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Building Innovation Capability in the Moroccan High-Tech Manufacturing Industry: An Intellectual Capital Perspective

Mahdi Taleb, Youssef Pheniqi

IREFMO Lab (FSJES), Sidi Mohamed Ben Abdellah University, Fez 30000, Morocco

mahdi.taleb@usmba.ac.ma(Corresponding Author); youssef.pheniqi@usmba.ac.ma

Abstract. Recent intellectual capital (ICC) literature has increased attention to SMEs' innovation capability. This current research aimed to evaluate the role of ICC dimensions—such as human capital as input, relational capital (mechanisms), and structural capital (structure)—in enhancing SMEs' innovation capability (IC). Data for this study were obtained from 219 top management teams (TMT) of High-Tech manufacturing SMEs using a quantitative explanatory technique, then PLS-SEM was applied to test the study hypotheses. Results showed that all elements of ICC recorded a positive and significant impact on IC. This study will bridge the gap in strategic management literature by evaluating the missing connection between several components of ICC and innovation generation and integration in the developing economy context (i.e., Morocco). The results confirmed that the development of ICC enhances SMEs' innovation activities. Hence, high-tech manufacturing SMEs would benefit from developing and reconfiguring the firms' human, relational, and structural capitals to improve their innovation goals. This study has various theoretical and practical implications for TMT in the high-tech industry

Keywords: Intellectual capital, Innovation capability, Human capital, Relational capital, Structural capital, High-Tech manufacturing SMEs

1. Introduction

In a turbulent economic environment, innovation capability (IC) is considered strategic to SMEs' performance and sustainability (Carvalho et al., 2013; Rumanti et al., 2022). Lawson & Samson (2001) conceptualize IC as "the ability to transform knowledge and ideas into new organizational processes continuously, news products design and systems for the benefit of the firm and its stakeholders." IC becomes a continuous process of developing effective innovation outcomes with the ongoing transformation of knowledge assets into new products and processes and high knowledge-intensive systems for the advantage of firms and (internal and external) stakeholders (Rajapathirana & Hui, 2018). Literature suggests that SMEs that can effectively utilize the recognition and the orchestration of knowledge resources with investment in intangible assets have more significant payoffs from innovation capabilities (Subramaniam & Youndt, 2005; Seo & Kim, 2020). For this purpose, "the intellectual capital based-view of innovation" (Delgado-Verde et al., 2011) could assist SMEs in driving new products or processes and have sustainable innovation activities (Mendoza-Silva, 2020).

Indeed, Intellectual capital (ICC) has been considered an increasingly critical source of wealth creation and competitive advantage (Ullberg et al., 2021; AlQershi et al., 2021), financial performance (Xu & Liu, 2021; Yoon and Joung 2019), and innovation performance (Wendra et al., 2019). The conceptual development and categorization of ICC components have developed since highlighting the importance of knowledge resources (Kaufmann & Schneider, 2004). ICC is conceptualized primarily as the association of human, relational, and structural resources and assets of an organization, comprising knowledge, core competencies, expertise, core techniques, intellectual property, customer relationships, networks, and experience (Inkinen, 2015; Agostini et al., 2017; Aljuboori et al., 2022). On the one hand, some scholars (e.g., Agostini et al., 2017) state that for some SMEs that invest more in the development of their ICC, the strength of the ICC is intrinsically related to their IC. On the other hand, researchers have demonstrated the pivotal role of ICC and these intangible resources in enhancing innovation generation and integration (Dost et al., 2016).

Based on these findings, the ICC-IC relationship has been the main focus of several previous studies (Sivalogathasan & Wu, 2015; Waseem et al., 2018; Indiran et al., 2021). There is a consensus among scholars that ICC influences various innovation capabilities in organizations (Subramaniam & Youndt, 2005; Dost et al., 2016; Zambon & Monciardini, 2015; Barkat et al., 2018). Thus, ICC is considered the "umbrella" of all (newly developed or already existing) intangible assets of a firm that transforms knowledge processes into innovative actions (Bueno et al., 2016). So far, due to the importance of the strategic model of the ICC, there is a lack of empirical studies that investigate the relationship between ICC and SMEs' innovative capability (Mendoza-Silva, 2020; Ali et al., 2021) and evaluate the

impact of ICC components (Wang & Chang, 2005) on innovation. Also, what we know about ICC-IC is primarily based on studies conducted in developed and emerging countries (Martinidis et al., 2021; Fajri & Aziz, 2020; Dost et al., 2016; Waseem et al., 2018).

Existing research on ICC focuses less on developing economies that require further investigation (Urban & Joubert, 2017; Ferramosca & Ghio, 2018; Dzenopoljac et al., 2022), especially in the context of SMEs (Agostini et al., 2017; Vakulenko, 2021). Emerging economies may exhibit different characteristics, barriers, and specific drivers (Cegarra-Navarro & Sánchez-Polo, 2010). To minimize this knowledge gap, Bontis (2004), Marcin (2013), and Dzenopoljac et al. (2017) propose completing additional research in the Arab region and national environment. Regarding their call, this research examines the separate impact of the elements of ICC on High-Tech manufacturing SMEs' innovation capability in the Moroccan context.

As a developing economy, Morocco currently experiences a new development model, a green economy transition (Smouh et al., 2022), with the manufacturing industry gradually changing to industry 4.0 (El Hamdi et al., 2020). Consequently, the Moroccan economic fabric (98% of companies are SMEs) is expected to develop new resources (brevets, intellectual property), core technological capabilities and knowledge-intensive business, specific employee skills, and competencies to maintain a sustainable innovation capacity (El Hamdi et al., 2018).

Based on these findings, the main challenge is ensuring innovativeness and growth (Gomezelj Omerzel & Smolčić Jurdana, 2016), overcoming the scarcity of resources, and the insufficient responsiveness to environmental changes (Kim et al., 2018), through intangibles assets investment (Seo & Kim, 2020), financial competitiveness (Xu et al., 2022), and building innovation capabilities (Ali et al., 2021).

Accordingly, this research seeks to answer the fundamental question: Does intellectual capital impact SMEs' innovation capability? Specifically, this paper hypothesizes that intellectual capital architecture positively and significantly affects innovation capability. The study will contribute to the empirical literature of ICC by reconfirming (or otherwise) findings of previous studies done across the world.

The present study attempts to extend ICC literature by considering that dynamic capabilities (DCs) play a strategic role in developing SMEs' intellectual capital and converting interactions between their components into sustainable innovation capabilities. Teece et al. (1997) defined DCs as organizational competencies for developing, mobilizing, reconfiguring, and maintaining intangible assets to support sustainable business success.

For this purpose, our study is organized as follows—first, a relevant literature review of the constructs of our theoretical model to formulate a series of hypotheses.

Second, a detailed description of the methods and obtained results, followed by the discussion and conclusion, in which the contributions of theory, implications, limitations, and suggestions for future studies are highlighted.

2. Theoretical Background and Hypotheses

2.1. Human Capital and SMEs Innovation Capability

Human capital (HC) is an employee's education, training, skills, experience, knowledge, flexibility, group-work abilities, and adherence to the organization's objectives and strategies (Chiganze & Sağsan, 2022). According to DCs perspective, human capital is the primary factor influencing the creation of new information and the enhancement of employees' intuitive skills to support a firm's knowledge management (KM) capabilities (Makhloufi et al., 2021).

In the context of the industry 4.0 (IR 4.0) and digitalization, the analysis performed in the various studies (Abbadi et al., 2020; Sima et al., 2020; El Hamdi et al., 2020; Pawłyszyn et al., 2020; Makhloufi et al., 2021; Taleb & Pheniqi, 2022) highlighted some critical aspects for the development of human resources: experience-education, new jobs, IT personal capability, technology, training-information, technical skills, automation, communication, core competency, productivity. These factors contribute to HC development in three directions, namely: (1) Reducing human-labor jobs; (2) Allocating labor to higher-value areas; and (3) Increasing the need for tech-savvy workers.

Danquah & Amankwah-Amoah (2017) revealed that HC helped SMEs increase the adoption of technology and technical change. Nowadays, manufacturing SMEs must recognize that IR 4.0 requires adopting new business innovation models, production processes, and technology; driven by a skilled workforce (Sima et al., 2020). Hence, business managers should invest intangible assets to accomplish innovation goals (Seo & Kim, 2020).

Much of the available literature on HC deals with its potential to directly boost IC from the individual to the organizational level (Cruz et al., 2018; Razavi et al., 2019; Kotsopoulos et al., 2022). However, other scholars (e.g., Lo et al., 2021; Liu et al., 2019; Li & Yu, 2018; Hiri & Achabi, 2022; Touate & Bennouna, 2019) are more concerned with the optimal combination of HC with other factors that influence SMEs' innovation performance.

Similarly, Silva et al. (2021) argued that IC requires a strong interrelation between innovation climate and dynamic capabilities. Also, Kim & Bang (2021) found that knowledge sharing, high-level employees' commitment to change, group diversity, and participative leadership are critical success factors for creativity and innovation in IR 4.0. Knowledge-based HRM practices that encourage employees to share, create, and use knowledge can improve the innovative capacity of

organizations (Kianto et al., 2017). Bonesso et al. (2020) claimed that social, emotional, and cognitive competencies, as elements of intangible human capital, are important determinants of the ability to implement innovation activities. Furthermore, Xu et al. (2019) argued that paying less attention to HC will significantly impact an organization's innovation capabilities. In recent literature, Chaudhuri et al. (2022) highlighted the significance of human capital development for enhancing SMEs' innovation capability and high-tech expertise, both of which are crucial to the growth of the entrepreneurial ecosystem. As such, this study hypothesizes that:

H1. Human capital (HC) positively influences SMEs' innovation capability

2.2. Structural Capital and Innovation Capability

Structural capital (SC) is a crucial element of the intellectual capital theoretical framework (Bontis, 1998). SC includes procedures, tactics, process handbooks, databases, and more that are not human-supported (Bontis et al., 2000; Urban & Joubert, 2017). SC is further subdivided into organizational and technological capital (Ordóñez de Pablos, 2004), with organizational capital (OC) encompassing firm culture, planning, coordination mechanisms, structure, organizational routines, and control systems, while technological capital (TC) includes R&D and process engineering outputs.

Beltramino et al. (2020) noted that a company without SC would struggle to exploit its intellectual capital properly, as substantial structural capital maximizes intellectual capital use (Fernández-Jardón et al., 2014). Yli-Renko et al. (2001) argue that SC supports knowledge acquisition and organizational learning. Other studies have demonstrated that organizations with solid systems and procedures will have a stable, positive organizational environment that inspires employees to learn new skills and knowledge and transfer these skills into organizational routines and memory (Karagiannis et al., 2008; Barbieri et al., 2021). Thus, companies with strong relationships and trust (high SC), knowledge acquisition, and utilization are highly developed.

Furthermore, Barpanda (2021) demonstrated a synergistic effect of HC and SC on performance, and this relationship encourages the organization to develop better human resources practices to improve performance. Other authors (Karagiannis et al., 2008; Barpanda, 2021) demonstrated the transformation of HC and RC into SC, as the latter is the only IC component a company may hold.

SC is closely related to social capital (Urban & Joubert, 2017), which channels the impact of SC on firm performance (Carmona-Lavado et al., 2010). Along the same lines, previous studies have acknowledged the crucial role of SC in improving innovation capability (Aramburu & Sáenz, 2011; Fernández-Jardón et al.; 2014; Xu et al., 2019), especially for manufacturing SMEs (Novotná et al., 2021; Beltramino et al., 2020; Aljuboori et al., 2022).

Zemlyak et al. (2022) claimed that SC and other IC aspects significantly influence technological innovation. In addition, Buenechea-Elberdin et al. (2018) revealed the complementary role of RC and SC in renewal capital and innovation in low and high-tech SMEs. However, other studies were convinced that innovation capabilities primarily depend on the interaction between SC and other organizational and managerial factors: e.g., corporate social responsibility (Zhang et al., 2021), absorptive capacity (Engelman et al., 2017), human resources management (Donate et al., 2016), and size effect (Aramburu & Sáenz, 2011). As such, this study hypothesizes that:

H2. Structural capital (SC) positively influences SMEs' innovation capability.

2.3. Relational Capital and Innovation Capability

Relational capital, often known as RC, refers to all cooperative relationships developed between firms and all stakeholders. Subramaniam and Snell (2004) describe RC as a company's external customer, supplier, government, and industry association ties. RC is implicit in all of a firm's external connections, which are the means through which a company may develop its competitive advantage with all its stakeholders (such as customers and trade partners) and boost its performance (Bontis, 1998). A company may increase its performance and benefit from relational capital by maintaining open communication lines and positive relationships with customers, distributors, and suppliers. With these ties, businesses can cut their expenses and decrease their prices while maintaining the same level of quality. Previous studies have found RC to be the most challenging for SMEs (Asiaei et al., 2018) as it is the most external aspect of the company compared to the other intellectual capital components (Ramírez-Solis et al., 2022). Indeed, RC is critical to a firm's success (Ibarra Cisneros & Hernandez-Perlines, 2018; Asiaei et al., 2018; Wendra et al., 2019).

In IR 4.0, the changing and dynamic environment compels manufacturing SMEs to be more innovative and remain competitive (Chao & Kang, 2022). Furthermore, by increasing uncertainty, SMEs are encouraged to build relationships with customers, business partners, and authorities to obtain essential information and develop their networks (Ramírez-Solis et al., 2022). Similarly, a firm's growth, development, and marketization can build RC and manage sustainability risk (Zhang et al., 2022).

Adopting a similar position, Allouch & Hafiane (2022), in the case of the large unlisted Moroccan firm, noted that developing solid RC can help build a reputation that ensures employees can innovate and deploy their skills and experience for the benefit of the company.

RC has recently been seen as a significant element in driving performance and technological innovation by enhancing knowledge-based business innovation (Zemlyak et al., 2022; Aljuboori et al., 2022). To this end, RC can enhance the

transition of internal information into the process and product innovation and accelerate innovation by absorbing valuable external knowledge obtained from partners and networks (Zhang et al., 2022). Furthermore, Niwash et al. (2022) revealed that RC positively affects innovation speed and quality, thus, enhancing financial and operational performance.

Previous studies corroborate (Sulistyo & Siyamtinah, 2016; Lekić et al., 2022) conclusions that higher RC improves innovation and business performance. As such, this study hypothesizes that:

H3. Relational capital (RC) positively influences SMEs' innovation capability.

2.4. Theoretical framework

The current research's novelty is examining the ICC elements and IC linkage. We defined a set of ICC components – human capital (HC), structural capital (SC), and relational capital (RC) – that enables High-Tech manufacturing SMEs to build innovation capability. Fig. 1 depicts the proposed conceptual model of this study:

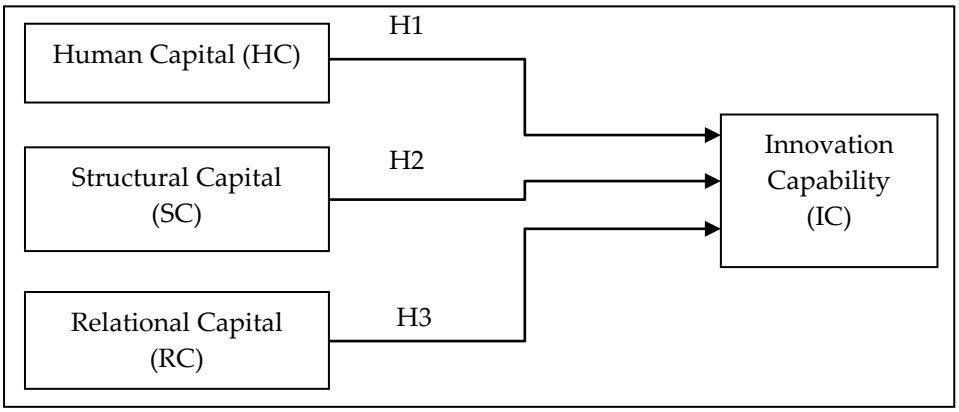

Fig. 1: Conceptual model

3. Methodology

3.1. Data Sampling

This study aims to confirm how ICC elements impact a firm's capacity for innovation. The conceptual model, presented in (Figure.1), highlight the interconnections between variables in light of the hypotheses proposed in the literature review. Selecting and choosing the appropriate participants is crucial for reliable data to assess model variable correlations.

This study targets the top manager's team (TMT) to conduct an empirical study focused on the SME context. The scope of the study covers three exemplary sectors: the Agri-food business, Automotive, and Textile industries. The sample was 4150 SMEs listed in KOMPASS (https://ma.kompass.com/, accessed on 20 April 2022).

Thus, 352 participants were randomly selected using Krejcie and Morgan's (1970) table. Wolf et al. (2013) recommended that researchers add 40% of surveys to the total sample size (352 +352*40% = 493). The author sent 500 questionnaires (a French version was provided via email with a cover letter outlining the study's scientific/ethical goals); only 219 completed surveys were collected with complete data, representing a rate of 44.42%. Table 1 details the respondent's profiles and firms.

The questionnaire was prepared in French with an authentically verified expert translator (English Senior Professor). This study conducts preliminary research to ensure the quality and validity of all items (Two academic experts on knowledge management studies and four senior managers working in the automotive firm's industry).

Following the academic expert's comment, the survey's final draft was made with some modifications to adapt them to our national context. The constructs were measured on a five-point Likert scale, from "strongly disagree" to "strongly agree."

Table 1: Respondents' profiles and Firms' characteristics

Respondents profile	Frequency	Percentage (%)
Education Level		
Diploma	95	43.37%
Degree (Bachelor)	81	36.98%
Master	23	10.50%
Engineer	20	9.13%
Experience		
1 to 5 years	31	14.15%
5 to 10 years	115	52.51%
More than 10 years	73	33.33%
Firm - years of operation		
Less than 5 years	19	8.67%
From 6 to 10 years	54	24.65%
More than 10 years	146	66.66%
Type of Ownership		
Private firms	125	50.07%
Foreign firms	67	30.59%
Limited	27	12.32%
Position		
Production Director	32	14.61%
Director IS	41	18.72%
Director of R&D	14	6.39%
Engineers	56	25.57%
Manager of sales and marketing	12	5.47%
CEO	06	2.73%
Others	58	26.48%
Number of employees		
Less than 50	45	20.54%
From 51 to 100	62	28.31%
From 101 to 150	91	41.55%
From 151 to 200	10	21.90%
More than 200	11	5.02%

3.2. Measures

This research adopted five (5) measures of HC dimensions as used in previous studies (Kengatharan, 2019; Aljuboori et al., 2022). Seven (7) measures were adopted (Wang et al., 2021; Aljuboori et al., 2022) to measure SC dimensions, and five (5) from the same authors (Wang et al., 2021; Aljuboori et al., 2022) to measure RC dimensions. The independent variable, innovation capability, was measured using a six (6) - items scale adapted from (Lin, 2007; Calantone et al., 2002) (Table 2).

Table 2: Study variable's measurements

Constructs	item	Questions
Human Capital (HC)	HC 1	Our employees are highly skilled.
	HC 2	Our employees are well experienced in their job.
	HC 3	Our employees are creative.
	HC 4	Our employees are knowledgeable.
	HC 5	Our employees are quick in problem-solving.
Structural Capital (SC)	SC 1	Our bank has efficient and relevant information systems to support business operations.
	SC 2	Our firm's overall operations procedure is very efficient.
	SC 3	Our firm responds to changes very quickly.
	SC 4	Our firm has an easily accessible information system.
	SC 5	Our firm has systems and procedures to support innovation.
	SC 6	Our firm's culture and atmosphere are flexible and comfortable.
	SC 7	Our firm emphasizes new market development investment.
Relational Capital (RC)	RC 1	Our firm discovers and solves problems through intimate communication and effective collaboration.
	RC 2	Our firm maintains appropriate interactions with its stakeholders.
	RC 3	Our firm maintains long-term relationships with customers.
	RC 4	Our firm has many excellent suppliers.
	RC 5	Our firm has stable and good relationships with strategic partners.
Innovation capability (InvCap)	InvCap 1	Our firm tries out new ideas.
	InvCap 2	Our firm seeks new ways of doing things.
	InvCap 3	Our firm is creative in its operating methods.
	InvCap 4	Our firm develops new products and services.
	InvCap 5	Our firm's perception of innovation is not risky and, therefore, acceptable.
	InvCap 6	Our firm introduced new products/services in the last five years.

3.3. Evaluation of Measurement Model

Smart-PLS software was utilized for partial least squares analysis (Hair et al., 2017). First, the measurement model's reliability and validity were assessed with a subsequent structural model assessment, which entails the evaluation of the hypothesis testing (path-coefficient), Cohen's f^2 (effective size), predictive relevance (Q^2), and the coefficient of determination (r-squared or R^2).

Following Hair et al. (2017), the convergent validity of the measurement tool was evaluated by comparing the indicator's outer loading, factor loading, composite reliability (CR), average variance extracted (AVE), and convergent validity (CV). It was further claimed that the item loadings could be accepted above 0.7 (Hair et al.,

2014). According to the results, SC1 and SC6 scored 0.599 and 0.559, respectively, below the permitted range, as shown in Figure 2. As a result, the items SC1 and SC6 were dropped, as illustrated in Figure 3.

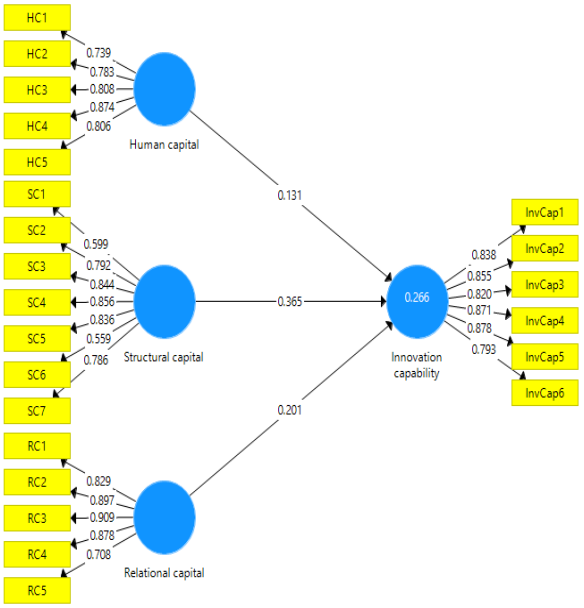

Fig. 2: Architecture of Measurement Model

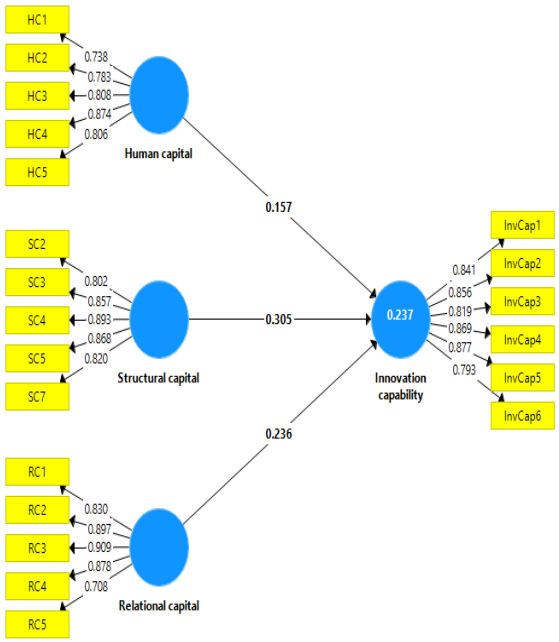

Fig. 3: Modification of Measurement Model

As can be seen in Figure 3, the authors reran the PLS-Algorithm after removing the low-loading SC1-SC6. Then, the values of all items were above 0.7 (Hair et al., 2014), with item loading ranging from 0.708 to 0.909. Also, all constructs' CR was higher than 0.70 (Chin, 1998), while AVE values were above 0.5, as recommended by (Hair et al., 2017). Besides, all constructions have a Cronbach's alpha of over 0.7, showing internal consistency and indicating that the study passed the convergent validity test (Table 3).

Based on Fornell and Larcker Criterion, the discriminant validity of a specific construct was evaluated by comparing the correlation with the square root of AVE (Hair et al., 2014). As indicated in Table 4, the values in bold are above those in the corresponding row and column, indicating that the study measures were discriminant.

In addition, the results showed that the outer loading exceeded the cross-loading of all variables and remained valid. The Heterotrait-Monotrait (HTMT) ratio, as established by (Henseler et al., 2015), was also used to prove the measurement model's effectiveness and adequacy. The values indicated in parentheses in Table 4. are less than 0.85, meeting the HTMT0.85 criterion (Kline et al., 2012), and confirming the discriminant validity of the construct.

Table 3: Convergent outcomes of the constructed measurement model

Constructs	Item	Loading	α	CR	AVE
Human Capital (HC)	HC1	0.738	0.864	0.901	0.645
	HC2	0.783			
	HC3	0.808			
	HC4	0.874			
	HC5	0.806			
Structural Capital (SC)	SC2	0.802	0.902	0.928	0.720
	SC3	0.857			
	SC4	0.893			
	SC5	0.868			
	SC7	0.820			
Relational Capital (RC)	RC1	0.830	0.9	0.927	0.718
	RC2	0.897			
	RC3	0.909			
	RC4	0.878			
	RC5	0.708			
Innovation Capability (InvCap)	InvCap1	0.841	0.919	0.936	0.711
	InvCap2	0.856			
	InvCap3	0.819			
	InvCap4	0.869			
	InvCap5	0.877			
	InvCap6	0.793			

Table 4: Fornell and Larcker Criterion and Heterotrait-Monotrait (HTMT) ratio

	Human capital	Structural capital	Relational capital	Innovation capability
Human capital	0.803			
Structural capital	0.167 (0.186)	0.848		
Relational capital	0.067 (0.089)	0.295 (0.32)	0.847	
Innovation capability	0.224 (0.236)	0.401 (0.435)	0.336 (0.358)	0.843

3.4. Structural Model Assessment

Using Smart-PLS®, boot-strapping of 5000 sample size was run with a significance of 5% and a two-tailed test. The structural path coefficient in Figure 4 and tabulated results in Table 5 showed a positive and significant relationship between HC and IC (β= 0.157, t= 2.736, p < 0.01), indicating that H1 was supported. Furthermore, the SC path was positive and significant on IC (β= 0.236, t= 3.278, p= 0.001), inferring that H2 was retained. Moreover, RC has a positive and significant effect on IC (β= 0.157, t= 2.736, p < 0.001), which means that H3 was accepted. Additionally, the effect size (f^2) of the three endogenous variables HC, SC, and RC is 0.031, 0.109, and 0.066, respectively, and are considered small effect sizes (Cohen, 1988). The value of the model's coefficient of determination (R^2-value) is 23.7%, which indicates a weak effect (Cohen, 1988) and shows that all ICC components explain 23% of the variance in the endogenous variable, namely innovation capability.

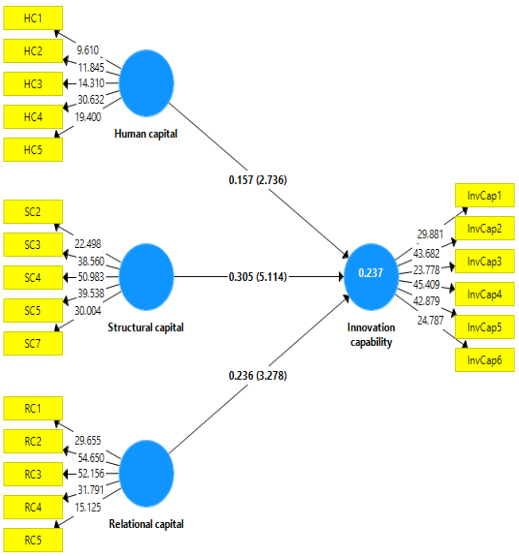

Fig 4: The Structural Model with All Variables

Table 5: Model-analysis outcomes

	Relationship	Std -B	*t*-Value	*p*- Value	Decision
H1	HC -- > IC	0.157	2.736	0.006	Supported
H2	SC -- > IC	0.236	3.278	0.001	Supported
H3	RC -- > IC	0.305	5.114	***	Supported

*** *p <0.001*

4. Discussion

Drawing on the DCs perspective (Teece et al., 1997) and the ICBVI (Delgado-Verde et al., 2011), the purpose of the study aimed to investigate whether and under which conditions ICC influences SMEs' innovation capability. By doing this, we respond to recent calls (e.g., Bontis, 2004; Marcin, 2013, and Dzenopoljac et al., 2017) to assess the effectiveness of ICC in developing SMEs' ICC and enhancing IC. Using insights from High-Tech manufacturing SMEs in Morocco, the results of our study suggest that SMEs in developing countries can benefit from intensive knowledge assets and the development of high-innovation value-added activities.

This research aims to predict the crucial role of ICC on SMEs' innovation capability. The study advances the body knowledge of intellectual capital theory by evaluating the role of ICC components (HC, SC, and RC) as strategic DCs that enable firms to level up innovation capability. This paper is among the pioneering studies emphasizing dynamic capability's significance in polishing a firm's human, relational, and structural capital to generate and adopt better innovation results.

Advancing the DCs approach, the study examined ICC's impact on enhancing innovation activities. Three hypotheses were developed to investigate whether the ICC component determines a positive correlation to innovation capability to accomplish these objectives. The results indicated that all ICC elements had a positive and significant direct impact on SMEs' innovation capability.

First, the significant relationship (t-value= 2.736) between HC and IC (H1) indicated that the higher the level of employees' skills, education, experience, and training, the higher the innovative capability of the SMEs, in that developing HC eventually enhances innovation capabilities. The current finding is consistent with previous research on this topic (Mariz-Perez et al., 2012; Timothy, 2022; Fonseca et al., 2019).

Recently, High – Tech manufacturing SMEs in Morocco witnessed considerable development in terms of human capital, providing enough training, and advanced IT skills (El Hamdi et al., 2020), contributing to progressive firms' absorption of innovation changes and uncertainty.

Second, the SC and RC relationship results with IC for H2 (t-value= 3.278) and H3 (t-value = 5.114) were strongly supported. Current results agree with the

published finding that SC and RC boost innovative capabilities (Ali et al., 2021; Beltramino et al., 2020; Ramírez-Solis et al., 2022; Xu et al., 2019; Zemlyak et al., 2022). The study findings also highlight how effective knowledge management supported by external and internal knowledge networks can build and develop new knowledge and organizational learning capabilities to develop new product development, enhance the existing products, improve the product design, and boost brand image. This research's positive and significant findings showed that High-Tech manufacturing SMEs demonstrated the critical impact of SC and RC on IC. It is believed that the implementation of High-Tech equipment, materials, industrial robots, e-platform, e-services, and Big-Data management, requires SMEs to have clear ideas about the type of technological innovation they want to generate and integrate and the SME's technology level; thus, the SC efficiency is critical to maintaining this process.

Verbano & Crema (2016) claim that SMEs typically display a flexible and informal organizational structure with little R&D physical resources. Furthermore, manufacturing SMEs are more agile and flexible due to their small and medium size, so it is comfortable for them to adopt new organizational and technological systems and processes compared to larger companies (Nooteboom, 1994; Yusoff et al., 2019).

Thirdly, the research findings showed that RC significantly and positively influenced IC. These results align with prior studies (Akhavan & Mahdi Hosseini, 2016; Waseem et al., 2018; Sulistyo & Siyamtinah, 2016), which found an essential contribution of RC toward superior innovation outcomes and business performance. Specifically, the study findings propose an open innovation perspective that offers a framework for the effectiveness of RC in promoting SME innovation capability (Ryu et al., 2021). Open innovation (OI) applied to a new product or business development encourages SMEs to adopt and integrate innovation practices, especially if its RC aspect involves sharing innovative ideas. OI can boost innovation capability by integrating the information acquired internally by exploring external knowledge for technical innovation with the information processed by external stakeholders (Chen et al., 2015).

Additionally, this research tried to fill the gap in the High-Tech SMEs context, as most research and studies had been conducted on Low-Tech SMEs or Larger companies and, then, less attention was given to SMEs. This result validates the importance of manufacturing SMEs investing in human, social, and structural capital to strengthen organizational capabilities like knowledge creation, knowledge sharing, leveraging innovative ideas and practices, employee mindset and experience, managerial and technical skills, and business process adaptability to fit business changes and uncertainty.

Generally, Morocco's SMEs suffer from weak financial competitiveness and

lack strategic HR to improve their performance and innovation capacities (Asli et al., 2020; Bakhouche, 2021). Local studies (Cegarra-Navarro & Sánchez-Polo, 2010; El Hamdi et al., 2020; Dahani et al., 2022; Tiguint & Hossari, 2018) studied Moroccan SMEs from different perspectives, such as the OI paradigm, DCs view and resource-based view (RBV) which they suggest that the SMEs that want to gain innovativeness and competitiveness must focus on developing and reinforcing their knowledge-intensive capabilities and high value-added innovation practices. Overall, the research findings have important theoretical and practical implications.

4.1. Theoretical Implications

This study provided several theoretical contributions to the DCs view (Teece et al., 1997) and the ICBVI (Delgado-Verde et al., 2011). According to the DCs approach, IC is a construct built on strategy and vision, leveraging organizational intelligence, creativity, organizational structures, technological processes, climate and culture, and technology management (Lawson & Samson, 2001). Meanwhile, the ICBVI primarily focuses on organizational knowledge assets, identified as a source of innovation capabilities (Subramaniam & Youndt, 2005). Few national scholars have explored the connection between ICBVI and the DCs view. This field is still new in our context, and the interconnections between the two factors might be a future approach for SME strategies.

In addition, national studies on ICC in strategic management still need to be completed. Thus, this research was not only confined to examining ICC; it also aims to provide original contributions that add to the understanding of ICC management responding to enhance IC.

Furthermore, most research on this topic has been accomplished in developed economies, whereas SMEs, particularly those in emerging economies, have largely yet to be considered. As a consequence, the findings of this study support and supplement the findings of earlier studies by providing additional insight into developing countries. e.g., Morocco.

4.2. Managerial implications

The conceptual framework proposed in this study serves as a guide for High-Tech manufacturing SMEs to assess the influence of ICC dimensions on IC. Knowledge-intensive assets can level up new business opportunities for manufacturing SMEs to build innovation capabilities. Furthermore, this study finds that HC had an essential effect on IC. HC is the most crucial resource contributing to technological innovation (Sima et al., 2020). The study suggests that manufacturing SMEs should provide more continuous training to their employees, especially in High-Tech core competencies and advanced IT skills.

Indeed, at the level of the national labor market, it necessitates a new set of skills to satisfy the demands of developing forms of employment (such as platforms)

and the imposition of new approaches, particularly in higher education (Taleb & Pheniqi, 2022; Goh, 2020). Automation and robotization of industrial processes will primarily affect workers whose work is repetitive and regular, resulting in the loss of a large number of jobs, disproportionately affecting individuals with a lower level of education (Sima et al., 2020).

Additionally, this current study supports the significance of SC toward IC. It suggests that the top management team should encourage knowledge-sharing practices for their employees to acquire and develop more new knowledge and invest more in High-Tech systems and processes to improve innovation capabilities that lead manufacturing SMEs to be more competitive (Beltramino et al., 2020).

Finally, this paper found a positive relationship between RC and IC. The study findings suggest that manufacturing SMEs should pay more interest to this aspect of ICC. According to previous researchers (Ryu et al., 2021; Cuevas-Rodríguez et al., 2014; Sulistyo & Siyamtinah, 2016), strong collaboration and extensive networking with partners might effectively integrate and reorganize a firm's owned resources to boost innovation capabilities.

Furthermore, the findings of this research suggest that TMT should adopt OI activities (Ryu et al., 2021). OI perspective is a critical framework for developing innovation potential; it supports information integration and external knowledge acquisition. Manufacturing SME executives should embrace the OI mindset to maximize the potential for developing technical innovation skills (Singh et al., 2021).

5. Conclusion

Nowadays, manufacturing SMEs are more diverse than ever, with significant technological advances, new core competencies, and various difficulties related to rising markets and environmental challenges. Many manufacturing SMEs actively seek new valuable resources, such as intellectual capital, to foster long-term innovation capabilities.

This work indicated an urgent need to focus on the value of intellectual capital in the manufacturing sector, especially in High-Tech SMEs. The presence of intellectual capital can contribute to sustainable innovation performance in the IR 4.0 era.

To the authors' knowledge, there is no study on the relationship between intellectual capital and innovative capacity in Moroccan high-tech manufacturing SMEs. Therefore, the present study is an attempt to fill this gap. First, our essay adds to the understanding of innovation in the manufacturing sector. The issue will continue to gain interest. Both academics and industry professionals have recognized the importance of innovation for the competitiveness of the high-tech manufacturing industry. This industry has distinctive qualities, and knowledge

assets are crucial (Bonesso et al., 2020). For these reasons, this paper concludes that innovation in the manufacturing sector depends heavily on the firm's intellectual capital development.

6. Limitations and Future Research Directions

Despite its critical contributions, the research has many limitations. First, our study relied on knowledge assets to derive the innovative capacity of SMEs. However, other factors or variables can be advanced as mediatrices or moderators—such as absorptive capacity, social capital, entrepreneurial orientation, and environmental dynamism—and may contribute to further explaining the ICC-IC relationship (Yeşil & Doğan, 2019; Makhloufi et al., 2021; Cao & Wang, 2015), and to remain variance in the endogenous variable (R^2 = 23.7%). Furthermore, similar studies can be conducted in other national sectors (knowledge-intensive services, public administration, tourism, Fin-Tech) for greater generalizability of findings. Finally, this study employed cross-sectional data. Qualitative methodologies and longitudinal research are necessary for valuable insights into how a manufacturing SME's innovation model changes over time.

Despite limitations, this study can potentially inform future research in various directions, with future studies focusing on environmental and social concerns. This study may add to other environmental aspects (institutional, political, and social impact) to expand the model.

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