Impact of Tangible Resources and Human Resources AI Driven Capabilities on Innovative Behavior: Exploring the Moderating Role of Digital Leadership among Supply Chain Professionals

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Abstract: The Inclusion of artificial intelligence (AI) brings numerous changes in the management of organizational operations as well as employee outcomes. Subsequently, it influences the innovative behavior (IB) of professionals working in the supply chain (SC). Hence, in the recent organizational setting, digital leadership plays a crucial role in implementing AI capabilities and IB. However, limited studies exist that examine AI-driven capabilities linked to IB among supply chain professionals working in the Pakistani organizational setup from the lens of resource-based theory (RBT). Hence, this study examines the link between AI-driven capabilities including tangible and human resources and IB with the moderating role of digital leadership (DL). In order to conduct this study, a quantitative (deductive) approach was adopted. In addition, data were gathered from 452 supply chain professionals (SCP) working at different levels in the service sector of Pakistan. In addition, for data gathering, a survey design was executed. In order to implement the survey design around 600 questionnaires were disseminated. Of 600 disseminated questionnaires, only 472 were received in completed form. After assessment, only 452 were found fit for analysis using Smart PLS 4.0 to assess the validity and reliability as well as the relationship among variables. The analysis showed that increased tangible resources and human resources driven AI capabilities amplify the IB of supply chain professionals. Moreover, DL moderates the link between tangible resources and human resources driven AI capabilities and IB of supply chain professionals. This study examines the two critical resources that drive AI capabilities including tangible resources and human resources. This study will help practitioners develop strategies to

build and train supply chain professionals for the execution of AI-related capabilities that can aid in spurring IB. Our study adds to the extant literature as little attention has been given to AI-driven capabilities that intricate resources from the lens of RBT. Moreover, no previous study has been conducted on assessing the AI-driven capabilities that affect IB by exploring the moderating role of DL among SC professionals.

Keywords: Digital Leadership, Innovative Behavior, Resource-Based Theory, AI-Driven Capabilities, Human Resources, Tangible Resources, Supply Chain Professionals.

Introduction

Living in the era of digitization, organizations are now moving to take first mover advantage through implementing industry 4.0 emerging technologies to enhance supply chain operation and innovation (Lamees & Ramayah, 2025). So, the execution of such technology in the form of (AI) not only helps to be innovative but amplifies the supply chain agility and resilience to be the first mover to incorporate technologies among the competitors like AI (Lamees & Ramayah, 2025; Lin et al., 2020). Thus, organizations are prioritizing to integrate AI in order to fuel their operations with big data analytics and its management (Davenport and Ronanki 2018; Sharma et al. 2024). So, AI aids in transforming the management process by timely assessing a larger amount of information to accomplish goals efficiently (Haefner et al., 2021). This leads to broadening the horizon of innovative reach, which is viewed as a human assignment to gain a competitive edge by displaying innovative behavior (IB) (Verma and Singh, 2022).

Referring to the extant literature, an organization can gain market visibility by having exclusive resources as well as capabilities that arise through merging and executing a diverse set of resources taken from internal or external sources (Schryen 2013; Gupta and George 2016; AL-khatib and Ramayah 2025). Grounded on this tributary of research, AI-driven capabilities are viewed as a resource that can be acquired from the market to combine with other resources for efficient working. Mikalef and Gupta (2021) elaborated on AI capability as the organizational ability to choose, arrange and leverage resources specifically focused on AI. As per the early reports, organizations need to blend human, physical, and organizational resources to make AI capable of conveying value to differentiate organizations from their competitor (Chui and Malhotra, 2018; Ransbotham et al., 2018). Thus, viewing the AI capabilities from the organizational context integrates resources like human resources and tangible resources and how these resources affect innovative behavior is yet to be explored in different contexts (Mariani et al., 2023).

Accordingly, AI can be a potential aspect that adds value to the business on one side (Ransbotham et al., 2018), and it can lead to improved IB on the other side as well (Verma and Singh, 2022). A large number of articles are presented by researchers on AI and SC resilience and performance (Belhadi et al., 2022), supply chain agility and innovation (Lamees & Ramayah, 2025), and digital supply chain performance (AL-khatib & Ramayah, 2025). However, it is unclear in what way the AI driven capabilities affect IB of supply chain professionals. So, contemporary organizations are executing new technologies like AI for which employees are required to adapt and accept change in order to implement innovative ideas in the digital era to respond to the customer's needs (Mustak et al., 2021), and yet it needs to be assessed how IB can be affected by AI (Kakatkar et al., 2020). Thus, to address this gap, in our study, two resources including human resources and tangible resources are taken to examine the AI capability. To assess how these resources affect IB of supply chain professionals through the lens of Resource-based theory (RBT). As per the prior assessments, RBT is seen as a suitable theoretical lens when a resource is driven to build AI capability to foster

the organization to build the capabilities to manage organizational change innovatively to grasp the competitive advantage (Priem and Butler, 2001).

Among all the myriads, the most crucial facet in the execution of AI capabilities is the role of leadership. Leadership is viewed as intellectually demanding behavior to shape abilities to facilitate innovative thinking and a work environment to acquire knowledge and technology (Khan and Aslam, 2012). So, in the process of implementing new ideas and technology; the role of digital leadership might be a crucial aspect leading to bring ease in the adoption and enhancement of IB (Erhan et al., 2022), and leadership support and awareness about digital aspects is perceived positively by employees, especially for the espousal of new technologies (Dhamija and Bag, 2020; Tortorella et al., 2023). It has been found that leadership that supports AI has an impact on team effectiveness, and as a result, behavior might improve (Rožman et al., 2023).

Our paper makes several contributions: Firstly, two resources are integrated into the model to examine AI capabilities including human resources and tangible resources. Secondly, the impact of AI-driven capabilities on IB of SC professionals in the presence of DL. Thirdly, the model is viewed from the theoretical lens of RBT. Therefore, the objectives of this research include finding out the impact of tangible resources driven AI capabilities on IB of supply chain professionals. Furthermore, to assess the impact of human resources driven AI capabilities on IB of SCP. Additionally, the moderating role of DL between tangible resources and human resources driven AI capabilities on IB of supply chain professionals.

Review of Literature

AI Driven Capabilities and Innovative Behavior

AI is an emerging notion from the prior decades, yet it has been explained from different perspectives by researchers in the literature. Primarily, there are two aspects intertwined in AI including the words “Artificial” and “intelligence”. Seeing the different definitions presented in the literature, for instance, Legg and Hutter (2007) elaborated intelligence as the ability to learn, adapt and interact to restore information in order to deal with uncertainties. Furthermore, artificial notion relates to the idea being developed by humans of something that resembles something natural (Walter, 2008).

Likewise, AI is the system's ability to interpret data that can be used to forecast and attain the preset organizational and employees related innovative goals (Dwivedi et al. 2021; Kaplan and Haenlein, 2019). Thus, innovation requires adaptive behavior from an employee that is beyond the consistent job responsibilities (Iqbal et al., 2022; Park and Jo, 2017). In this regard, organizations put efforts into helping employees display IB with management support. Therefore, IB refers to an individual act towards creating, processing and implementing new ideas to improve supply chain operations (Bos-Nehles & Veenendaal, 2019; Suhana et al., 2020). Hence, complementary resources might be required to improve IB of supply chain professionals.

Additionally, Fountaine et al. (2019) explained that interdepartmental coordination and the presence of skilled analytical experts including both technical as well as managerial support are needed to execute such technologies (Chui and Malhotra, 2018) and help to realize business value extracted from the investment in AI (Ransbotham et al., 2018), resulting in improved IB (Wang, 2024). There are two categories of resources: tangible (data, technology and basic resources) and human resources (technical and business skills) (Grant 199; Mikalef and Gupta, 2021), and these

resources together constitute AI capabilities. The next section entails the link between resources and innovative behavior from the view of RBT (Barney, 2001).

Considering the RBT literature, resources that can be sold or bought in the market are known as tangible resources, for instance, "equipment", "facilities" and "financial assets". These resources are considered indispensable resources but it is not enough to produce capabilities (Barney, 1991). These resources include data, technology, and basic resources. Data is a crucial resource and corporate asset (Ransbotham et al., 2018). Consequently, in AI the conjunction of big data is now shaping the value of business derived from the data resources they have within the organization (Bean, 2017). This specifies that quality data is needed in such a way that algorithms are developed to deliver value (Alonso, 2015). Data can be divided into internal and external data levels (Zhao et al., 2014). So, internal data contains all details about organizational operations like accounting and sales, human resource management, supply chain and production, as well as manufacturing. On the other side, external data is not related directly to the organizational operations, yet it brings insights regarding the competitive advantage in the contemporary situation where the organization operates.

Viewing the technological perspective, data sources are essential to building infrastructure to implement AI applications. This helps in storing, processing, transferring and saving the data throughout the stages from acquisition to implementation in the organizational processes. For this, infrastructure is needed to support the execution of AI (Bayless et al., 2020). An organization usually invests in infrastructure development to process large amounts of data and algorithms using emerging technology (Nurvitadhi et al., 2017). Nowadays, numerous organizations are investing in and implementing cloud-based algorithms to strengthen AI infrastructure (Del Sole, 2018). Therefore, investment in infrastructure development for the execution of AI technologies can help employees be better able to innovate and display better performance.

For AI execution, apart from the investment in the data as well as technological infrastructure, it is important to prioritize time as a resource to invest financial resources in real time to achieve the intended outcomes. Organizations are now focusing on executing AI technologies, and it will take time to mature and yield outputs related to employees as well as the organization (Pereira et al., 2023; Richey et al., 2023). Apart from time as a resource, financial resources are also needed to acquire, develop and execute AI initiatives. As per the report presented by McKinsey, digital spending on AI initiatives was less than one-tenth (Chui and Malhotra, 2018). However, the allocation of financial resources for the commencement of AI projects is an essential aspect. It helps employees to use AI applications in the presence of a technological setup. However, it might be a challenge for employees as well as the organization to adapt swiftly to the emerging changes (Bibi, 2019; Davenport and Ronanki, 2018). As per Mikalef and Gupta (2021) and Schryen (2013), time and investments are considered basic resources that are primarily needed to create the capability for AI initiatives (Gupta and George, 2016).

Human resources are the main asset of an organization, and they are measured through knowledge as well as skill set and experience (Shela et al., 2021). From the human resources perspective, prior research on digital capabilities has recognized two important skill sets including technical and business skills (Bharadwaj, 2000; Ravichandran et al., 2005). In a parallel vein, our study is focused on technical and business skills as they are important aspects of human resources needed for AI initiatives and display of IB. Technical skills include knowledge about AI algorithms, data

structures, hardware and software (Spector and Ma, 2019), programming, and processing needed for AI implementation (Lesgold, 2019).

Three key roles are identified by the investigators that will come under the canopy of technical skills required for AI, such as trainers, explainers and sustainers (Wilson et al., 2018). Therefore, trainers are concerned with teaching AI systems (e.g., chatbots and resolve human communication). Explainers fill the gap between technologists and business managers to provide direction about AI systems to non-technical audiences. Sustainers are responsible for ensuring the AI system is operating well and resolving unexpected issues if they occur. However, these resources are scarce, but competency can be developed with the help of training and education (Danyluk and Buck, 2019).

In the adoption of AI technologies, the most common hindrance seen in organizational settings is the lack of managerial knowledge and skills about business operations concerning where and how to apply AI technologies (Fountaine et al., 2019). One of the major factors that can affect AI initiative adoption is role leadership and skill set (Ransbotham et al., 2018). This means that realizing the value of AI adoption requires a greater level of support from leadership having the skill set to opt for the digital technologies like AI. So it is the responsibility of the manager to be acquainted with AI technologies and their link with different organizational functions (Rudko et al., 2021). Accordingly, the role of leadership as well as skills is very crucial as a threat posed by AI execution is the replacement of jobs from humans to AI (Bibi, 2019). Therefore, being able to manage change the leaders with appropriate skill sets will not only help organizations to manage change effectively.

This change can help in the enhancement of service quality (Davenport and Ronanki, 2018), improved decision-making (Iansiti and Lakhani, 2020), organizational practices (Boden, 2016), and promoting innovation (Brougham and Haar, 2018). It is further argued how resources are managed to promote IB (Ayoko, 2021; Mousa et al., 2023). The above-mentioned arguments indicate that AI capabilities might influence IB in organizations (Cockburn et al., 2018). As per the review conducted by Haefner et al. (2021), innovations can be improved through AI execution in organizations. On the other side, Liang et al. (2022) found that AI can be a factor that inhibits IB (strain path) due to the presence of emotional exhaustion; however, through using a motion pathway the IB can be improved as a result. This means AI execution has implications in the organizational setting for employees' outcomes, i.e., IB, as well as for leaders (Ayoko, 2021). However, limited literature exists in which tangible resources AI driven capabilities (TRAICs) and human resources driven AI capabilities (HRAICs) that affect IB of supply chain professionals are examined. Thus, to see the above-mentioned link, the following hypotheses were framed:

Hypothesis 1: TRAICs affect innovative behavior.

Hypothesis 2: HRAICs affect innovative behavior.

Moderating Role of Digital Leadership

Digital leadership (DL) is defined as a way of collaborating with employees as compared to a traditional leadership style (De Araujo et al., 2021). So, in the digital milieu, the skill sets are changing and the role of the leader is shifting from hierarchical context to facilitating collaboration and increasing the agility of projects (Kane et al., 2019). The prime base of DL contains the elements of task achievement in the form of developing a digitally savvy environment for

collaborative working to achieve long-term goals (Tigre et al., 2023). Thus, in the changing environment, a digital leader is well suited to drive innovation and creativity and move ahead (Gozman and Willcocks, 2019; Hassani et al., 2017). This means that to connect with AI emergence along with a focus on innovation, leadership is needed to deal with algorithms and help team members improve their behavior and work related outcomes (Quaquebeke and Gerpott, 2023). Moreover, in doing so, the presence of DL can also aid in shaping performance and IB through the use of information and data to identify different patterns in AI-driven capabilities (Munir et al., 2023). Therefore, DL's role is to provide autonomy to its team to share innovative ideas to adapt in a continually changing environment (Pulley et al., 2002). Consequently, the provision of digitizing the digital platforms and the presence of DL aids in improving the innovation (Benitez et al., 2022). Moreover, leaders with digital skills may have a crucial role in improving IB (Erhan et al., 2022) and help in adapting these disruptive and risky initiatives like AI (Abbu et al., 2022; Chatterjee et al., 2022). Tough, scarce evidence exists for the moderating role of DL between AI capabilities and IB among supply chain professionals. Therefore, in our study, digital leadership is seen as a moderator. Thus, the subsequent hypotheses were framed.

Hypothesis 3: Digital leadership moderates the link between TRAICs and innovative behavior.

Hypothesis 4: Digital leadership moderates the link between HRAICs and innovative behavior.

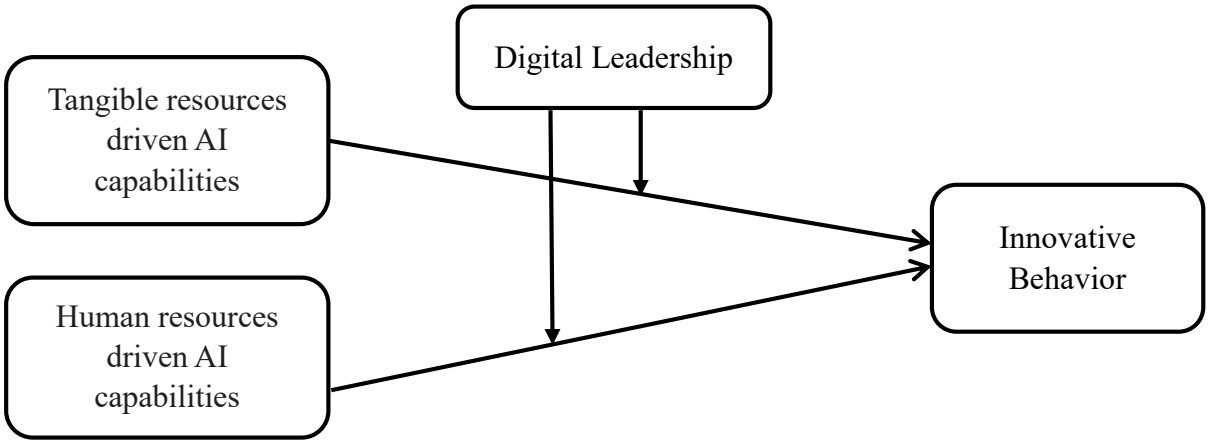

Figure 1 Research Framework

Materials and Methods

In our study, the data were collected from supply chain professionals working in the service sector of Pakistan, particularly those who have been working for more than five years. Supply chain professionals working across organizations were approached and consent was taken by explaining the purpose of the study. Among all, 59.3% of the professionals are from the healthcare sector, 30.3 % are from the IT sector, and 10.4% are from the banking sector. Moreover, the questionnaire was disseminated among 600 respondents. Hence, we received 452 in complete form. The response

rate for our study is 75.3%, which is considered good for analysis. Out of 452 respondents, 60% were male and 40% were female representing the sample. The data gathering process was completed between October 2024 to January 2025. AI capabilities include sixteen items of tangible resources and fourteen items for human resources were adopted from a scale developed by Mikalef and Gupta (2021). To measure DL, nine items were taken from Büyükbeşe et al. (2022). To assess IB six items were taken from Monica Hu et al. (2009). To assess the collected data, the tools used for analysis were SPSS for descriptive analysis, whereas Smart PLS 4 was used to assess the measurement model (reliability and validity) and structural model to specify the relationship among the study variables. These tools were chosen to employ a variance based technique that helps to assess the survey based data and overcome the limitations of CB SEM as elaborated by Hair et al. (2022); Legate et al (2023) and Wilden et al (2013).

RESULTS

According to correlation results, the values among the variables are signification and no issues of collinearity as values were less than 0.85. Values are shown in table 1.

Table 1: Correlation analysis

		DL	TRAICs	HRAICs	IB
DL	Pearson's r	—			
	p-value	—			
TRAICs	Pearson's r	0.397	—		
	p-value	< .001	—		
HRAICs	Pearson's r	0.418	0.036	—	
	p-value	< .001	0.449	—	
IB	Pearson's r	0.704	0.498	0.514	—
	p-value	< .001	< .001	< .001	—

Table 2 shows the measurement model specifying the validity and reliability. Following the recommendation of Hair et al (2019), factor loadings and alpha values greater than 0.70 were retained, and low factor loading items were removed as per the recommendation of Hair et al. (2014) and Alzahrani (2020). In addition, AVE values were greater than 0.70; thus construct validity was supported (Henseler et al., 2015). Furthermore, figure 2 shows the PLS SEM model.

Table 2: Measurement model (validity and reliability)

Constructs	Loadings	Cronbach alpha	Composite Reliability	AVE
HRAICs1	0.85	0.955	0.959	0.655
HRAICs2	0.78			
HRAICs3	0.89			
HRAICs4	0.876			
HRAICs5	0.755			
HRAICs6	0.861			
HRAICs7	0.838			

HRAICs8	0.741			
HRAICs10	0.808			
HRAICs11	0.721			
HRAICs12	0.827			
HRAICs13	0.838			
HRAICs14	0.707			
TRAICs1	0.795	0.956	0.963	0.638
TRAICs3	0.806			
TRAICs4	0.734			
TRAICs5	0.814			
TRAICs6	0.737			
TRAICs7	0.822			
TRAICs8	0.701			
TRAICs10	0.886			
TRAICs11	0.826			
TRAICs12	0.779			
TRAICs13	0.842			
TRAICs14	0.89			
TRAICs15	0.76			
TRAICs16	0.76			
DL1	0.773	0.943	0.946	0.685
DL2	0.871			
DL3	0.852			
DL4	0.757			
DL5	0.843			
DL6	0.816			
DL7	0.821			
DL8	0.851			
DL9	0.858			
IB1	0.817	0.907	0.910	0.682
IB2	0.811			
IB3	0.801			
IB4	0.838			
IB5	0.823			
IB6	0.864			

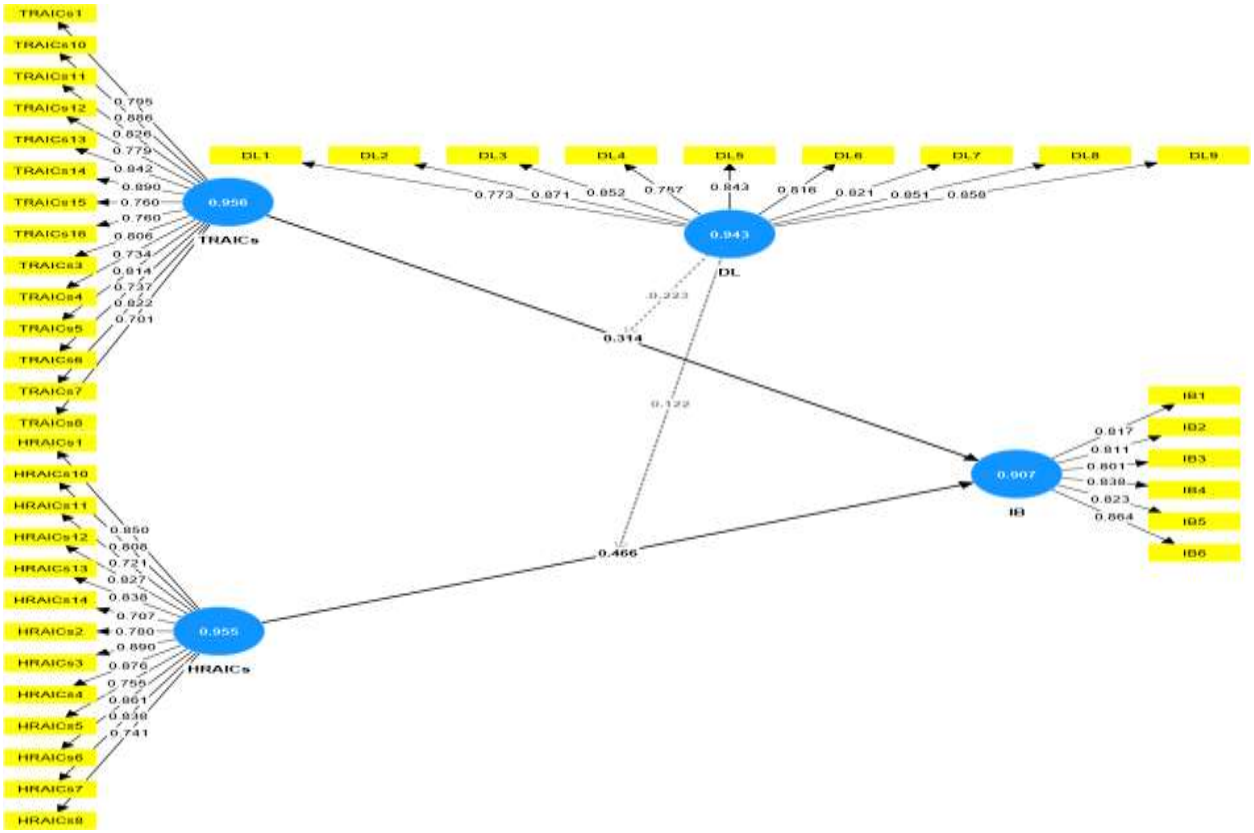

Figure 2: Measurement model

In addition, the discriminant validity was assessed using the HTMT ratio. As per the results, there are no issues of discriminant validity as the HTMT ratio of correlation was less than 0.85 among all the variables (Henseler et al., 2015). HTMT values are shown in Table 3.

Table 3: Discriminant validity

	1	2	3	4	5	6
DL (1)						
HRAICs (2)	0.448					
IB (3)	0.757	0.555				
TRAICs (4)	0.427	0.067	0.547			
DL x TRAICs (5)	0.247	0.111	0.338	0.149		
DL x HRAICs (6)	0.073	0.43	0.092	0.08	0.006	

As per the analysis of data, the r square value indicates that 71.8% variability in the IB was due to the presence of DL, TRAICs, and HRAICs. Furthermore, TRAICs have a significant impact on IB as beta=0.314 and p=0.000. Moreover, HRAICs also have a meaningful impact on IB as beta=0.466 and p=0.000. In addition, DL strengthens the link between HRAICs and IB, whereas DL weakens the link between TRAICs and IB. Hypothesized relationships are mentioned in Table 4 with lower and upper limits of confidence interval (LCI and UCI). Furthermore, the moderating (interaction) between DL, TRAICs, HRAICs and IB are shown in Figure 2 and Figure 3 and the model figure is shown in Figure 4.

Table 4: Hypothesis testing

Hypotheses Relationship	beta	Std Dev	t values	P values	LCI	UCI
R^2 Value	0.718					
H1: TRAICs →IB	0.314	0.036	8.838	0.000	0.248	0.386
H2: HRAICs →IB	0.466	0.046	10.143	0.000	0.376	0.555
Moderation effect						
H3: TRAICs→ DL→IB	-0.223	0.033	6.761	0.000	-0.285	-0.155
H4: HRAICs→ DL→IB	0.122	0.027	4.579	0.000	0.066	0.170

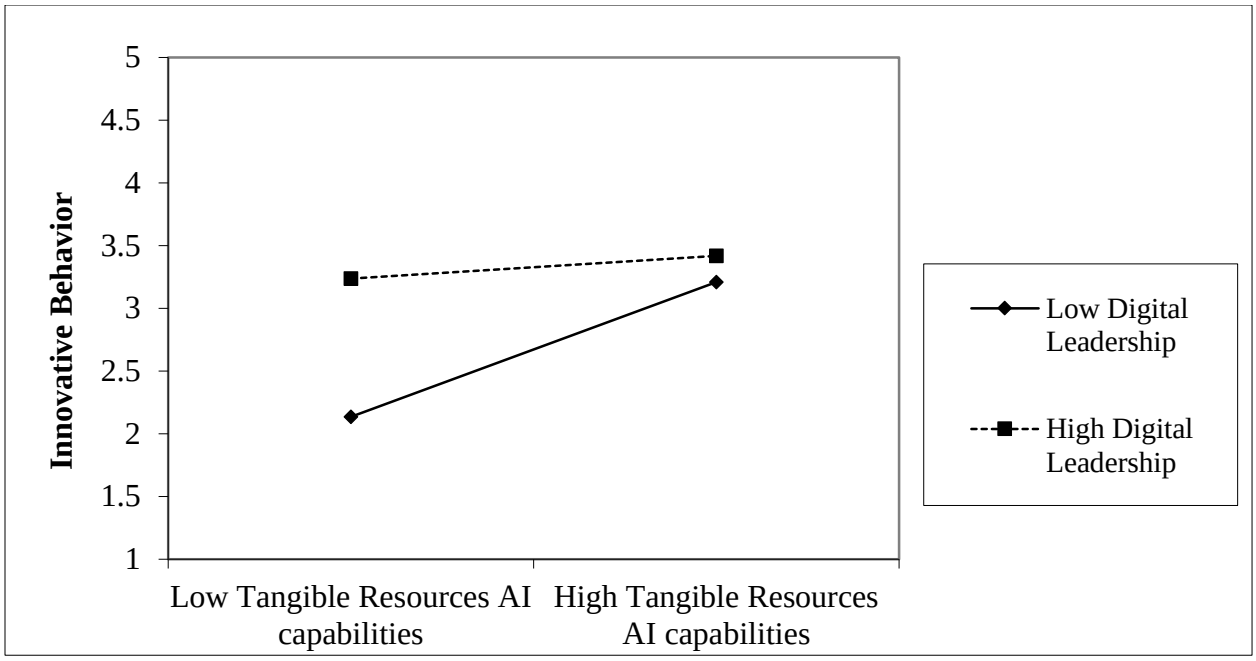

Figure 2 Moderating the role of digital leadership between TRAICs and IB

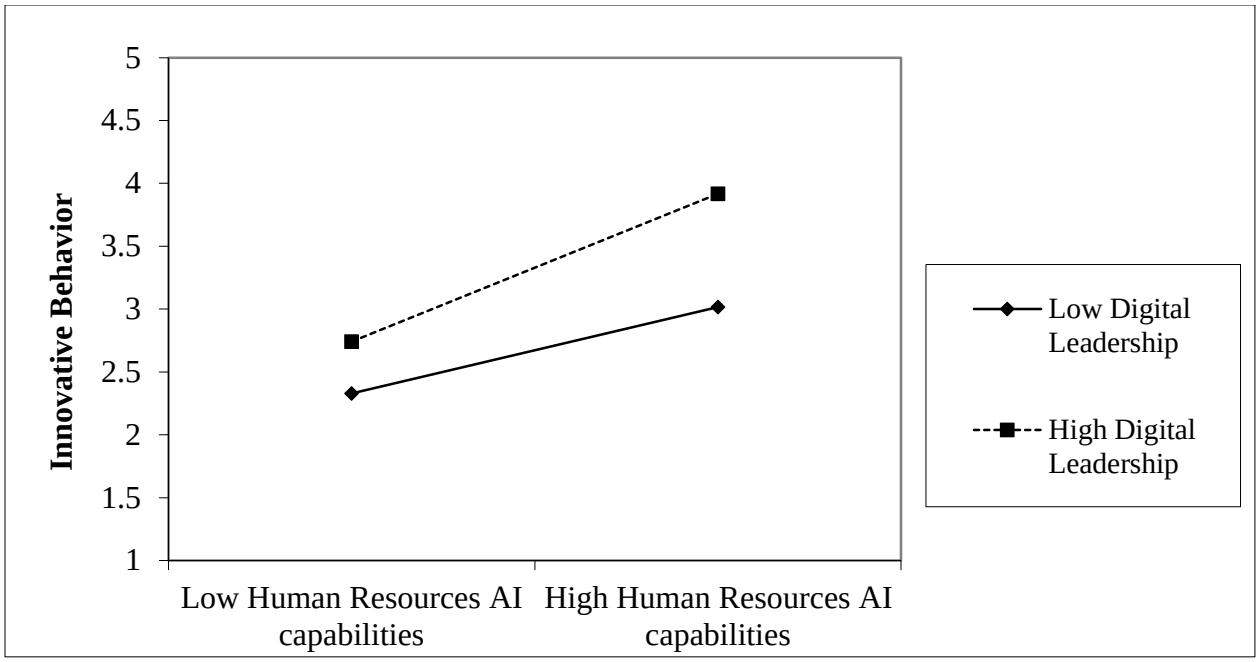

Figure 3 Moderating the role of digital leadership between HRAICs and IB

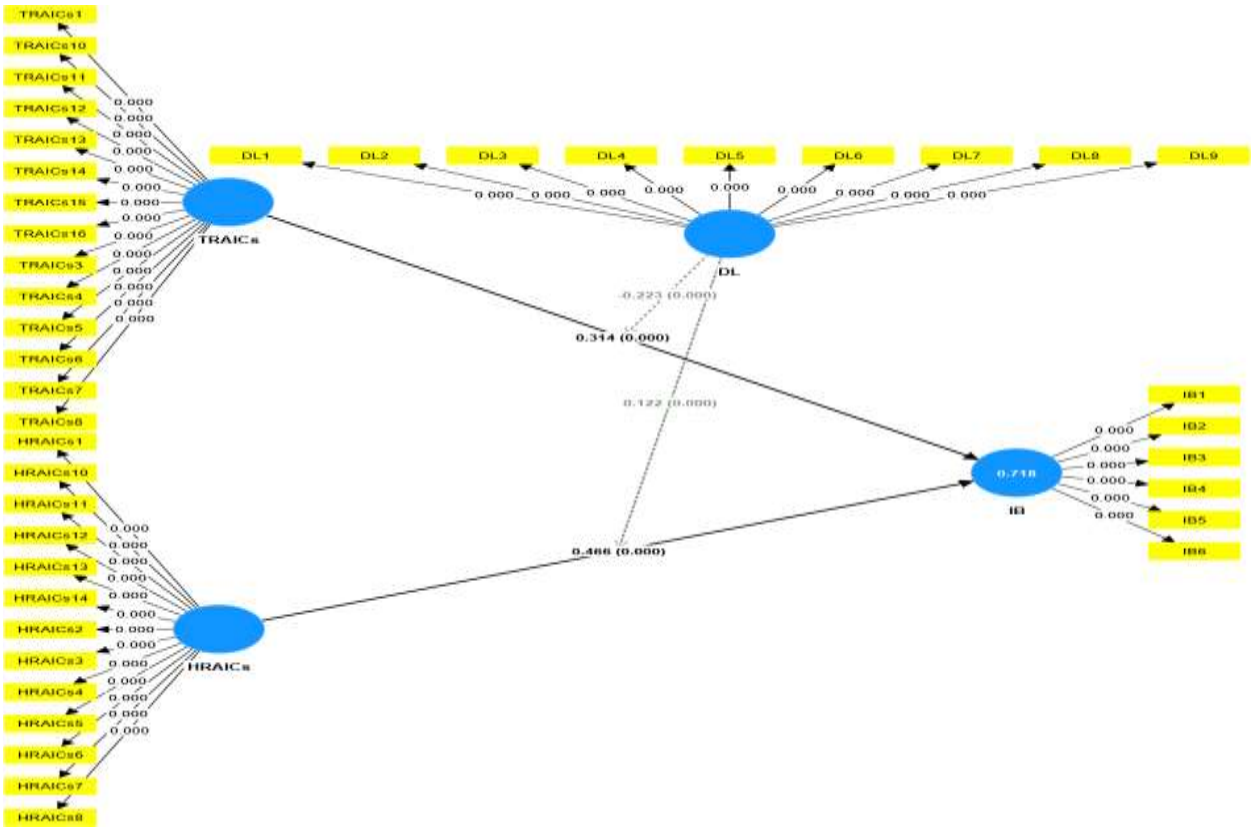

Figure 4 Structural model

Discussion

In this research, one of the important aspects was assessed as limited research is conducted on the analysis of AI capabilities from the view of tangible and human resources on IB of SC professionals working in the context of the service sector of developing countries like Pakistan along with the moderating role of DL. Concerning the significance of AI capabilities in the service sector, as per the results, it is evident that tangible and human resources AI capabilities are a potential predictor in augmenting IB of SC professionals. Moreover, viewing the practice-based studies, they accentuated the significance of complementary resources (Fountaine et al., 2019) such as interdepartmental coordination and the presence of skilled experts can work well within the organization when implementing AI (Chui and Malhotra, 2018), and it can lead to amplify the IB. This means that the presence of these resources can help supply chain professionals display IB working in service organizations can help to gain a competitive advantage.

Our study adds to and supports the theoretical lens regarding organizations' resources-driven AI capabilities that can lead to improving IB from the lens of RBT (Barney, 2001). In addition, the role of DL between AI capabilities and IB plays a crucial role. As it is evident that leadership having digital traits can collaborate well with employees as compared to traditional leadership (De Araujo et al., 2021), this will aid in achieving innovation and creative behavior (Gozman and Willcocks, 2019; Hassani et al., 2017). This means leadership support can strengthen AI implementation and help team members display IB to deal effectively with change (Quaquebeke and Gerpott, 2023). This specifies that leadership or managers need to develop the skill to be tech-savvy to innovate effectively by developing capabilities (Munir et al., 2023) and aid in improving innovation (Benitez et al., 2022). Thus, DL support can help in developing AI capabilities within organization which in turn improves IB of supply chain professionals.

Conclusion

AI is changing the dynamics of organizations, so it is important to view how AI driven capabilities can aid in IB of supply chain professionals. It is concluded that AI capabilities including TRAICs, and HRAICs have a significant impact on IB of SC professionals working in the service sector of Pakistan. Our study supported the theoretical lens of RBT. The provision of resources can aid in attaining a competitive advantage through the development of AI capabilities and display of IB. Moreover, DL is found to be a significant moderator between TRAICs, and HRAICs and IB. In the era of emerging technologies, it is now important for organizations to execute such technologies to achieve a competitive edge over others on one side but also focus on how to build the leadership and employee competencies to deal with such technological change effectually through the provision of training to supply chain professionals on the other side in developing country like Pakistan. Our study makes the following theoretical contributions. Firstly, AI capabilities are measured through TRAICs, and HRAICs and how these resources affect IB is evident and adds to the literatures as per the recommendation of Mariani et al (2023). Furthermore, our study adds to the extant literature on AI driven capabilities and IB from the lens of RBT along with DL as a moderator between AI driven capabilities and IB.

In the era of digital technology and digitalization, AI capabilities can help to develop supply chain professionals' competency and transform the business model to achieve organizational goals. This study will help to develop strategies to build the TRAICs and HRAICs that can aid in spurring the IB of supply chain professionals by devising a training program to inculcate the importance of digitalization among supply chain professionals as well as leaders before major transformation occurs. So that both can work in a synchronized manner to achieve the organizational goals. Still,

AI is in the early stages. However, still more changes will come with organizational process transformations. Moreover, to deal with digitization, leaders can play a crucial role in the organizational transformation process by providing training to supply chain professionals that will help them to deal effectively with such technological change.

This study is limited to service organizations, future researchers may examine it in other sectors to further expand the AI-related studies. Moreover, other types of resources may also be examined such as intangible resources. Moreover, in the current study data was collected from supply chain professionals only, future researchers may collect data from organization leaders. In addition, data were collected at one point in time which may result in endogeneity issues. To address this concern future studies may examine the data set using a longitudinal aspect.

References

Abbu, H., Mugge, P., Gudergan, G., Hoeborn, G., & Kwiatkowski, A. (2022). Measuring the Human Dimensions of Digital Leadership for Successful Digital Transformation. *Research-Technology Management*, *65*(3), 39–49. https://doi.org/10.1080/08956308.2022.2048588

AL-khatib, A. wael, & Ramayah, T. (2025). Artificial intelligence-based dynamic capabilities and circular supply chain: Analyzing the potential indirect effect of frugal innovation in retailing firms. *Business Strategy and the Environment*, *34*(1), 830–848. https://doi.org/10.1002/bse.4018

Alonso, O. (2015). Challenges with Label Quality for Supervised Learning. *Journal of Data and Information Quality*, *6*(1), 2:1-2:3. https://doi.org/10.1145/2724721

Alzahrani, H. (2020). A Comparison of Three Models in Multivariate Binary Longitudinal Data Analysis: Application to FDCS Study. *OALib*, *07*(02), 1–13. https://doi.org/10.4236/oalib.1106030

Ayoko, O. B. (2021a). Digital Transformation, Robotics, Artificial Intelligence, and Innovation. *Journal of Management & Organization*, *27*(5), 831–835. https://doi.org/10.1017/jmo.2021.64

Ayoko, O. B. (2021b). SMEs, innovation and human resource management. *Journal of Management & Organization*, *27*(1), 1–5. https://doi.org/10.1017/jmo.2021.8

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, *27*(6), 643–650. https://doi.org/10.1177/014920630102700602

Bayless, S., Kodirov, N., Iqbal, S. M., Beschastnikh, I., Hoos, H. H., & Hu, A. J. (2020). Scalable constraint-based virtual data center allocation. *Artificial Intelligence*, *278*, 103196. https://doi.org/10.1016/j.artint.2019.103196

Bean, R. (2017). How Big data is empowering ai and machine learning. *MIT Sloan Management Review*, *8*. https://scholar.google.com/scholar_lookup?title=How%20big%20data%20is%20empowering%20ai%20and%20machine%20learning%20at%20scale&publication_year=2017&author=R.%20Bean

Belhadi, A., Kamble, S., Fosso Wamba, S., & Queiroz, M. M. (2022). Building supply-chain resilience: An artificial intelligence-based technique and decision-making framework.

International Journal of Production Research, *60*(14), 4487–4507. https://doi.org/10.1080/00207543.2021.1950935

Benitez, J., Arenas, A., Castillo, A., & Esteves, J. (2022). Impact of digital leadership capability on innovation performance: The role of platform digitization capability. *Information & Management*, *59*(2), 103590. https://doi.org/10.1016/j.im.2022.103590

Bharadwaj, A. S. (2000). A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation. *MIS Quarterly*, *24*(1), 169–196. https://doi.org/10.2307/3250983

Bibi, M. (2019). Execution of Artificial Intelligence Approach in Human Resource Management Functions: Benefits and Challenges in Pakistan. *Sarhad Journal of Management Sciences*, *5*(1), Article 1. https://doi.org/10.31529/sjms.2018.5.1.8

Boden, M. A. (2016). *AI: Its nature and future*. Oxford University Press. https://books.google.com/books?hl=en&lr=&id=yDQTDAAAQBAJ&oi=fnd&pg=PP1&dq=Boden,+M.+(2016).+AI:+Its+nature+and+future.+Oxford,+UK:+Oxford+University+Press&ots=T1mq4w5aJ7&sig=Rrcj2s0_8HGkTnnb-KomdED_pmA

Bos-Nehles, Anna. C., & Veenendaal, A. A. R. (2019). Perceptions of HR practices and innovative work behavior: The moderating effect of an innovative climate. *The International Journal of Human Resource Management*, *30*(18), 2661–2683. https://doi.org/10.1080/09585192.2017.1380680

Brougham, D., & Haar, J. (2018). Smart Technology, Artificial Intelligence, Robotics, and Algorithms (STARA): Employees' perceptions of our future workplace. *Journal of Management & Organization*, *24*(2), 239–257. https://doi.org/10.1017/jmo.2016.55

Büyükbeşe, T., DiKbaş, T., & Ünlü, S. B. (2022). A Study On Digital Leadership Scale (DLS) Development Dijital Liderlik Ölçeği (Djl) Geliştirme Çalışması. *Journal of Social Sciences of Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Dergisi*, *19*(2), 740–760.

Chatterjee, S., Chaudhuri, R., Vrontis, D., & Jabeen, F. (2022). Digital transformation of organization using AI-CRM: From microfoundational perspective with leadership support. *Journal of Business Research*, *153*, 46–58. https://doi.org/10.1016/j.jbusres.2022.08.019

Chui, M., & Malhotra, S. (2018). AI adoption advances, but foundational barriers remain. *Mckinsey and Company*. https://doi.org/2108

Cockburn, I. M., Henderson, R., & Stern, S. (2018). The Impact of Artificial Intelligence on Innovation: An Exploratory Analysis. In *The Economics of Artificial Intelligence: An Agenda* (pp. 115–146). University of Chicago Press. https://www.nber.org/books-and-chapters/economics-artificial-intelligence-agenda/impact-artificial-intelligence-innovation-exploratory-analysis

Danyluk, A., & Buck, S. (2019). Artificial Intelligence Competencies for Data Science Undergraduate Curricula. *Proceedings of the AAAI Conference on Artificial Intelligence*, *33*(01), Article 01. https://doi.org/10.1609/aaai.v33i01.33019746

DAVENPORT, T. H., & RONANKI, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, *96*(1), 108–116.

de Araujo, L. M., Priadana, S., Paramarta, V., & Sunarsi, D. (2021). Digital leadership in business organizations. *International Journal of Educational Administration, Management, and Leadership*, 45–56.

Del Sole, A. (2018). Introducing Microsoft Cognitive Services. In A. Del Sole (Ed.), *Microsoft Computer Vision APIs Distilled: Getting Started with Cognitive Services* (pp. 1–4). Apress. https://doi.org/10.1007/978-1-4842-3342-9_1

Dhamija, P., & Bag, S. (2020). Role of artificial intelligence in operations environment: A review and bibliometric analysis. *The TQM Journal*, *32*(4), 869–896. https://doi.org/10.1108/TQM-10-2019-0243

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., … Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, *57*, 101994. https://doi.org/10.1016/j.ijinfomgt.2019.08.002

Erhan, T., Uzunbacak, H. H., & Aydin, E. (2022). From conventional to digital leadership: Exploring digitalization of leadership and innovative work behavior. *Management Research Review*, *45*(11), 1524–1543. https://doi.org/10.1108/MRR-05-2021-0338

Fountaine, T., McCarthy, B., & Saleh, T. (2019a). Building the AI-powered organization. *Harvard Business Review*, *97*(4), 62–73.

Fountaine, T., McCarthy, B., & Saleh, T. (2019b). Building the AI-Powered Organization. *Harvard Business Review*, *97*(4), 62–73.

Gozman, D., & Willcocks, L. (2019). The emerging Cloud Dilemma: Balancing innovation with cross-border privacy and outsourcing regulations. *Journal of Business Research*, *97*, 235–256. https://doi.org/10.1016/j.jbusres.2018.06.006

Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, *33*(3), 114–135. https://doi.org/10.2307/41166664

Gupta, M., & George, J. F. (2016a). Toward the development of a big data analytics capability. *Information & Management*, *53*(8), 1049–1064. https://doi.org/10.1016/j.im.2016.07.004

Gupta, M., & George, J. F. (2016b). Toward the development of a big data analytics capability. *Information & Management*, *53*(8), 1049–1064. https://doi.org/10.1016/j.im.2016.07.004

Haefner, N., Wincent, J., Parida, V., & Gassmann, O. (2021a). Artificial intelligence and innovation management: A review, framework, and research agenda☆. *Technological Forecasting and Social Change*, *162*, 120392. https://doi.org/10.1016/j.techfore.2020.120392

Haefner, N., Wincent, J., Parida, V., & Gassmann, O. (2021b). Artificial intelligence and innovation management: A review, framework, and research agenda☆. *Technological Forecasting and Social Change*, *162*, 120392. https://doi.org/10.1016/j.techfore.2020.120392

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). Multivariate data analysis: Pearson new international edition. *Essex: Pearson Education Limited*, *1*(2).

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2022). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage Publications, Thousand Oaks, CA.

Hassani, H., Silva, E. S., & Al Kaabi, A. M. (2017). The role of innovation and technology in sustaining the petroleum and petrochemical industry. *Technological Forecasting and Social Change*, *119*, 1–17. https://doi.org/10.1016/j.techfore.2017.03.003

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*, 115–135.

Iansiti, M., & Lakhani, K. R. (2020). From disruption to collision: The new competitive dynamics. *MIT Sloan Management Review*, *61*(3), 34–39.

Iqbal, A., Nazir, T., & Ahmad, M. S. (2022). Entrepreneurial leadership and employee innovative behavior: An examination through multiple theoretical lenses. *European Journal of Innovation Management*, *25*(1), 173–190. https://doi.org/10.1108/EJIM-06-2020-0212

Kakatkar, C., Bilgram, V., & Füller, J. (2020). Innovation analytics: Leveraging artificial intelligence in the innovation process. *Business Horizons*, *63*(2), 171–181. https://doi.org/10.1016/j.bushor.2019.10.006

Kane, G. C., Phillips, A. N., Copulsky, J., & Andrus, G. (2019). How digital leadership is (n't) different. *MIT Sloan Management Review*, *60*(3), 34–39.

Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons*, *62*(1), 15–25. https://doi.org/10.1016/j.bushor.2018.08.004

Khan, M. J., & Aslam, N. (2012). Leadership Styles as Predictors of Innovative Work Behavior. *Pakistan Journal of Social and Clinical Psychology*, *10*(1), 17–22.

Lamees, A.-Z., & Ramayah, T. (2025). How artificial intelligence-based supply chain analytics enable supply chain agility and innovation? An intellectual capital perspective. *Supply Chain Management: An International Journal*, *30*(2), 233–249. https://doi.org/10.1108/SCM-09-2024-0558

Legate, A. E., Hair Jr, J. F., Chretien, J. L., & Risher, J. J. (2023). PLS-SEM: Prediction-oriented solutions for HRD researchers. *Human Resource Development Quarterly*, *34*(1), 91–109. https://doi.org/10.1002/hrdq.21466

Legg, S., & Hutter, M. (2007). Universal Intelligence: A Definition of Machine Intelligence. *Minds and Machines*, *17*(4), 391–444. https://doi.org/10.1007/s11023-007-9079-x

Lesgold, A. M. (2019). Learning for the age of artificial intelligence: Eight education competences. *Routledge*. https://scholar.google.com/scholar_lookup?title=Learning%20for%20the%20Age%20of%20Artificial%20Intelligence%3A%20Eight%20Education%20Competences&publication_year=2019&author=A.M.%20Lesgold

Liang, X., Guo, G., Shu, L., Gong, Q., & Luo, P. (2022). Investigating the double-edged sword effect of AI awareness on employee's service innovative behavior. *Tourism Management*, *92*, 104564. https://doi.org/10.1016/j.tourman.2022.104564

Lin, R., Xie, Z., Hao, Y., & Wang, J. (2020). Improving high-tech enterprise innovation in big data environment: A combinative view of internal and external governance. *International Journal of Information Management*, *50*, 575–585. https://doi.org/10.1016/j.ijinfomgt.2018.11.009

Mariani, M. M., Machado, I., Magrelli, V., & Dwivedi, Y. K. (2023). Artificial intelligence in innovation research: A systematic review, conceptual framework, and future research directions. *Technovation*, *122*, 102623. https://doi.org/10.1016/j.technovation.2022.102623

Mikalef, P., & Gupta, M. (2021). Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. *Information & Management*, *58*(3), 103434. https://doi.org/10.1016/j.im.2021.103434

Monica Hu, M.-L., Horng, J.-S., & Christine Sun, Y.-H. (2009). Hospitality teams: Knowledge sharing and service innovation performance. *Tourism Management*, *30*(1), 41–50. https://doi.org/10.1016/j.tourman.2008.04.009

Mousa, F.-T., Chowdhury, J., & Gallagher, S. R. (2023). The implications of CEO power on the relationship between firm resources and innovation. *Journal of Management & Organization*, *29*(1), 14–29. https://doi.org/10.1017/jmo.2019.84

Munir, S., Mahmood, G., Abdullah, F., & Noreen, A. (2023). Exploring the Impact of Digital Leadership on Sustainable Performance with Mediating Role of Artificial Intelligence. *Journal of Accounting and Finance in Emerging Economies*, *9*(3), 213–226.

Mustak, M., Salminen, J., Plé, L., & Wirtz, J. (2021). Artificial intelligence in marketing: Topic modeling, scientometric analysis, and research agenda. *Journal of Business Research*, *124*, 389–404. https://doi.org/10.1016/j.jbusres.2020.10.044

Nurvitadhi, E., Venkatesh, G., Sim, J., Marr, D., Huang, R., Ong Gee Hock, J., Liew, Y. T., Srivatsan, K., Moss, D., Subhaschandra, S., & Boudoukh, G. (2017). Can FPGAs Beat GPUs in Accelerating Next-Generation Deep Neural Networks? *Proceedings of the 2017 ACM/SIGDA International Symposium on Field-Programmable Gate Arrays*, 5–14. https://doi.org/10.1145/3020078.3021740

Park, S., & Jo, S. J. (2017). The impact of proactivity, leader-member exchange, and climate for innovation on innovative behavior in the Korean government sector. *Leadership & Organization Development Journal*, *39*(1), 130–149. https://doi.org/10.1108/LODJ-09-2016-0216

Pereira, V., Hadjielias, E., Christofi, M., & Vrontis, D. (2023). A systematic literature review on the impact of artificial intelligence on workplace outcomes: A multi-process perspective. *Human Resource Management Review*, *33*(1), 100857. https://doi.org/10.1016/j.hrmr.2021.100857

Priem, R. L., & Butler, J. E. (2001). Is the Resource-Based "View" a Useful Perspective for Strategic Management Research? *The Academy of Management Review*, *26*(1), 22–40. https://doi.org/10.2307/259392

Pulley, M. L., Sessa, V., & Malloy, M. (2002). E-Leadership: A Two-Pronged Idea. *T+d*, *56*(3), 34–44.

Quaquebeke, N. V., & Gerpott, F. H. (2023). The Now, New, and Next of Digital Leadership: How Artificial Intelligence (AI) Will Take Over and Change Leadership as We Know It. *Journal of Leadership & Organizational Studies*, *30*(3), 265–275. https://doi.org/10.1177/15480518231181731

Ransbotham, S., Gerbert, P., Reeves, M., Kiron, D., & Spira, M. (2018). Artificial Intelligence in Business Gets Real. *MIT Sloan Management Review*. https://sloanreview.mit.edu/projects/artificial-intelligence-in-business-gets-real/

RAVICHANDRAN, T., LERTWONGSATIEN, C., & LERTWONGSATIEN, C. (2005). Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective. *Journal of Management Information Systems*, *21*(4), 237–276. https://doi.org/10.1080/07421222.2005.11045820

Richey, R. G., Chowdhury, S., Davis-Sramek, B., Giannakis, M., & Dwivedi, Y. K. (2023). Artificial intelligence in logistics and supply chain management: A primer and roadmap for research. *Journal of Business Logistics*, *44*(4), 532–549. https://doi.org/10.1111/jbl.12364

Rožman, M., Tominc, P., & Milfelner, B. (2023). Maximizing employee engagement through artificial intelligent organizational culture in the context of leadership and training of

employees: Testing linear and non-linear relationships. *Cogent Business & Management*, *10*(2), 2248732. https://doi.org/10.1080/23311975.2023.2248732

Rudko, I., Bashirpour Bonab, A., & Bellini, F. (2021). Organizational Structure and Artificial Intelligence. Modeling the Intraorganizational Response to the AI Contingency. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(6), Article 6. https://doi.org/10.3390/jtaer16060129

Schryen, G. (2013a). Revisiting IS business value research: What we already know, what we still need to know, and how we can get there. *European Journal of Information Systems*, *22*(2), 139–169. https://doi.org/10.1057/ejis.2012.45

Schryen, G. (2013b). Revisiting IS business value research: What we already know, what we still need to know, and how we can get there. *European Journal of Information Systems*, *22*(2), 139–169. https://doi.org/10.1057/ejis.2012.45

Sharma, P., Gunasekaran, A., & Subramanian, G. (2024). Enhancing Supply Chain: Exploring and Exploiting AI Capabilities. *Journal of Computer Information Systems*, 1–15. https://doi.org/10.1080/08874417.2024.2386527

Shela, V., Ramayah, T., & Noor Hazlina, A. (2021). Human capital and organisational resilience in the context of manufacturing: A systematic literature review. *Journal of Intellectual Capital*, *24*(2), 535–559. https://doi.org/10.1108/JIC-09-2021-0234

Spector, J. M., & Ma, S. (2019). Inquiry and critical thinking skills for the next generation: From artificial intelligence back to human intelligence. *Smart Learning Environments*, *6*(1), 8. https://doi.org/10.1186/s40561-019-0088-z

Suhana, S., Suharnomo, S., Mas'ud, F., Mansyur, A., Febrianto, B., & Santoso, I. H. (2020). Investigating the role of the knowledge sharing and innovative behavior in supply chain management. *International Journal of Supply Chain Management*, *9*(3), 871–880.

Tigre, F. B., Curado, C., & Henriques, P. L. (2023). Digital Leadership: A Bibliometric Analysis. *Journal of Leadership & Organizational Studies*, *30*(1), 40–70. https://doi.org/10.1177/15480518221123132

Tortorella, G., Prashar, A., Antony, J., Mac Cawley, A. F., Vassolo, R., & Sony, M. (2023). Role of leadership in the digitalisation of manufacturing organisations. *Journal of Manufacturing Technology Management*, *34*(2), 315–336. https://doi.org/10.1108/JMTM-09-2022-0312

Verma, S., & Singh, V. (2022). Impact of artificial intelligence-enabled job characteristics and perceived substitution crisis on innovative work behavior of employees from high-tech firms. *Computers in Human Behavior*, *131*, 107215. https://doi.org/10.1016/j.chb.2022.107215

Walter, E. (2008). Cambridge Advanced Learner's Dictionary with CD-ROM. *Cambridge University Press*. https://scholar.google.com/scholar_lookup?title=Cambridge%20Advanced%20Learners%20Dictionary&publication_year=2008&author=E.%20Walter

Wang, H. (2024). Linking AI supply chain strength to sustainable development and innovation: A country-level analysis. *Expert Systems*, *41*(5), e12973. https://doi.org/10.1111/exsy.12973

Wilden, R., Gudergan, S. P., Nielsen, B. B., & Lings, I. (2013). Dynamic capabilities and performance: Strategy, structure and environment. *Long Range Planning*, *46*(1–2), 72–96.

Wilson, H. J., Daugherty, P. R., & Morini-Bianzino, N. (2018). The Jobs That Artificial Intelligence Will Create. In Mit Sloan Management Review, *What the Digital Future Holds* (pp. 97–104). The MIT Press. https://doi.org/10.7551/mitpress/11645.003.0020

Zhao, J. L., Fan, S., & Hu, D. (2014). Business challenges and research directions of management analytics in the big data era. *Journal of Management Analytics*, *1*(3), 169–174. https://doi.org/10.1080/23270012.2014.968643