MITIGATING NEGATIVE PERCEPTIONS TOWARDS CPEC THROUGH AI-DRIVEN COMMUNICATION, COMMUNITY ENGAGEMENT AND TRANSPARENCY

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Abstract

This research investigates the potential of AI-driven communication strategies to enhance transparency, create trust, and improve stakeholder engagement in the China-Pakistan Economic Corridor (CPEC) to confront the obstacles presented by negative perceptions. This study gathered data from 211 residents of the Baluchistan and Gilgit-Baltistan (GB) provinces who are directly or indirectly associated with CPEC programs. This research utilized quantitative techniques and PLS-SEM to analyze the data. The findings of the study show that community engagement (CE) has a vital role in addressing the negative perception concerns (NPC) related to CPEC projects. As can be seen, transparency (TR) has a considerable influence in enhancing community engagement and, therefore, addressing adverse impressions. Nonetheless, there is very little association between communication (COM) and CE, as well as negative perception directly. In the study, the moderating role of artificial intelligence (AI) is also investigated, and the findings indicate that communication significantly determines the engagement of the community, and the presence of AI increases the effect of communication on community engagement. However, it does not moderate the relationship between transparency and community engagement. Such results emphasize the role of information disclosure and AI-mediated communication in engaging local communities and mitigating concerns regarding large infrastructure ventures.

Keywords: Negative Perceptions, Artificial Intelligence, Community Engagement, CPEC, PLS-SEM

INTRODUCTION

Overview

The China-Pakistan Economic Corridor (CPEC) is a significant initiative in developing economic and political relations to foster growth and regional integration. The fund is meant to support regional connectivity. CPEC, which comprises infrastructure, energy, and transport projects, can provide a good chunk for Pakistani economic development and bolster the Pak-China friendship in the future (Abb, 2024). Contrarily, the CPEC, though a beneficial initiative with long-term potential, also faces skepticism and a hostile reception across global circles. Certain CPEC activities have not been effectively implemented because of the reasons outlined above, including non-transparency, environmental concerns, and the transfer of activities within the country (Adnan et al., 2024). On this account, AI-Driven systems can change how stakeholders interact with each other since it breaks silos reporting, real-time data and information, advanced analytics and clear, transparent decision-making processes (Zhao, 2024). A good environment for the adoption of Artificial Intelligence (AI) may encourage more collaboration and trust among stakeholders wherein they are not as opposed to issues regarding misunderstandings of the project

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(Wani, 2023). This research seeks to find out what effective AI solutions can alter the perception of key stakeholders, guarantee business success in the long run and help them manage activities related to CPEC (Ahsan, 2022).

Problem Statement

In the case of CPEC is the deterrents associated with negative perceptions for existing negatives eliminate the benefits that may be derived from the positives of CPEC. Such cross territorial negotiations have raised deeper concerns regarding accountability, environmental responsibility and social justice among the local populace, the interested parties and regional and global observers (Abb, 2024; Tan Mullins, 2020). The result of these negative emotions is limited attainment of the project objectives, higher risks against project resistance, and less stakeholder engagement in a win-win scenario for CPEC Projects. Yet, the conventional methods of contact and communication have failed to resolve these issues (Wani, 2023; Zhao, 2024). The issues related to transparency in the process and interaction space with major stakeholders create a drop in confidence from their end and more chaos than clarity. Existing methods to promote transparency and build trust must, by necessity, be re-invigorated if everybody is sincerely working towards achieving a particular goal (Adnan et al., 2024; Zhao, 2024).

Research Gap

The Information concerning the CPEC lacks geographical analysis despite its political and economic impacts. Excluding the regional impact of Pakistan, studies have explored global macroeconomic repercussions and strategic factors. Because of this geographical divide, there is limited understanding of how these CPEC projects impact residents in some of these areas (Ahsan, 2022). In the contextual approach, research on sociopolitical issues and the contentious perspective of CPEC is limited. Earlier research looked at monetary motivation and tangible organizational enrichment while overlooking the social-cultural and environmental perceptions of local stakeholders. Because of this, the ground perception associated with CPEC operations and how it influences project success and implementation should be analyzed (Wani, 2023; Zhao, 2024).

In addition, the use of AI-based communication technologies has yet not been effectively harnessed for the engagement of stakeholders and management of complicated project info within CPEC related projects. Yet, the potential of enriching improvisation of real-time communication and enhancing decision-making by incorporating AI has not been fully examined in connection with the communication tactics of CPEC. This oversight creates space to explore the avenue of how AI-driven communication can improve the aspects of transparency, participation, and feedback of CPEC initiatives (Adnan et al., 2024; Zhao, 2024). Moreover, the theory-building effort exploring the extension of the dynamic capability view to CPEC and similar large infrastructure projects is scarce (Abb , 2024). Although the role of DCVs has been noted in business and strategic management publications, the effect has not been tested with regard to increasing openness, involvement, and communication in integrated projects with a nested structure. Further, past research has mostly employed quantitative methodologies, without considering the use of mixed method or even a purely qualitative method that may be more useful in capturing the perceptions and dynamic of stakeholder engagements. Thus, DCV could be broadly implemented to meet this theoretical void and enhance stakeholder perceptions, particularly when combined with AI-based communication technologies to meet multifaceted project requirements (Wani, 2023).

Purpose Statement and Research Question

This research examines if there are communication strategies only intelligent by AI to increase transparency and guarantee the creation of trust to enable the engagement of the CPEC projects to address the challenges posed by negative perceptions. Therefore, the study raises the question of *how AI can be leveraged to enhance stakeholder communication, transparency, and engagement in CPEC projects to mitigate active perceptions*?

Structure of the Study

The rest of this study aims to explain the rationale behind the DCV theory and develop the hypothesis along with the research framework. The third part will describe the research strategy, data collection, and analysis methods. The fourth section will include the findings, results, and discussion. Finally, the paper will conclude by offering overall conclusions, contributions to theory and practice, and future research directions.

LITERATURE REVIEW

Theoretical Underpinnings

In the early 1990s, David Teece and his team invented the Dynamic Capabilities View (DCV). Firms that integrate, extend, and rebuild internal and external resources can cope with changes more effectively (Teece, 1993). When opportunity manifests itself, organizations need to be able to recognize it and either take advantage of those chances or adjust to new conditions if they do not want to lose the competitive edge, as per the DCV proclaiming (Javed et al., 2024). This is why companies in today's complex and ever-changing markets need to ensure that they are employing flexible employees rather than permanent assets if they want to thrive. These skills include problem-solving abilities and adaptability in the face of novelty (Faiz et al., 2024).

CPEC projects must be proactive, respond adaptively, and minimize negative views, as advocated by DCV theory (Parks et al., 2023). Including transparency, Engagement and communication enhanced by the use of artificial intelligence (Bhatti et al., 2024), another advantage for project managers is to monitor stakeholder concern more effectively, to be able to answer to any level of interest or participation at the right time as well as to change the communication strategies as to meet changed expectations. It can be believed that DCV might shed more light on how some CPEC projects may further incorporate the AI technology to enhance the relationship and perception with stakeholders, making the process more adaptive and productive (Parks et al., 2023).

Development of the Hypotheses

Research suggests that community engagement plays a pivotal role in shaping public perceptions of large-scale infrastructure projects like CPEC (Aziz et al., 2023). Effective community engagement has been shown to increase acceptance and support for infrastructure projects by addressing concerns, fostering a sense of ownership, and ensuring that local communities benefit from the project (Akhtar et al., 2021). When local communities are involved in the planning and decision-making process, they are more likely to perceive the project as beneficial, leading to improved perceptions (Kanwal et al., 2020). Research has shown that community engagement initiatives can reduce negative perceptions and increase support among residents. Furthermore, community engagement can help to address misinformation and misconceptions, promoting a more informed and nuanced understanding of the project (Khalil et al.,

2021).
H1: Community engagement has a significant effect on the negative perceptions of community toward CPEC.

Today's communication pattern seems to have an influential role in the concern project and the participation of the community in the CPEC. According to research, one of the dynamic capabilities includes communication and as this study showed interaction enables the creation of a positive relation, which consequently has a direct positive effect on the community participation (Zhong et al., 2022). Poor communication reduces the chances of success due to a lack of community engagement, hence the support required in CPEC projects. When it comes to communication, with the help of practical solutions and AI tools, project managers may communicate on time, adequately, and to the point, dispelling any doubts and providing more information to the community members (Mahmood et al., 2022). Such an approach enhances cooperation, increases the rate of participation, and decreases the level of resistance. Therefore, communication can directly impact participation in a particular community (Tan Mullins, 2020). Hence, it has been hypothesized:
H2: Communication has a significant effect on the community engagement.

Well-executed communication efforts can drastically diminish the community's negative views of CPEC projects. One of the dynamic capabilities necessary for managing stakeholder relationships and adjusting to feedback is communication, according to the DCV idea. One way to resolve issues and improve views is through effective communication (Kanwal et al., 2022). These strategies can clarify project aims, dispel misconceptions, and demonstrate transparency. Robust methods of communication are essential in CPEC projects, as doubt and hostility frequently emerge from people's perceptions of lack of transparency and knowledge (Ibrar et al., 2022). Through regular communication and AI-driven solutions, project managers can improve the project's standing and address any skeptics, thereby bolstering its reputation. This improved communication facilitates the decrease of opposition and the improvement of project acceptance by resolving concerns, developing trust, and matching community expectations with project objectives (Aziz et al., 2023). Therefore, it has been proposed:
H3: Communication has a significant effect on the negative perceptions of community toward CPEC.

The level of community participation in the CPEC projects is highly likely to be boosted as and when there is an improvement in transparency. According to the study, companies use transparency to create a positive attitude toward themselves and enhance stakeholders' faith (Aziz et al., 2023). Sharing project information, constant reporting on activities, and explaining why solutions have been made are aspects of transparency. A more cognitively active and receptive community might constitute the outcome of these policies (Waheed et al., 2024b). The current practice is showing concerns about the transparency of the projects; thus, for the development of trust and encouraging involvement from the community, a responsible environment should be created. Paying disputes, decreasing the level of cynicism, and ensuring the correspondence of the community's expectations with the goals of a project is possible with the help of effective communication (Nisar et al., 2022). Project managers can aim to increase communication and coordination between the community members by adopting new measures, such as being more forthcoming in the project activities. In the same way, better relations with stakeholders enhance the probability of large-scale infrastructural contracts being welcome and successful (Dodo Khan et al., 2023). Thus, the following statement has been proposed:

H4: Transparency has a significant effect on the community engagement.

It is asserted that the level of communication contributed a lot to the formation of the negative attitude that the affected communities developed toward the projects under CPEC. As per the study, communication is also a critical dynamic capability to influence the stakeholder's perception and manage the concern (Ahmad et al., 2023). Proper communication here involves escalating issues and goals and providing factual information to employees, which eliminates distorted perceptions and results in positive perceptions concerning the project (Aziz et al., 2023). Thus, in the CPEC projects, where negative perceptions often arise out of a lack of information and perceived information management, there is a need for solid communication exercises. With appropriate and effective communication technologies and techniques deployed to provide appropriate, timely, and accurate information, the project managers are well placed to deal with such issues as people's concerns and also to set the record straight where there are negative perceptions about a project (Ahmad et al., 2023; Ali et al., 2024). This way, the perception of the community and general support and approval for the project is significantly increased, ensuring the successful implementation of the project (Ahmad et al., 2023). Therefore, this study hypothesized:

H5: Communication has a significant effect on the negative perceptions of community toward CPEC.

A study argues that community involvement is a significant moderator through which the quality of communication influences the negative evaluation of CPEC projects. Communication can solve most concerns the community may have regarding the project and help explain more about the project and its intent, thus helping create trust (Mahmood et al., 2022). The paper has explained that when proper communication strategies are adopted, misunderstanding is reduced, and skepticism is fought off. As for CPEC projects, where negative attitudes presuppose low levels of participation and perceived openness, the increased amount of community participation may close the gap (Ibrar et al., 2022). Being open and communicative with the community not only helps to decrease the negative attitudes but also increases the central positive attitude of the community. Hence, community engagement verifies as a potent mediator that enhances communication and decreases the perceived negativity on the project (Aziz et al., 2023). Hence, the following statement has been proposed:

H6: Community engagement significantly mediates the effect of communication on negative perceptions of community toward CPEC.

Community engagement has a considerable mediation role between communication and CPEC projects' negative perceptions. The misunderstandings can then be resolved by regularly disseminating accurate information and clearing the air, meaning that people would be more trusting of the information being passed around (Aziz et al., 2023). On the other hand, the community's readiness has a positive relationship with the reciprocity of communication in that the direct impact on negative perceptions is improved. Activities that prompt the community members to communicate more and get involved more, for example, through fountains, feedback mechanisms, and work-shops, help the members to involve themselves more profoundly in the community's activities (Kanwal et al., 2022). This active input can also assist in dealing with the issues and turning some of the negative attitudes into positive or even neutral ones (Mahmood et al., 2022). Hence, although communication is an essential aspect of perception, the level of community engagement determines negativity's effectiveness in minimizing perceptions. Due to this, the project can measure and effectively address poor perceptions within the community by promoting solid and positive interaction (Ibrar et al., 2022). Thus, it has been hypothesized:

H7: Community engagement significantly mediates the effect of communication on negative perceptions of community toward CPEC.

AI moderately moderates how communication predicts community engagement, arguing that adopting AI increases CPEC projects' community engagement (Ullah et al., 2022). This is why communication can also be effective when the tools used for this process are an AI Chatbot, predictive analytics, and messages explicitly designed for the target audience. Such sophisticated instruments allow for more engaging and sensitive forms of communication, which can help respond to communities' concerns and needs (Gul et al., 2024). Therefore, adopting AI in communication as a strategy will increase community engagement. By applying AI in communication and providing more target-oriented interactions regarding a project, one can increase the people's involvement, making the project work more efficient and providing better support (Dhaka, 2023). Communication, therefore, plays an exploded role in determining the extent of involvement of the communities in the CPEC projects through being enhanced by the application of AI (Wani, 2023). Thus, it has been proposed:

H8: AI significantly moderates the effect of communication on community engagement postulating that the use of AI for communication will improve community engagement with the CPEC.

AI can change how transparency helps engage public opinions on mega projects like CPEC. AI-driven tools such as automated reporting systems, natural language processing, and predictive analytics can allow project stakeholders to provide accurate information more rapidly within a community (Ullah et al., 2022). These tools all help communicate tailored messaging that speaks directly to the needs and fears of different community groups, leading to a deeper understanding (Wani, 2023). AI helps to improve transparency as well, but it also allows for a two-way flow of communication by actively listening and being able to provide instant feedback for community questions. AI is expected to improve the clarity, availability, and responsiveness in disbursing information, leading to more backing and participation in CPEC projects (Saleem et al., 2024). This suggests that AI is the critical player in engaging people for any mega project as this makes the process highly transparent, unlike traditional methods. However, it also magnifies the significance of transparency on community input. Therefore, it has been hypothesized:

H9: AI significantly moderates the effect of transparency on community engagement postulating that the use of AI for transparency will improve community engagement with the CPEC.
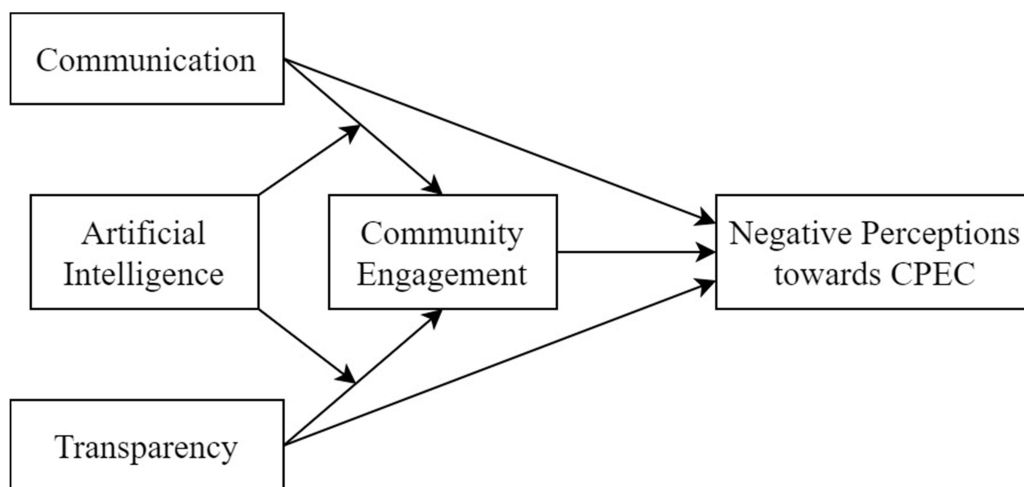

Figure 1: Research Framework

METHODOLOGY

Sample and Population

This study is confined to residents of the Baluchistan and GB provinces who are directly or indirectly associated with CPEC programs. This category is chosen so that the study can present a holistic view of how CPEC projects are affecting these groups. Focusing on regions where CPEC is already being implemented, the study aims to understand what project-affected individuals think and experience (Adnan et al., 2024). This focus allows for an in-depth review of how CPEC projects are perceived at the grassroots level, which is essential to understand their effectiveness and feasibility in the peculiar social and political context presented by Baluchistan and GB. Table 1 shows the respondents' profile.

Table 1
Demographic Profile (n = 211)

		Frequency	Percent
Province	Balochistan	107	50.7
	Gilgit-Baltistan	104	49.3
Age	18-24	40	19
	25-34	38	18
	35-44	44	20.9
	45-54	34	16.1
	55 or above	55	26.1
Gender	Male	169	80.1
	Female	42	19.9
Education Level	Primary or below	57	27
	Secondary	45	21.3
	Tertiary (College/University)	57	27
	Postgraduate	52	24.6
Occupation	Student	41	19.4
	Government employee	29	13.7
	Private sector employee	30	14.2
	Businessperson	40	19
	Farmer/Herder	35	16.6
	Other	36	17.1
Level of awareness about CPEC	Very aware	50	23.7
	Somewhat aware	60	28.4
	Not very aware	44	20.9
	Not at all aware	57	27
Perceived impact of CPEC on your community	Very positive	56	26.5
	Somewhat positive	36	17.1
	Neutral	35	16.6
	Somewhat negative	49	23.2

	Very negative	35	16.6
Access to social media	Yes	100	47.4
	No	111	52.6
Trust in government sources of information	High	74	35.1
	Moderate	75	35.5
	Low	62	29.4

Measures

Communication

Communication has 5 items based on a 5-point Likert scale adopted by (Malik et al., 2023). The sample item is *"Government has a factual communication channel to address residents' concerns about CPEC*."

Artificial Intelligence

Artificial intelligence has 5 items based on a 5-point Likert scale adopted from (Schepman & Rodway, 2020). The sample item is *"There are many beneficial applications of Artificial Intelligence in addressing community concerns about CPEC*."

Transparency

Transparency has 6 items based on a 5-point Likert scale adopted (Park & Blenkinsopp, 2017). The sample item is *"Residents can readily access necessary information anywhere about the impact of CPEC*."

Community Engagement

Community engagement has 4 items based on a 5-point Likert scale adopted by (Malik et al., 2023). The sample item is *"Community engagement effectively addresses residents' concerns about CPEC projects*."

Negative Perceptions towards CPEC

Negative perceptions towards CPEC have 6 items based on a 5-point Likert scale adopted from (Sánchez-Teba et al., 2019). The sample item is *"CPEC increases the price of land and housing*."

Data Collection

The online survey was carried out with the purpose of collecting opinion of the locals of Baluchistan and GB for the projects of CPEC. Invitations to complete the survey were sent to online groups, mailing lists and social networks. Because personal answers may impose sensitive matters, the researchers offered extensive guidance and ensured confidentiality to the participants (Purwanto, 2021). It was a questionnaire with Likert scale-format questions and should take not more than ten to fifteen minutes to fill. The reminder was made to the participants who had not completed the questionnaire after one week. They were fixed at once since the system was checked daily for data collection problems (Phillips & Stawarski, 2008).

Data Analysis

Measurement and structural model used in the analysis of the data was Partial Least Squares Structural Equation Modeling (PLS-SEM). In this research, PLS-SEM selection is justified because it is very well

suited when there are many components and indicators in the model, such as how the importance of Artificial Intelligence methods for communication or transparency occurs within CPEC projects (Purwanto, 2021). This method is selected because it is able to handle situations in which data distribution is not normal and minimize measurement errors in terms of inevitable irregularity (Hair et al., 2011). PLS-SEM is suitable for this research given it supports the testing of mediating effects, and does not assume that data distributions are normally distributed according to customary law. In this study, the method which is selected to contribute to extend the theoretical view of DCV in the CPEC´s setting is PLS-SEM (Hair et al., 2018; Hair et al., 2022).

RESULTS AND DISCUSSIONS

Measurement Model
The segmentation model in PLS-SEM explains how a given Latent Variable vis-à-vis a newly proposed indicator. It describes how numerous signs or objects signify each of the hidden factors, as per Purwanto (2021). This model tests the validity and reliability of the constructs, to ensure that the indices measure each of the variables accurately. PLS-SEM involves assessing the coefficients between measured variables and their corresponding constructs and internal consistency while asserting the outer loadings measure of convergent and discriminant validity (Memon et al., 2021).
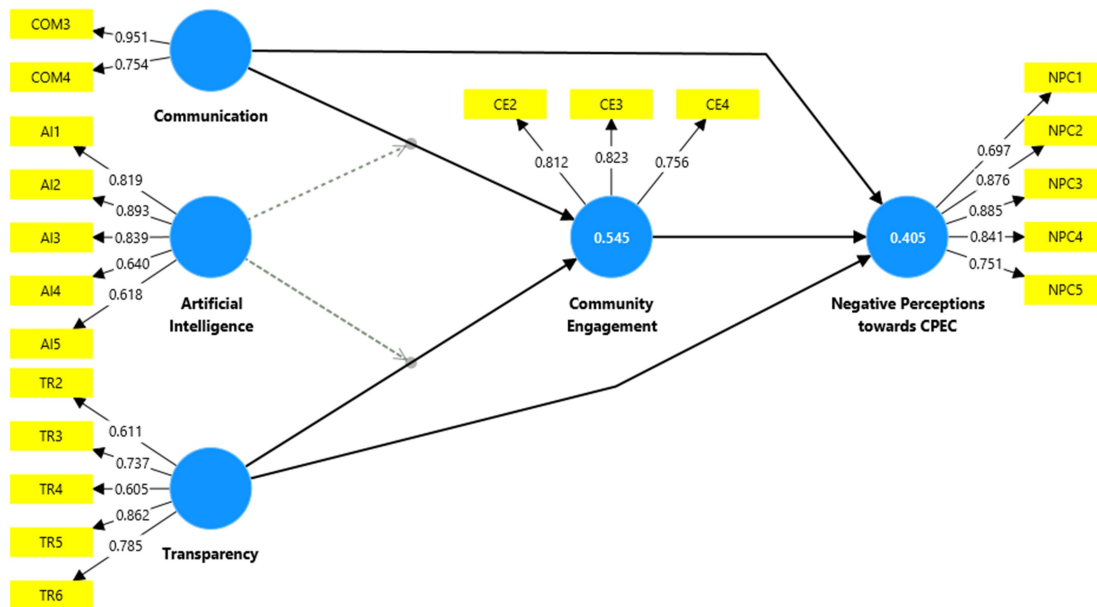

Figure 2: PLS Algorithm

Table 2
Measurement Model

	Loadings	Prob.	VIF	CR	AVE
AI1 <- AI	0.819	0.000	2.778		
AI2 <- AI	0.893	0.000	3.730	0.877	0.593
AI3 <- AI	0.839	0.000	2.711		

AI4 <- AI	0.640	0.000	1.808		
AI5 <- AI	0.618	0.000	1.994		
CE2 <- CE	0.812	0.000	1.766		
CE3 <- CE	0.823	0.000	1.807	0.840	0.636
CE4 <- CE	0.756	0.000	1.188		
COM3 <- COM	0.951	0.000	1.359	0.847	0.737
COM4 <- COM	0.754	0.000	1.359		
NPC1 <- NPC	0.697	0.000	1.661		
NPC2 <- NPC	0.876	0.000	2.601		
NPC3 <- NPC	0.885	0.000	2.862	0.906	0.661
NPC4 <- NPC	0.841	0.000	2.261		
NPC5 <- NPC	0.751	0.000	1.712		
TR2 <- TR	0.611	0.000	1.326		
TR3 <- TR	0.737	0.000	1.516		
TR4 <- TR	0.605	0.000	1.332	0.846	0.528
TR5 <- TR	0.862	0.000	2.201		
TR6 <- TR	0.785	0.000	1.781		

Table 2 provides the results of the measurement model using the PLS algorithm technique. It is recommended by Hair et al. (2011) that all the values of outer loadings must be higher than 0.60 for acceptance. Moreover, Diamantopoulos and Siguaw (2006) proposed that if the VIF values were lower than 5, it indicated that multi-collinearity was not severe for the study. Analysis displayed in Table 2 shows that all the VIF values are lower than 5. Hence, the study can proceed to the hypotheses testing. Additionally, Cronbach's alpha (α) was calculated to assess the internal consistency of the constructs. Following the guideline proposed by George and Mallery (2003), values above 0.9, 0.8, and 0.7 were classified as excellent, good, and acceptable, respectively. As per Hair et al. (2011), composite reliability is considered acceptable when it surpasses the threshold value of 0.7, while the average variance extracted (AVE) should be at least 0.5. Upon examining the following table, it is evident that all variables demonstrated high reliability. Each variable's AVE value exceeded the cutoff point of 0.50, affirming the reliability of the measurement model for further analyses. The above table shows that indicators and constructs have met these criteria, and, therefore, construct validity and convergent validity have been achieved.

Discriminant Validity

Discriminant validity in PLS-SEM evaluates how well a construct can be distinguished from other constructs, ensuring that they are unrelated. It ensures that each variable captures a single concept rather than too highly correlated with another one (Hair & Alamer, 2022). This validation ensures the constructs effectively represent different dimensions of a particular topic, which, in turn, further increases both levels of dependability and understandability, which ensures lesser error due to misinterpretation (Purwanto, 2021).

Table 3
Fornell-Larcker Criterion (FLC)

	AI	CE	COM	NPC	TR
AI	**0.770**				
CE	-0.584	**0.798**			
COM	-0.092	0.211	**0.858**		
NPC	0.526	-0.564	-0.187	**0.813**	
TR	-0.417	0.608	0.476	-0.570	**0.727**

AI = Artificial Intelligence; CE = Community Engagement; COM = Communication; NPC = Negative Perceptions towards CPEC; TR = Transparency

Table 3 shows the result of FLC for discriminant validity assessment. The table 3 has shown that squared-root AVE of constructs (bold diagonal values) are higher than their respective horizontal (Hair et al., 2011) and vertical correlation (non-bold) values, and therefore, discriminant validity using the FLC method has been achieved (Fornell & Larcker, 1981).

Table 4
HTMT Ratio

	AI	CE	COM	NPC	TR
AI					
CE	0.714				
COM	0.204	0.361			
NPC	0.690	0.698	0.252		
TR	0.480	0.764	0.689	0.654	

AI = Artificial Intelligence; CE = Community Engagement; COM = Communication; NPC = Negative Perceptions towards CPEC; TR = Transparency

The table 4 demonstrates the results of the HTMT ratio for discriminant validity assessment.Henseler et al. (2015,2016) recommended that the HTMT ratio between two latent constructs should be less than 0.90 in order to establish discriminant validity. The above table shows that the highest HTMT ratio of 0.764 was found between TR and CE, implying that discriminant validity using the HTMT ratio has been attained.

Predictive Power and Relevance

Table 5
Predictive Relevance

	R Square	Q Square
Community Engagement	0.545	0.531
Negative Perceptions towards CPEC	0.405	0.367

Table 5 shows the predictive power and relevance using the PLS algorithm and PLS blindfolding

techniques.Falk and Miller (1992) recommended that R^2 values should be equal to or greater than 0.10 in order for the variance explained by a particular endogenous construct to be deemed adequate. In the structural model, community engagement shows a strong prediction of 54.5%, and negative perceptions towards CPEC also have a strong prediction of 40.5%. Hair et al. (2013) recommended that $Q^2 > 0.02$ indicates weak relevance, $Q^2 > 0.15$ indicates moderate relevance, and $Q^2 > 0.35$ indicates strong relevance. The above table demonstrates that both community engagement and negative perceptions towards CPEC have strong relevance of 53.1% and 36.7%.

Structural Model

The structural model of the study provides a graphic depiction of the relationships among underpinning concepts, mainly how AI techniques influence stakeholder communication, transparency, and involvement in CPEC projects. This research aims to consider the suggested pathways that measure how deeply connected these relationships are and assesses the impact of AI on project outcomes in light of those direct and indirect effects (Hair & Alamer, 2022). Hence, the structural model is determined by the significance of path coefficients and model fit. This evaluation helps to confirm the suggested theoretical framework and ensures that the detected links are solid and relevant (Purwanto, 2021).
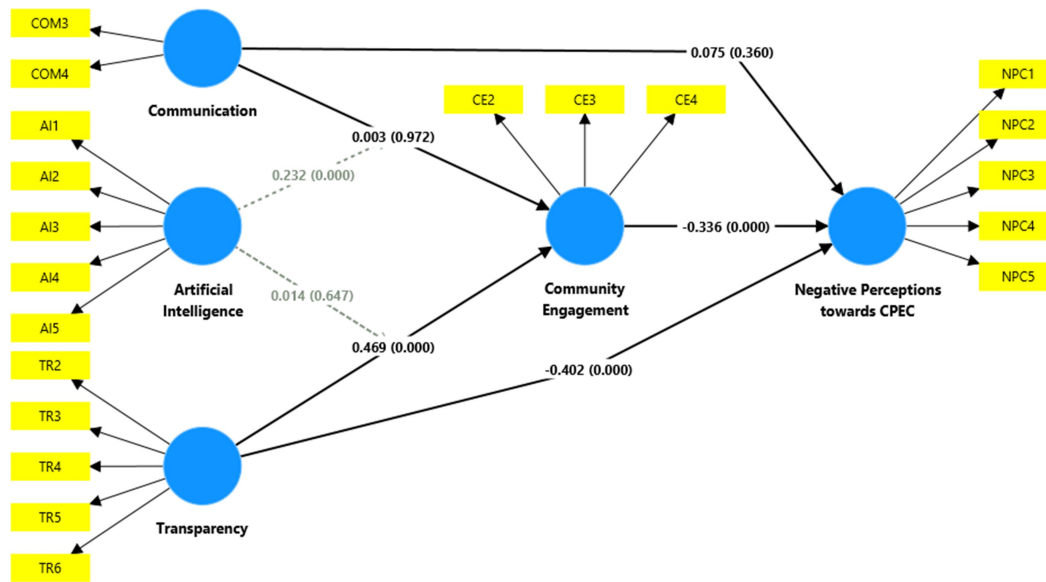

Figure 3: PLS Bootstrapping

Table 6
Direct-Effect Analysis

	Estimate	S. D.	t-Stats	Prob.	Decision
CE -> NPC	-0.336	0.071	4.754	0.000	Accepted
COM -> CE	0.003	0.100	0.035	0.972	Rejected
COM -> NPC	0.075	0.082	0.916	0.360	Rejected
TR -> CE	0.469	0.060	7.792	0.000	Accepted
TR -> NPC	-0.402	0.077	5.250	0.000	Accepted

AI = Artificial Intelligence; CE = Community Engagement; COM = Communication; NPC = Negative Perceptions towards CPEC; TR = Transparency

Table 6 provides hypothesis-testing for direct-effect analysis using PLS path modeling. The table 6 demonstrates that CE (β = -0.336; $p < 0.05$) has a negative significant effect on NPC. COM (β = 0.003; $p > 0.05$) has a positive insignificant effect on CE. COM (β = 0.075; $p > 0.05$) has a positive insignificant effect on NPC. TR (β = 0.469; $p < 0.05$) has a positive significant effect on CE. TR (β = -0.402; $p < 0.05$) has a negative significant effect on NPC.

Table 7
Specific Indirect-Effect Analysis

	Estimate	S. D.	t-Stats	Prob.	Decision
COM -> CE -> NPC	-0.001	0.035	0.033	0.973	Rejected
TR -> CE -> NPC	-0.157	0.034	4.571	0.000	Accepted

AI = Artificial Intelligence; CE = Community Engagement; COM = Communication; NPC = Negative Perceptions towards CPEC; TR = Transparency

Table 7 provides the results of hypothesis-testing for specific indirect-effect analysis using PLS path modeling. The above table 7 shows that CE (β = -0.001; $p > 0.05$) negatively insignificantly mediates the relationship between COM and NPC. CE (β = -0.157; $p < 0.05$) negatively significantly mediates the relationship between TR and NPC.

Table 8
Moderation Analysis

	Estimate	S. D.	t-Stats	Prob.	Decision
AI x COM -> CE	0.232	0.044	5.208	0.000	Accepted
AI x TR -> CE	0.014	0.031	0.458	0.647	Rejected

AI = Artificial Intelligence; CE = Community Engagement; COM = Communication; NPC = Negative Perceptions towards CPEC; TR = Transparency

The table 8, provides the results of hypothesis-testing for moderation analysis using PLS path modeling. The above table 8 shows that AI (β = 0.232; $p < 0.05$) positively and significantly moderates the relationship between COM and CE. Also, AI (β = 0.014; $p > 0.05$) positively insignificantly moderates the relationship between TR and CE.

DISCUSSIONS

The result showed that community engagement has a negative but significant impact on negative perception towards CPEC. Social exchange theory explains the strong inverse correlation between CE and NPC by arguing that people are more likely to take action when they believe their problems are being taken seriously. Stakeholders see a win-win in community involvement with CPEC projects, which helps mitigate unfavorable feelings (Muhammad et al., 2023). This is in line with previous research that shows how community involvement boosts trust, ownership, and transparency, which are three crucial factors in lowering opposition to massive projects (Aziz et al., 2023). By enabling real-time input, AI-driven

platforms can improve these results by addressing complaints immediately and inclusively, further minimizing NPC (Waheed et al., 2024).

The result demonstrated that communication has a positive but highly insignificant influence on community engagement. The fact that passive communication seldom succeeds in promoting real involvement helps to explain the weak correlation between COM and CE. Although stakeholders may receive the necessary data, two-way communication cannot happen if there is no way the stakeholders can participate and respond (Babaei et al., 2023). This is in line with the assertion that knowledge sharing does not necessarily lead to increased confidence or interaction. There is evidence that communication is not enough, as engagement requires transparency, dialogues, and even cooperation where people make decisions together (Kumar et al., 2023). AI-derived solutions mean that CE is achieved through two-way communication, and this is far more effective than one-way communication (Yayla et al., 2023).

The result showed that communication has a positive but insignificant impact on negative perceptions towards CPEC. Therefore, frequency of communication also appears to be an insufficient tool here to reduce the effects of negative sentiments on CPEC because there seems to be no correlation between communication and negative perception. This discovery underscores the contention that the quality and relevance of communication are major factors that define communication effectiveness rather than its frequency (Iftikhar et al., 2024). It may be deeper problems that cannot be solved even by the process of communication. It has been found that what is appreciated by the stakeholders are purposeful, clear, and engaging interactions rather than information exchange (Farooq et al., 2023). Moreover, it means that AI can enhance communication by focusing on meaningful and truthful interactions instead of mass communication, which is senseless in decreasing unfavorable attitudes (Ullah et al., 2023).

The result demonstrated that transparency has a positively significant impact on community engagement. This correlation is supported by the notion that transparency brings confidence and makes stakeholders feel like they are part of something bigger. This study affirms that dissemination of information that is transparent and unambiguous about project activity increases stakeholders' worth and sense of commitment (Langella et al., 2023). This research shows that the policy of transparency helps reduce ambiguity and contributes to enhancing trust in the decision-making process, which allows for increasing participation (Aripin et al., 2023). This is achieved by several transparency solutions that are AI-powered, like real-time dashboards and open-access platforms, which make pertinent information easily accessible and understandable (Babaei et al., 2023).

The result showed that transparency has a negatively but significant influence on negative perception towards CPEC. The reason for the strong negative relationship is that increased transparency reduces uncertainty and concerns among stakeholders. Clear processes reduce risks by providing understandable, precise information so people develop a sense of responsibility and trust (Waheed et al., 2024a). Past studies have supported the fact that when the stakeholders have detailed information about the project process and outcome, their negative perceptions are reduced (Farooq et al., 2023). AI-integrated transparency solutions amplify this by automating the process of dissemination of relevant and updated information – a way of ensuring that stakeholders are informed at all material times. Thus, the data supplied in this study add to the growing literature on the advantages of transparency in eradicating prejudicial perceptions while enhancing the role of transparency in building trust and credibility for vast programs like CPEC (Aziz et al., 2023).

The result showed that the indirect effect of communication (COM) on negative perceptions towards CPEC (NPC) through community engagement (CE) is negatively insignificant. This means that regardless of the communication that is done to depict a certain image to the participants, communication

alone is incapable of bringing a drastic change to unfavorable perceptions (Erie, 2023). Frequency without content and depth to the communication may prove to have a low effect because it lacks any substantial input from stakeholders and their needs (Ashraf, 2024). In earlier research, it has been found that transparency, quick responses, and actual interaction are important to build engagement. Thus, if the goal is to leave the audience interested one has to work on one's speech and evolve other mechanisms influencing the audience (Shirshikova, 2022).

The result indicated that the indirect effect of transparency (TR) on negative perceptions towards CPEC (NPC) through community engagement (CE) is negatively significant. These outcomes stated that openness is useful in increasing the participation level of the community hence useful in the minimization of the negative effects of absence. It was shown that the level of stakeholder confidence and participation rises with the level of transparency, which excludes negative attitudes regarding the project (Shirshikova, 2022). Such conclusions raise the need to use effective approaches to formulate adequate strategies for stakeholders and avoid negative perceptions (Erie, 2023). Better AI-based transparent solutions can strengthen this effect by giving clients immediate and easily digestible information that attracts their attention and builds trust (Zou & Jones, 2021).

The result indicated that the interaction between Artificial Intelligence (AI) and communication (COM) positively significant enhances community engagement (CE). The findings revealed that when COM is augmented with AI, CE rises to a level that is far higher than anyone would anticipate. When one completes that, artificial intelligence increases the effectiveness of communication and engagement because the interaction process fits better and comes closer to filling stakeholders' needs and wants to a larger degree (Bilal et al., 2024). Amplified by AI communication will advance the real-time, recipient-targeted, and interactive communication and will enhance the user's engagement (Chataut et al., 2024). This implies the need to fund artificial intelligence technological advancements and initiatives to ensure that the communities obtain the necessary equity in their participation within such structures as well as improve the communication stratagem (Caputo et al., 2023).

The result showed that the interaction between Artificial Intelligence (AI) and transparency (TR) does not significantly affect community engagement (CE). As a consequence, it is possible to identify an absence of change in the total beneficial impact by means of transparency when it is supported by artificial intelligence (Akinrinola et al., 2024). While there is an emphasis towards openness in the interest of creating trust, the position that AI has in this process does not significantly contribute toward improving community engagement (Felzmann et al., 2020). The findings of this research imply that the benefits related to engagement and transparency are quite separable from AI, as enhanced transparency practices are adequate on their own to motivate engagement even if advanced by AI (Ueda et al., 2024).

CONCLUSION

The study focuses on the prospect AI holds in transforming the efficiency of communicating strategies to foster stakeholders' understanding, confidence, and consequently their participation on large-scale projects like the CPEC. The study proves that there is a new way in altering communication issues and concerns and in turn; refute the negative attitudes from the locals by adopting AI technologies such as predictive analyses and automation of reports. By enhancing the level of transparency, the AI systems facilitate the establishment of positive interaction with the stakeholders, facilitating positive interaction with the CPEC projects. The study also reveals the importance of community engagement as a mediator in the relationship between communication activities and the change of such perceptions. This means that increased active participation through open and artificial intelligence-integrated project platforms

improves public perception and project success.

Theoretical Implications

The contributions of this study can be categorized under the literature domain and the DCV theory, where this study enlightened the usage of DCV, extending its usage in business and large-scale infrastructure projects such as CPEC. Therefore, the study contributes to the knowledge of how communication, engagement, and transparency strategies facilitated by AI improve the strengthening of stakeholders' relationships to offer practical ways through which dynamic capabilities can be implemented to manage complex projects (Wani, 2023). It shows that managing dynamic capabilities, such as reacting to stakeholder perceptions and configuring successful strategies, is indispensable for managing and enhancing project outcomes regarding stakeholders' negative perceptions (Zhong et al., 2022). This application enhances the DCV theory by demonstrating its applicability in public infrastructure undertakings. It provides a conceptual approach to how complex technologies such as AI can be embodied under the theory of DCV. Therefore, the study contributes to developing theory regarding how organizations can use dynamic capabilities in various and dynamic contexts (Ibrar et al., 2022).

Recommendations

Given the importance of communication and openness by decision-makers in CPEC, AI-assisted solutions are vital for successfully executing the project. Among the available AI solutions are chatbots, automated reporting systems, and predictive analytic tools. These solutions increase communication, process reporting, and individual interventions (Abb, 2024). Using these tools allows for the rapid and efficient resolution of stakeholder issues and the prevention of false news. AI capabilities and team training are essential to AI projects' success (Ibrar et al., 2022). To fight adverse views towards self and AI, the deployment of AI must be supported by communication with stakeholders that is both open and transparent. AI has the potential to enhance transparency by generating daily and weekly updates, monitoring the leadership of thought on social media, and countering fake news. Therefore, by exposing the project's development, government officials can increase the stakeholders' trust and remove cynicism over the CPEC project (Mahmood et al., 2022; Ullah et al., 2022). Both Baluchistan and GB demand significant engagement from the local population. The government and policymakers should develop interactive AI apps to collect feedback, address problems, and include locals in decision-making (Zhong et al., 2022). Involvement that begins early and continues over time leads to ownership, which in turn helps communities, be governed. In addition to enhancing local support, this strategy simplifies project implementation (Wani, 2023). It is necessary to evaluate AI-facilitated interactions and communications to determine their function and the results they produce. Evaluation should be performed frequently to identify weaknesses in AI and areas where changes are required to align tools with their intended purpose. The suggestions of key stakeholders might help evaluate these efforts and make adjustments (Nisar et al., 2022; Waheed et al., 2024).

Limitations and Future Research

A few limitations exist in this work that also suggests new horizons for future research. The first is that the findings cannot be generalized to other parts of CPEC-affected areas, as only the populations of Baluchistan and GB had been included. This limitation suggests that a wider geographic spread, such as over other provinces, could give us better insight into the effects of CPEC in different areas. Although attempts to ensure anonymity and elicit truthfulness minimize response bias, this potential source of

response bias is never completely removed. One way to overcome this limitation is by using future research studies of mixed-methods design in both validation and supplementation with the survey results, such as focus groups or qualitative interviewing. That means it is also conceivable that the study's data collection period could not capture how stakeholder sentiments may change over time. Longitudinal studies may help understand the long-term efficacy of AI communication tactics and how views on CPEC change over time. Further, the study does not discuss constraints and operational problems related to implementing AI in CPEC projects. Technology adoption and data security are two operational concerns that should be addressed in future studies. The study does not cover additional AI applications like predictive analytics for project management, even though its focus is AI-driven communication. Additional benefits and concerns may be revealed if research is expanded to incorporate these elements. Finally, the results could be more robust and representative if the sample size was more significant or if multi-stage sampling methods were used. Resolving these limitations will enhance our comprehension of the role of CPEC and AI in engaging stakeholders.

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