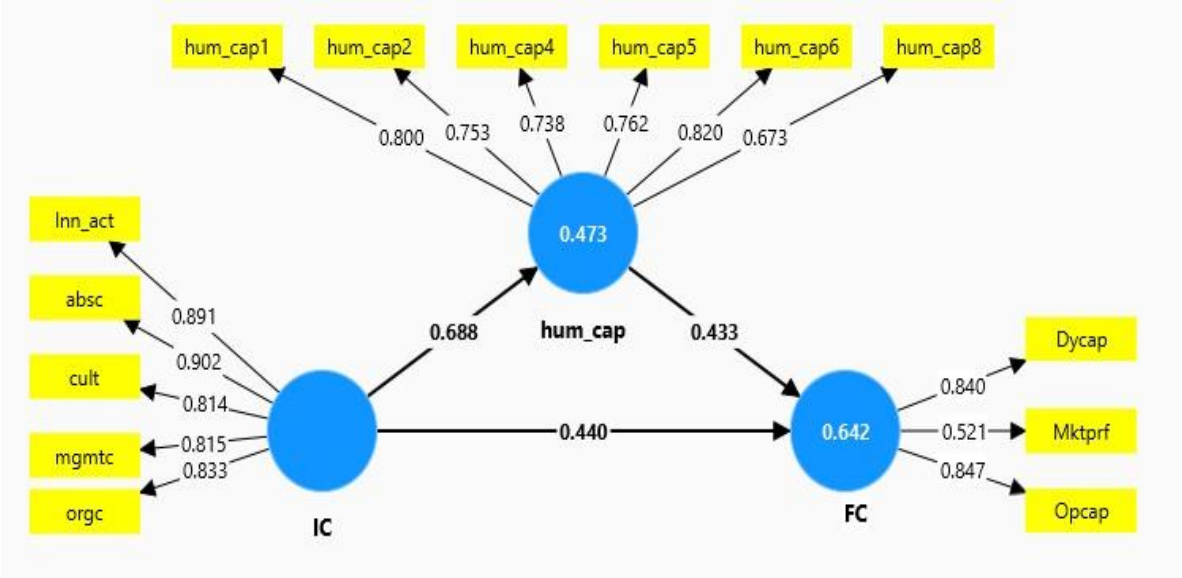

Figure 3. Results of the study.

Table 3. Hypothesis test.

Hypothesized relationships	ß	Confidence interval		t-value	p-value	Decision
		2.50%	97.50%			
Inno_cap --> Firm_comp (H1)	0.440	0.273	0.639	4.542	0.000	Accept
hum_cap --> firm_comp (H2)	0.433	0.277	0.666	4.887	0.000	Accept
Inno_cap --> hum_cap (H3)	0.688	0.523	0.792	10.171	0.000	Accept

4.2.1. Mediation Analysis

A bootstrapping analysis using 5000 samples was carried out to test the mediating role of human capital in the in the relationship between innovation and firm competitiveness. The findings in Table 4 indicate that innovation capability has a significant indirect effect on firm competitiveness through human capital (b = 0.297, t = 4.539, p < 0.00). Human capital partially mediates the relationship. Thus, the result supported hypothesis four (H4).

Table 4. Mediation analysis (Hypothesis H4).

Relationship	Direct effect	Indirect effect	Confidence interval		t value	P value	Conclusion
			2.5%	97.5%			
Inno_Cap -> Hum_cap -> Firm_Cmp (H4)	0.440	0.297	0.198	0.488	4.539	0.000	Partial mediation

4.2.2. Moderation Analysis

To test the fifth proposition (H5), which hypothesized a significant moderating effect of human capital in the relationship between innovation capability and firm competitiveness. The SmartPLS 4 output of moderation analysis illustrated in Figure 4 *indicates that human capital has no statistically significant moderating effect (hum_cap x IC* -> FC (b = 0.073, t = 1.440, p = 0.150)) in the relationship. Further simple slope analysis indicates no change in the relationship between innovation capability and firm competitiveness in terms of strength and direction of the relation when human capital quality is low (-1 SD), medium (mean), and high (+1 SD). Hence, hypothesis (H5) was rejected.

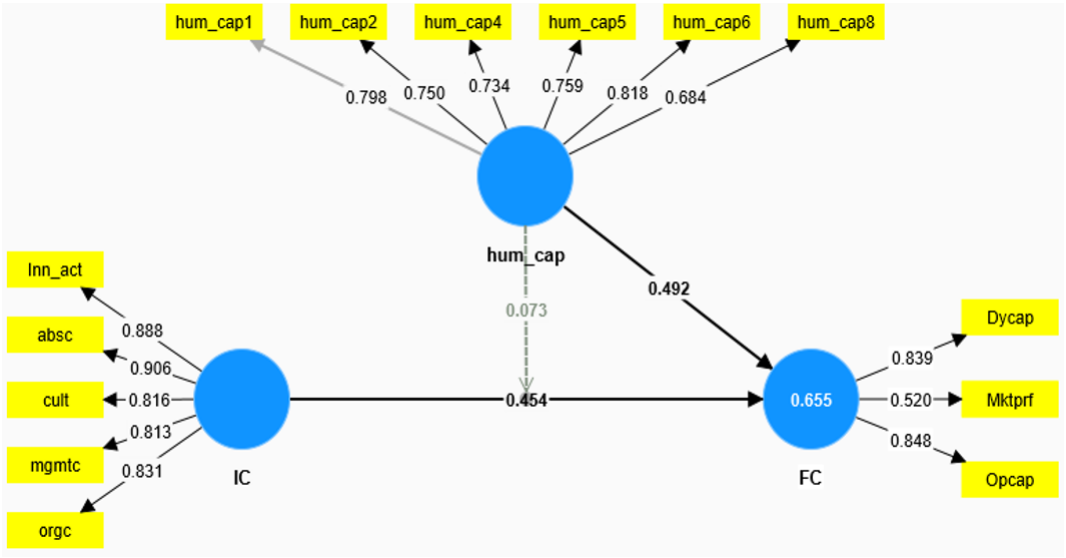

Figure 4. Moderation analysis.

4.2.3. Explanatory and Prediction Power Analysis of the Model

R^2 is a measure of in-sample predictive power [82]. R-square values of 0.642 and 0.473 were computed for the two endogenous latent variables: firm competitiveness and human capital, respectively (see Figure 3). From this, we can conclude that human capital and innovation capability explain 64.2 percent of the variance in firm

competitiveness. Similarly, innovation capability explains 47.3 percent of the variance in human capital. According to Henseler, et al. [83] each R^2 value was considered moderate. Effect size f^2 was also employed to evaluate the explanatory power of the R-square result. Accordingly, innovation capability (f^2 = 0.284) and human capital (f^2 = 0.276) had a medium effect size on firm competitiveness, whereas innovation capability (f^2 = 0.897) had large effect size on human capital [84]. The rank order of the path coefficients and the effect size were comparable. Additionally, the PLS predict was calculated to evaluate the structural model's predicting ability. The Q2 values (> 0) determined the predictive usefulness of the model. Analyzing the prediction summary data showed that for all three metrics, PLS-SEM_RMSE and PLS-SEM-MAE had smaller prediction errors than the naïve benchmarks, LM_RMSE and LM_MAE. We may therefore say that the model has a high degree of predictive power [85].

5. DISCUSSION

The study investigated the relationship between innovation capability and firm competitiveness by considering both mediating and moderating roles of human capital. The findings indicated that human capital has no moderating effect in the relationship; rather, it partially mediates the relationship between innovation capability and firm competitiveness. These results support limited empirical evidence [24, 29]. This result does not necessarily refute larger existing empirical evidence [25, 27, 28] which shows the mediating role of innovation capability in the relationship between human capital and firm performance or competitiveness. Because analysis of alternative models highlights the presence of feedback loop in the model, indicating innovation capability and human capital have a positive reciprocal effect on one another. In this respect, this study provided fresh empirical evidence. This result has significant practical implications. Businesses can enhance their competitiveness by either enhancing their innovation capacity or cultivating innovative skills within their human capital. Because firms investing in developing innovation capacity: organizational capability, managerial capability for innovation, innovative culture, absorptive capacity, and innovation activity indirectly develop their human capital innovative skills.

Like innovation capability, human capital has also a significant direct impact on firm competitiveness. This result supports earlier findings [67-69]. This study also found a significant positive association between human capital and firm innovation capacity, lending support to many earlier studies [14-17, 21, 72]. Except in limited cases, human capital has dominantly an antecedent. By exploring and identifying the impact of innovation capability on human capital, help develop the limited perspective and literature. This result highlights the importance of developing human capital for enhancing innovation capability and firm competitiveness.

6. CONCLUSION

This study explored the impact of innovation capability on firm competitiveness through the mediating and moderating role of human capital. The study identified the determinant role of human capital and innovation capacity for gaining firm competitive advantage. The findings revealed that human capital is a critical element of a firm, which affects firm innovation capacity and competitiveness. Firm can also develop its human capital innovative skills by focusing and working on components of its innovation capacity. Innovation capability also had significant direct impact on firm competitiveness and on human capital. Developing a firm's human capital is critical and significant to developing innovation capability as well as competitiveness. This ultimately improves the firm's capacity for innovation and competitiveness.

This study contributes to the literature by identifying the reciprocal impact of human capital and innovation capability on firm competitiveness. The findings strengthen existing empirical literature. For example, the findings of the study could strengthen the scant empirical evidence regarding the mediating role of human capital in the relationship between innovation capability and firm competitiveness. The study made a significant contribution by demonstrating that human capital does not significantly moderate the relationship between innovation capability and firm competitiveness. Practically, the study will help manufacturing firms develop effective strategies for

human capital and innovation capacity development in order to gain competitive advantage over rivals. This study simply highlights firm innovation capacity and human capital innovative skills as a critical source of sustainable competitive advantage. Therefore, to enhance a firm's capacity for innovation, managers should prioritize the development of the firm's human capital, particularly in the areas of creativity and innovative skills, by developing appropriate strategies.

The first limitation of the study is its scope. The study only focused on manufacturing firms operating in government-owned industrial parks. Thus, future studies should consider firms operating in privately owned industrial parks. Second, this study employed a relatively small sample and cross-sectional data to test the hypothesis. Hence, future studies may replicate the study with a larger sample using panel data. This study has also employed an indicator-based approach to evaluate firm human capital development, which could limit comparability of the results of the study. Therefore, future studies may consider monetary approaches in the assessment of firm human capital.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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