

ARTIFICIAL INTELLIGENCE AND SOCIAL CAPITAL AS CATALYSTS OF TECHNOLOGICAL INNOVATION IN SMES: THE POWER OF COLLABORATIVE KNOWLEDGE

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Abstract

In the evolving landscape of small and medium-sized enterprises (SMEs), the strategic integration of social capital and artificial intelligence (AI) emerges as a crucial driver of green technological innovation. Grounded in the Resource-Based View (RBV), this study examines how green human resource management (GHRM) practices cultivate social capital, which in turn fosters tacit green knowledge sharing and enhances innovation outcomes. Drawing on empirical data from SMEs across various industries, the research highlights the structural, relational, and cognitive dimensions of social capital as key enablers of collaborative knowledge flows. The mediating role of green tacit knowledge sharing and the moderating influence of AI are also explored, illustrating AI's capacity to enhance the efficacy and personalization of knowledge-sharing processes when aligned with organizational culture. Findings demonstrate that GHRM significantly impacts social capital development, which positively influences knowledge exchange and green innovation. The study contributes to both theoretical and practical discourse by integrating socio-technological constructs within the RBV framework and offering actionable insights for SME managers aiming to leverage human and AI capabilities for sustainable innovation.

INTRODUCTION

The fast-changing business environment has made innovation a basic source of competitive advantage for small and medium-sized enterprises (SMEs), usually with limited resources, that mainly need to be quick in adapting to survive (O'Regan & Ghobadian, 2005). As many of the innovations are intangible assets these days, social capital-space-the networks, norms, and trust that enable employees to collaborate and share flows of knowledge-is coming to the fore for both

scholars and practitioners (Nahapiet & Ghoshal, 1998). And for SMEs, which are usually less formal in their structures and have more fluid communication, social capital becomes an important aspect in knowledge-based innovation. Empirical investigations into resource-based approaches have proposed social capital as a strategic resource likely to enhance innovation outcomes. According to the RBV (Resource-Based View), a firm can be said to achieve

sustained competitive advantage when it possesses resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Within this view, knowledge-sharing is a principal means of translating social capital into innovative (Grant, 1996).

The organization can better adapt and innovate when employees effectively share ideas, insights, and experiences. Knowledge is taken of the fact that social capital and knowledge sharing are being cascaded by the advent of artificial intelligence in HR and knowledge systems. AI has a dual potential in the knowledge-sharing scenario may enhance this dynamic if properly adopted and managed, or delay it. In this regard, AI plays another interesting moderating role to maximize the achievement of innovation, strengthening social capital through enabling smarter collaboration, real-time analytics, and personalized learning pathways (Dwivedi et al., 2021). Such a social and technological resource interplay becomes obvious within SMEs, where resource limits require an utmost strategic alignment of human and technological capabilities.

How does this contribute to the body of literature? By bringing in a social and technological viewpoint into the RBV paradigm, the way social capital relates to innovation through knowledge sharing, and how AI moderates that relation, this research is towards the understanding of how social capital is carved out. This research could build on strategic HRM insights by giving a practical angle for small and medium businesses, an area mostly overlooked by research, on how such firms could better leverage both human and artificial intelligence to facilitate innovations within their environment.

This study addresses two research questions. First, how does social capital influence innovation in SMEs, and what role do knowledge sharing and artificial intelligence play in this relationship? Second, does knowledge sharing mediate the relationship between social capital and innovation? Our findings contribute to the theory of IT companies and how SMEs function in terms of social capital, knowledge sharing, and innovation, with practical implications for facilitating social capital formation and knowledge sharing in IT companies.

In the past few years, the concept of sustainability/greening is in limelight in both academic and

educational field. Organizations are in a continuous process of adopting sustainable practices for their regular compliance and gaining a competitive advantage globally. For this purpose, organizations are taking green initiatives which reduces the environmental impact and promotes ecofriendly practices at workplace (Farooq Ahmad, 2023).

Green Knowledge sharing is mostly associated with organizational learning, and is also used as a moderator in the organizational behavior aspect. It is defined as the extent of organizational members sharing green knowledge to improve organizational environmental performance (Lin and Chen, 2017). Here, green knowledge sharing acts as a moderator between Green Human Resource Management and Green Behavior (Kalimullah Khan, 2022). Whereas in this study, Green Knowledge Sharing acts as a mediator between Green Training, which is a dimension of Green Human Resource Management

Literature Review and Hypothesis development

GHRM practices are sustainable and contribute in environmentally friendly activities to create sustainability in the organization (TK Shalaka et al., 2022). GHRM, defined by (Opatha, 2013) is "activities which are aimed at developing, implementing and maintaining the ongoing system of the organization for the purpose of making the normal employees as green employees". (Arulrajah et al. 2015) and (Zaid and Jaaron, 2018) state GHRM "is concentrated towards the planned and systematic alignment of the normal HRM system of an organization with the environmentally sustainable objectives". GHRM is considered as a comprehensive outline of corporate social responsibility (CSR), which means that it is the application of HR policies and procedures toward the sustainable utilization of resources and support of environmental sustainability (Bombiak & Marciniuk Kluska, 2018). Moreover, (Opatha and Arulraja, 2014) clinched that GHRM is the orientation of HR functions at all levels of the organization, promoting and implementing green practices towards environmental sustainability. Social capital, then, consists of the networks, norms, and trust that facilitate coordination and cooperation for mutual benefit among people within the right organizations (Nahapiet & Ghoshal, 1998). In small

and medium enterprises (SMEs), where informal relationships and personal trust usually replace rigorous hierarchies, social capital is more essential in achieving collaborative behavior and innovation (Anderson et al., 2007). Given RBV, social capital is an intangible asset and can give a sustainable competitive advantage if properly leveraged (Barney, 1991).

According to the empirical studies, firms with significantly high social capital validate that increased communication, idea exchanges, and creativity are critical barriers to innovation (Maurer et al., 2011). Usually, those interactions result in knowledge recombination and new solutions.

Knowledge sharing implies a process whereby individuals exchange knowledge, experience, and skills across organizational boundaries (Wang & Noe, 2010). Under the RBV umbrella, this is the mechanism through which social capital gets converted into innovative outputs (Grant, 1996). Through social capital, trust and reciprocity develop to lower the barriers to knowledge sharing (Nahapiet & Ghoshal, 1998). In contrast, effective knowledge-sharing practices mediate between different knowledge domains, encouraging creativity and innovation. This connection becomes highly salient in SMEs that rely heavily on socially embedded interactions, where collaborative knowledge becomes unspoken knowledge. Artificial Intelligence (AI) technologies will change the way knowledge is accessed, shared, and made use of in organizations. In the case of SMEs, technologies such as AI-enabled machine learning algorithms, natural

language processing, and recommendation systems are capable of improving the efficiency and personalization of knowledge-sharing processes (Dwivedi et al., 2021). From an RBV angle, AI becomes a technological capability that supplements human and social resources to boost their productivity for innovation. However, the role of AI is contingent - it may either strengthen or weaken the relationship between knowledge sharing and innovation, depending on how well it is aligned with organizational culture and HRM practices (Marouf, 2016).

Research Hypotheses

H1: Green HRM practices positively influence the development of Green Social Capital in organizations.

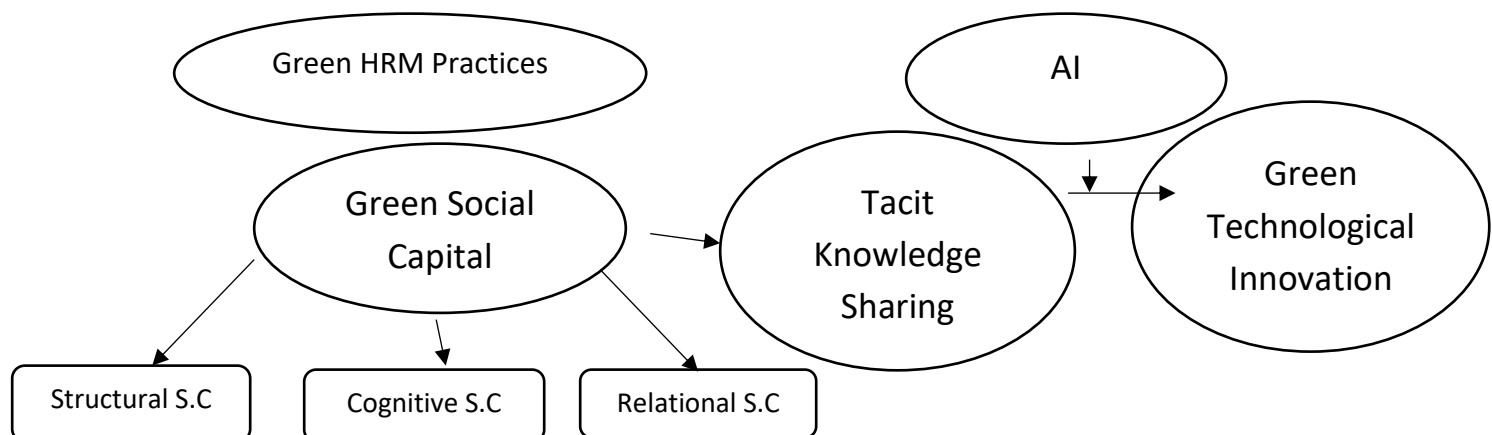
H2: Social capital positively affects the generation and sharing of green tacit knowledge.

H3: Green tacit knowledge sharing has a positive effect on technological innovation.

H4: Green Tacit Knowledge sharing mediates between Green Social Capital and Green Technological innovation.

H5: Green Social capital mediates the relationship between Green HRM practices and green tacit knowledge sharing.

H6: Artificial Intelligence positively moderates the relationship between knowledge sharing and innovation, such that the relationship is stronger at higher levels of AI use.



Proposed**Research Model:**

Research Method: In this research, a quantitative, cross-sectional design is evident to substantiate the relationship among social capital, knowledge sharing, innovation, and artificial intelligence in SMEs. The hypothesis-driven approach will be used to validate the proposed conceptual framework based on the Resource-Based View (RBV). It would seem that the target population is made up mainly of managers, HR professionals, and knowledge workers from small and medium-sized enterprises, meaning those from the IT, Manufacturing industry, and Services sectors. Stratified random sampling will then be employed for proper representation when it comes to different industries and, again, different company sizes, on the number of employees, or based on annual turnover.

The duration for data collection will be approximately 6–8 weeks. The final questionnaire will be put online through professional networks, SME associations, and social media platforms for wider reach. Response rates will be monitored weekly, and reminder emails will be sent to increase participation. At the end of the data collection, responses will be exported to SPSS to undergo cleaning and analysis, during which incomplete or inconsistent responses will be screened out. Once data quality is ensured, descriptive statistics will be computed, and reliability and validity tests will follow. Confirmatory factor analysis (CFA) will demonstrate the measurement model's credibility, while structural equation modeling (SEM) will be employed for testing the direct, mediating, and moderating hypotheses. All analyses will consider the acceptable cut-off values and indices of fit in assessing the adequacy of the model.

Table 1: Hypotheses Results H1-H3

Variables	Beta Values	C R Values	P value	Status
$\beta_1(\text{SC} \leftarrow \text{GHRM})$	0.77	8.22	0.00	Supported
$\beta_2(\text{GTKS} \leftarrow \text{SC})$	0.53	11.2	0.00	Supported
$\beta_3(\text{GTI} \leftarrow \text{GTKS})$	0.61	9.24	0.00	Supported

*** $p \leq 0.05$

In the above cited hypothesis which shows GHRM has a significant effect on SC with the beta value of 0.77 and CR value is 8.22 indicated the significant level and hypothesis has been accepted. Similarly, in H2 SC has a significant positive effect on GTKS with the beta value of 0.53 and CR value is 11.2. However, the third hypotheses indicated that GTKS has again positive effect on GTI with the beta value of 0.61.

Table 2: Mediation Analysis H4-H5

Variable	Total Effect (C)	Direct Effect (C')	Indirect effect (ab)	Result	Mediation status
GHRM-SC-GTKS	$\beta = .214$ $p = 0.00$	$\beta = .541$ $p = 0.002$	$\beta = .751$ $p = 0.001$	Significant	Partial
SC-GTKS-GTI	$\beta = .669$ $p = 0.00$	$\beta = .214$ $p = 0.021$	$\beta = .225$ $p = 0.00$	Significant	Partial

*** $p \leq 0.05$

In the mediated analysis the fourth hypothesis of GHRM, SC and green tacit knowledge sharing has been accepted the beta value of .214 and the significant value of this is 0.00. While the secondly, mediated hypothesis is also partly accepted with the beta value of .669 at the same significant level.

Table 3 Green Tacit Knowledge Sharing on Green Technological Innovation through Artificial Intelligence.

	Consequent							
		M (AI)				GTI (Rep. Int.)		
Antecedent		Coeff.	SE	P		Coeff.	SE	P
M (AI)		—	—	—	b_1	0.235	0.457	< 0.00
V (GTI)					b_2	0.665	0.041	<.006
M X V		---	---	--	b_3	0.147	0.002	0.021
Constant	i_1	2.397	.0521	< .000	i_2	2.147	0.615	<.000

The above analysis shows that AI plays a very criticle role in transformig of GTKS into Technologiccal innovation with the significant interection term at .002 level, which indicate a partial moderation.

Discussion and Findings

Presnet study indicates that underscore of the significant role that social capital plays in fostering innovation within SMEs, particularly through the mediating influence of knowledge sharing. Structural, relational, and cognitive dimensions of social capital collectively enhance the collaborative environment necessary for the generation and exchange of ideas. These findings support earlier works (Nahapiet & Ghoshal, 1998; Maurer et al., 2011) by confirming that trust, shared understanding, and network ties within SMEs directly contribute to their innovative capacity.

The mediating effect of knowledge sharing strengthens the theoretical proposition that innovation is not solely a product of having social resources but also of how effectively those resources are translated into actionable knowledge. This reinforces the resource-based view (RBV), where intangible assets like social capital only yield competitive advantage when they are actively leveraged—through knowledge flows—into tangible outcomes like innovation.

A novel contribution of this study is the moderating role of Artificial Intelligence (AI). When AI tools are strategically integrated, they significantly enhance the efficiency, reach, and personalization of knowledge-sharing practices. AI thus acts as a technological enabler, facilitating smarter collaboration and decision-making processes within SMEs. However, the moderating role is context-dependent; the effectiveness of AI hinges on alignment with

organizational culture, employee readiness, and strategic goals. Poor implementation or lack of alignment can neutralize or even hinder knowledge flows, highlighting the dual potential of AI as both an enabler and a barrier.

These results contribute to the emerging literature that seeks to merge social and technological perspectives within strategic GHRM and innovation studies. They suggest that innovation in SMEs is best understood as a socially embedded process that can be technologically accelerated, provided the socio-technical interface is well-managed.

Conclusion

This study concludes that social capital is a key strategic resource for SMEs seeking to innovate in today's dynamic business environment. When supported by effective knowledge sharing and further enhanced by the appropriate use of AI, SMEs can overcome resource constraints and build sustainable innovation capabilities.

The study contributes to the RBV literature by offering a nuanced perspective that integrates human, social, and technological capital. Practically, it provides a roadmap for SME managers and HR practitioners: invest in building trust-based networks, promote a culture of sharing, and strategically deploy AI to support—not replace—human collaboration.

Future research may explore longitudinal impacts, sector-specific dynamics, and the role of organizational readiness in moderating AI's influence on innovation outcomes.

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