

Identification of Engineer Mentality Problems in Intra and Inter Organizational Stakeholders of Sustainable Infrastructure Development Projects

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Abstract. Sustainable infrastructure projects require technical competence and an engineer mentality that supports sound judgment, emotional regulation, creativity, and constructive stakeholder relations. This study aimed to identify individual-psychological and social-organizational problems affecting engineers in interactions among project owners, consultants, and contractors. A mixed-method grounded assessment was conducted using an internally developed 39-item, four-point scale, exploratory factor analysis (EFA), in-depth interviews, and a focus group discussion. The quantitative analysis involved 77 consultant respondents, while seven key informants represented project owners, consultants, and contractors. The data were suitable for factor analysis. Nine factors explained 74.915% of the variance: compliance, emotional condition, work motivation, problem solving, altruism, stereotypes, communication effectiveness, discrimination, and decision making. Compliance was the dominant factor (34.531%), whereas the qualitative findings showed that ineffective communication, constrained voice, emotional pressure, distrust, and inhibited creativity were the most visible problems in cross-stakeholder practice. The combined findings indicate that engineer mentality is multidimensional and shaped by the interaction between individual capacities and hierarchical, social, and organizational conditions.

Keywords: *engineering mentality; sustainable infrastructure; individual psychology; social psychology; exploratory factor analysis*

Introduction

Indonesia's construction sector has remained strategically important because infrastructure provision contributes to economic activity and public services. The increasing scale and complexity of infrastructure projects require engineers from project-owner, consultant, and contractor organizations to coordinate quality, safety, cost, schedule, and sustainability objectives. In such settings, human factors are not peripheral; they influence how technical information is interpreted, communicated, and converted into action.

Construction failures and accidents demonstrate that project risk cannot be explained solely by engineering calculations. Weak planning, supervision, communication, coordination, work methods, safety programs, and human error can interact and amplify project risk (Darmali & Waty, 2022; Khilbran & Sakti, 2019; Koseoglu et al., 2018). Research on safety behavior similarly shows that workers' actions emerge from the interaction of cognition, social influence, organizational climate, and supervisory practices (Chen et al., 2021; Kadir et al., 2022; Meng et al., 2021; Ye et al., 2020; Zohar & Luria, 2003). These findings establish the importance of studying the mentality that underlies engineers' responses to uncertainty and stakeholder pressure.

From an individual-psychology perspective, problem solving, decision making, emotional regulation, motivation, and creativity are central to professional functioning. Emotional intelligence and trust have been associated with project success, while self-determined motivation depends on autonomy, competence, and relatedness (Deci & Ryan, 2000; Rezvani et al., 2016). Creativity is also necessary when field conditions require solutions that cannot be produced by routine procedures alone. However, creative behavior can be weakened when personnel fear blame, sanctions, or employment consequences.

From a social-psychology and organizational perspective, compliance, conformity, altruism, stereotypes, prejudice, discrimination, and communication influence collaboration across institutional boundaries. Social identity processes may encourage in-group and out-group judgments that shape trust and attribution between owners, consultants, and contractors (Ashforth & Mael, 1989, 2024; Tajfel & Turner, 1979). Communication quality is likewise critical because inadequate information exchange and weak stakeholder integration are associated with rework, conflict, delay, and poor project outcomes (Butt et al., 2016; Gamil & Abd Rahman, 2023; Patrashkova-Volzdoska et al., 2003). Sustainable-project research further emphasizes that stakeholder collaboration must be treated as a relational process rather than a purely contractual arrangement (Hamdan et al., 2021; Tumpa & Naeni, 2025).

Previous studies have generally examined safety climate, unsafe behavior, communication failure, emotional intelligence, motivation, or stakeholder collaboration as separate domains. They have rarely integrated individual psychological dimensions and social-

organizational dynamics into a single empirical mapping of engineer mentality across project stakeholders. Consequently, limited evidence is available on how hierarchical compliance, emotional pressure, suppressed communication, social bias, and decision constraints jointly shape project interactions.

This study addresses that gap by identifying the multidimensional structure of engineer-mentality problems and interpreting it through the experiences of project owners, consultants, and contractors. The novelty lies in combining EFA-based mapping of individual and social factors with cross-stakeholder qualitative evidence. The study asks: What individual-psychological and social-organizational problems characterize engineer mentality in intra- and inter-organizational stakeholder relations in sustainable infrastructure projects.

Method

This study used a mixed-method grounded assessment to obtain complementary quantitative and qualitative evidence. The quantitative component was exploratory and aimed to identify latent dimensions of engineer-mentality problems. The qualitative component used a phenomenological orientation to understand how these problems were experienced in interactions among project owners, consultants, and contractors. Triangulation was performed by comparing survey patterns, factor-analytic results, interview narratives, and focus-group validation.

The research instrument was developed by the authors rather than adopted as a named pre-existing scale. Item generation was based on literature concerning individual psychology, social psychology, organizational behavior, and construction stakeholder relations. The initial domains included work attitudes and behavior, emotional and cognitive functioning, motivation, creativity, problem solving, decision making, compliance, conformity, altruism, stereotypes, prejudice, discrimination, and communication. Examples of items were the frequency of compliance behavior, the level of individual emotional difficulty, difficulty solving work problems, the effectiveness of work communication, and the frequency of discrimination. Responses were recorded on a four-point scale adapted to the wording of each item. Initial

validity testing and Cronbach's alpha assessment resulted in 39 items retained as valid and reliable for analysis.

Quantitative respondents were selected purposively from engineers and technical personnel directly involved in sustainable infrastructure projects and stakeholder coordination. The final EFA dataset comprised 77 respondents, all from consultant organizations. By educational level, 42 respondents (54.5%) held bachelor's degrees, 30 (39.0%) master's degrees, 3 (3.9%) doctoral degrees, and 2 (2.6%) were recorded in other or uncategorized educational entries. Because the quantitative respondents were consultants, the EFA primarily represents the consultant perspective.

Qualitative data were obtained from seven key informants: three project-owner representatives, two consultant representatives, and two contractor representatives. Participants were selected because they had direct responsibilities in project management, supervision, technical coordination, or field decision making. In-depth interviews began on 27 November 2023 in Padang. A focus group discussion was subsequently held on 19 December 2023 at P2JN West Sumatra to validate the emerging interpretation across stakeholder groups.

Qualitative transcripts were analyzed through seven phenomenological stages adapted from Kahija (2017): repeated reading, identification of significant statements, formulation of meaning, clustering of themes, development of textural and structural descriptions, synthesis of the essence of experience, and reporting. Participant identities were anonymized in the revised presentation by using stakeholder codes.

EFA was conducted using principal component analysis with Varimax rotation. Data adequacy was evaluated using the Kaiser-Meyer-Olkin (KMO) statistic, Bartlett's test of sphericity, and the Measure of Sampling Adequacy (MSA). The criteria were KMO $\geq$.60, Bartlett's $p \leq$.05, and MSA $\geq$.50 (Shrestha, 2021). Components with eigenvalues greater than 1 were retained, and loadings of approximately .50 or higher were prioritized for interpretation (Akhtar-Danesh, 2017; Hair et al., 2019). Although a conventional ratio of 5-10 respondents per item would suggest 195-390 participants for 39 items (Stefana et al., 2024), the available sample

was 77. Therefore, the factor solution is interpreted as exploratory and should be externally validated in a larger sample.

Results

Respondent Profile

The quantitative dataset comprised 77 consultant respondents. Their educational profile is summarized in Table 1.

Table 1.
Quantitative Respondent Profile

Characteristic	Category	n	%
Role/organization	Consultant	77	100.0
Education	Bachelor's degree	42	54.5
	Master's degree	30	39.0
	Doctoral degree	3	3.9
	Other/uncategorized	2	2.6

Preliminary Descriptive Findings

The preliminary descriptive assessment compared the most prominent individual and social problems reported for project-owner, consultant, and contractor stakeholders across existence, determination, degree, frequency, and impact criteria. Table 2 condenses the original graphical results.

Table 2.
Most Prominent Problems by Assessment Criterion and Stakeholder

Criterion	Project owner	Consultant	Contractor
Existence - individual	Decision making (86.4%)	Problem solving (73.7%)	Problem solving (81.8%)
Existence - social	Prejudice (90.9%)	Communication (93.3%)	Compliance/altruism (86.4%)
Determination - individual	Creativity (91.0%)	Creativity (89.1%)	Creativity (81.3%)
Determination - social	Communication (93.3%)	Communication (95.7%)	Communication (94.1%)
Degree - individual	Creativity (81.8%)	Creativity (85.4%)	Motivation (81.3%)
Degree - social	Compliance (76.5%)	Communication (59.6%)	Compliance (78.9%)

Criterion	Project owner	Consultant	Contractor
Frequency - individual	Creativity (45.5%)	Creativity (71.7%)	Decision making (80.0%)
Frequency - social	Compliance (70.6%)	Compliance (69.4%)	Communication (64.7%)
Impact - individual	Decision making (57.9%)	Creativity (58.7%)	Work motivation (71.4%)
Impact - social	Altruism (57.2%)	Stereotypes (66.7%)	Communication (88.2%)

The descriptive findings show that communication was consistently prominent in problem confirmation and perceived impact, while compliance was particularly prominent in the degree and frequency assessments. Creativity was the main individual problem for project owners and consultants, whereas contractors more often emphasized decision making, work motivation, and communication. The complete original graphical results are retained in Figures 1-10 below.

Graphical Presentation of the Descriptive Results

The following figures retain the original graphical presentation of the survey results for project owners, consultants, and contractors. The captions and explanatory narratives have been edited for clarity and consistency with the revised manuscript.

1. Existence

Existence aims for confirm existence problem Good in factor both individual and human social to each *stakeholder*. The following is a graph of respondents who chose the existence of problems in individual human factors.

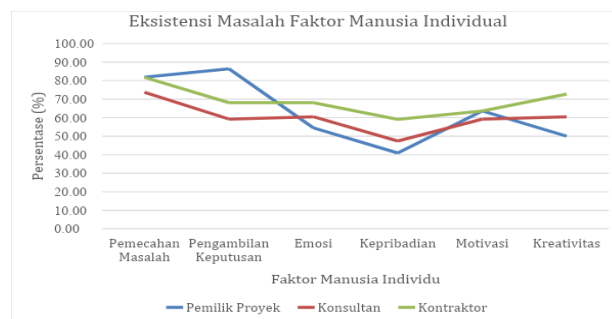


Figure 1. Graph of The Existence of Individual Human Factor Problems

From Figure 1 above, it can be seen that the majority of respondents, 86.40%, believe there are problems with decision-making among project owners. Meanwhile, the majority of consultant

respondents, 73.70%, and contractor respondents, 81.80%, believe there are problems with problem-solving. Furthermore, only 40-60% stated that there are personality issues among civil engineers working in the industry. in project owners, consultants, and contractors.

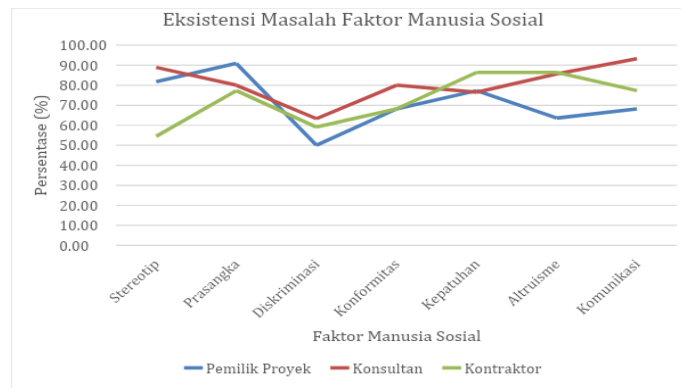


Figure 2. Graph of The Existence of Social Human Factor Problems

Figure 2 shows that 90.90% of project owners believe there is a problem with prejudice. Meanwhile, 93.30% of consultants believe there is a problem with communication. And 86.40 % of respondents are contractors. have an opinion that there is problems with obedience and altruism. And around 50-60% of respondents have an opinion existence problem discrimination against owners' projects, consultants and contractors.

2. Determination

Determination aims to confirm the problem in both individual human and social factors for each *stakeholder*. The following is a graph of determination of individual and social human factors.

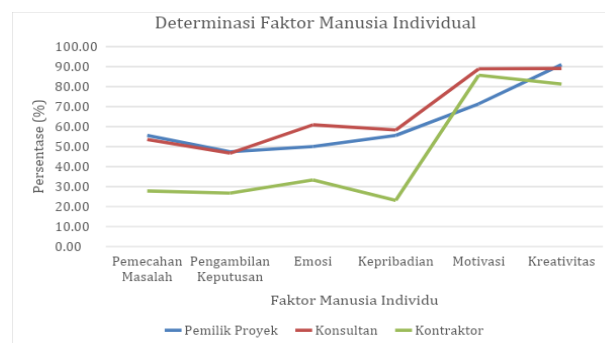


Figure 3. Graph of Individual Human Factor Determination

From Figure 3, it can be seen that 91.00% of project owners chose that there was a problem with creativity. Meanwhile, the majority of respondents, consultants (89.10%) and contractors (81.30%), chose that there was a problem with creativity.

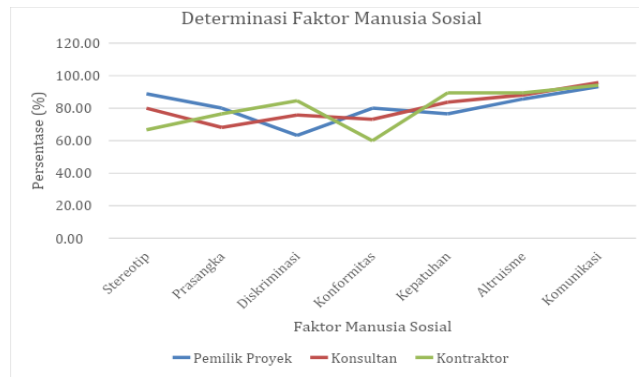


Figure 4. Graph of Social Human Factor Determination

Figure 4 shows that 93.30% of project owners believe there is a communication problem, while 95.70% of consultants and 94.10% of contractors believe there is a communication problem.

3. Degrees

Degrees aim for determine level the weight something problem Good in factor both individual and human social to each *stakeholder*. The following is a graph of the degree of problems in individual and human social factors.

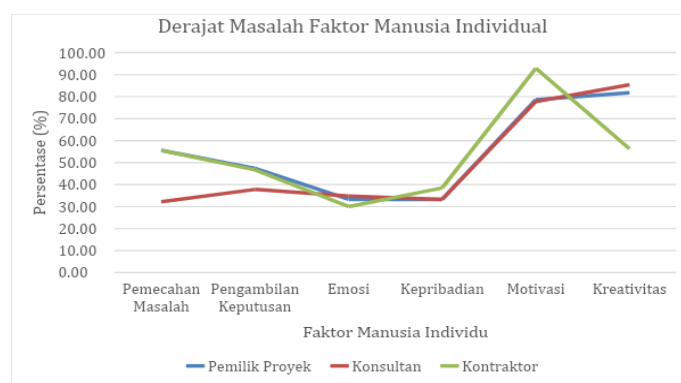


Figure 5. Chart Degrees Individual Human Factors Problems

From Figure 5 it can be seen that known as many as 81.80% of owners project or majority most respondents choose that height problems that exist in creativity. Meanwhile majority

respondents to consultants that is as many as 85.40% chose creativity as problem with degrees tall. And as many as 81.30% of respondents from contractor choose motivation as problem with degrees tall.

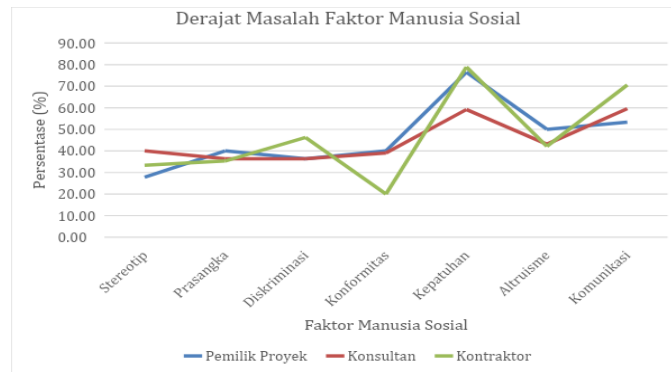


Figure 6. Chart Degrees Social Human Factors Problems

From Figure 6 it can be seen that known as much as 76,5 0% owners project have an opinion that communication is the problem of the highest degree. While as much as 59.60 % of consultants have an opinion communication own degree high problems. And as much 78,90% of respondents are contractors have an opinion that communication own degrees problem tall.

4. Frequency

Frequency aims to determine how often problems arise in both individual and social human factors for each *stakeholder*. Below is a graph of the number of respondents who chose the frequency of problems in individual and social human factors.

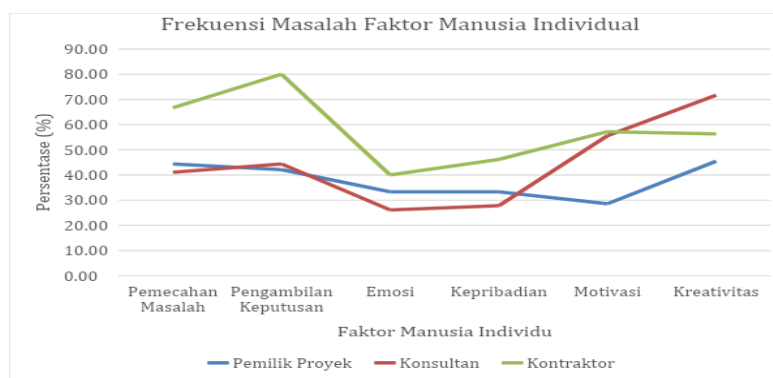


Figure 7. Graph of Problem Frequency in Individual Human Factors

From Figure 7, it can be seen that 45.50% of project owners chose that the most common problem was related to creativity. majority respondents to consultants that is as many as 71.70% also chose creativity as common problems happened. And as many as 80.00% of respondents from contractor choose taking decision as common problems happen.

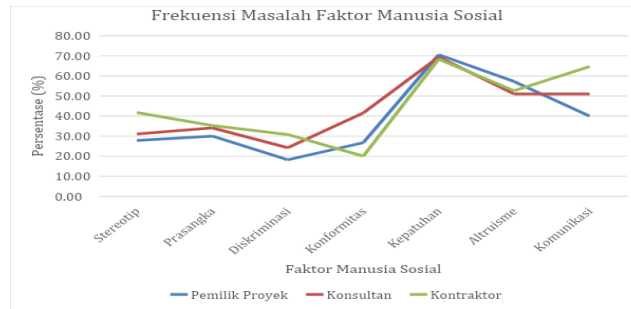


Figure 8 Frequency Graph of Problems in Social Human Factors

Figure 8 shows that 70.60% of project owners and 69.40% of consultants chose compliance as a frequent issue. And 64.70% of contractor respondents chose communication as a frequent issue.

5. Impact

Aim For know how much big impact problem Good in factor both individual and human social to each *stakeholder*. The following is a graph of the number of respondents who expressed their opinions about the impact of existing problems on individual and social human factors.

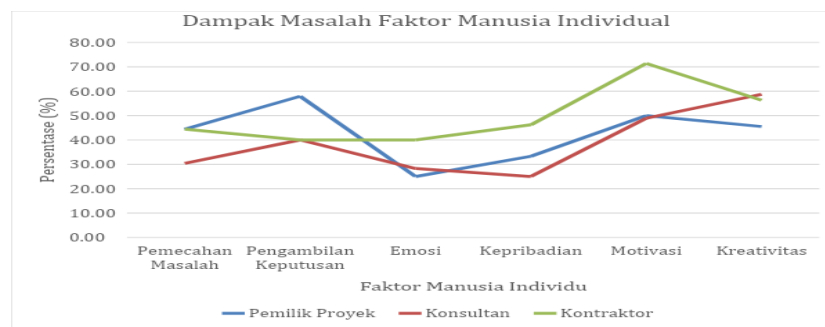


Figure 9 Chart Impact of Problems on Individual Human Factors

From Figure 9 it can be seen that known as many as 57.90% of owners project choose taking decision own big impact to individual performance or organization. While majority respondents to consultants that is as many as 58.70% chose creativity as problems that have

impact big to individual performance or organization. And as many as 71.40% of respondents from contractor choose communication as problems that have impact big to individual performance or organization.

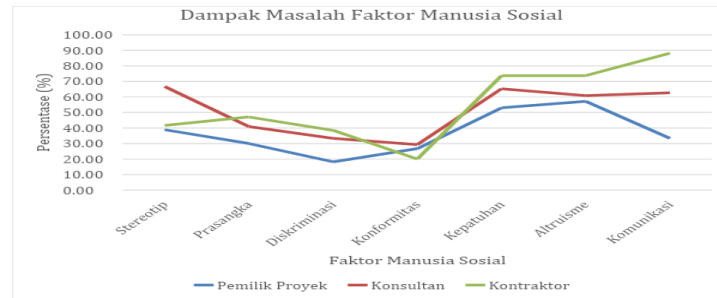


Figure 10. Graph of the Impact of Problems on Social Human Factors

Figure 10 shows that 57.20% of project owners chose altruism as having a significant impact on individual or organizational performance. Meanwhile, the majority of consultant respondents (66.70%) chose stereotypes as having a significant impact on individual or organizational performance. And 88.20% of contractor respondents chose communication as having a significant impact on individual or organizational performance.

Exploratory Factor Analysis (EFA) Results

Implementation analysis factors produce reduction of 39 variables and manifest become latent variables, so that can identify factors dominant influencing.

- Inspection Matrix Correlation

Purpose of Bartlett's test is to know whether there is significant correlation intervariable in the data. As shown in Table 3, the value p is .000 shows significant correlation between a number of variables in sample. In addition, the value The Kaiser-Meyer-Olkin (KMO) is .939, which exceeds the common minimum limit. used that is .60, confirms that the data is valid for analyzed use analysis factors.

Table 3.

KMO Value and Bartlett's Test of Sphericity			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			.789
Bartlett's Test of Sphericity		Approx. Chi-Square	2379.287
		Df	741
		Sig.	.000

- Measure of Sampling Adequacy (MSA) Test

The Measure of Sampling Adequacy (MSA) test is a statistical technique used to assess the appropriateness of each variable in factor analysis, based on its level of correlation with other variables. The results of the MSA analysis are presented in Table 4.

Table 4.
MSA Values

Item	MSA Value	Item	MSA Value
P1	0.883	P21	0.797
P2	0.822	P22	0.668
P3	0.837	P23	0.513
P4	0.682	P24	0.803
P5	0.761	P25	0.755
P6	0.814	P26	0.792
P7	0.755	P27	0.683
P8	0.842	P28	0.849
P9	0.774	P29	0.831
P10	0.818	P30	0.751
P11	0.834	P31	0.620
P12	0.801	P32	0.822
P13	0.757	P33	0.791
P14	0.871	P34	0.810
P15	0.822	P35	0.810
P16	0.825	P36	0.665
P17	0.836	P37	0.848
P18	0.633	P38	0.847
P19	0.597	P39	0.754
P20	0.752		

Based on Table 4, all variables own MSA value $> .5$, so that worthy, analysed use analysis factor . The highest MSA value found at X7 (.980) and the lowest at X12 (.585), which shows data sufficiency for analysis factor r.

Table 5.
Factor Extraction

Item	Initial	Extraction	Item	Initial	Extraction
P1	1	0.867	P21	1	0.636
P2	1	0.695	P22	1	0.731
P3	1	0.859	P23	1	0.737
P4	1	0.7	P24	1	0.665
P5	1	0.845	P25	1	0.662
P6	1	0.77	P26	1	0.783
P7	1	0.728	P27	1	0.653
P8	1	0.705	P28	1	0.786
P9	1	0.693	P29	1	0.728
P10	1	0.72	P30	1	0.630
P11	1	0.742	P31	1	0.688
P12	1	0.7	P32	1	0.821
P13	1	0.758	P33	1	0.794
P14	1	0.806	P34	1	0.738
P15	1	0.872	P35	1	0.774
P16	1	0.798	P36	1	0.757
P17	1	0.832	P37	1	0.782
P18	1	0.789	P38	1	0.741
P19	1	0.828	P39	1	0.638
P20	1	0.766			

Based on Table 5, all variables have adequate extraction values, with the highest value at P1 (.867) and the lowest at P30 (.463), so the data is suitable for analysis using factor analysis.

Table 6.
Eigen Value

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	13.467	34.531	34.531
2	3.905	10.014	44.545
3	2.691	6.9	51.444
4	2.282	5.851	57.296
5	1.723	4.417	61.713

6	1.362	3.493	65.206
7	1.327	3.404	68.61
8	1.269	3.255	71.865
9	1.19	3.05	74.915

Table 6 shows that the nine dominant factors are able to explain 74.915 % of the variation of the 39 manifest variables, which indicates a fairly high level of analysis accuracy even though there are still variations in the data that have not been explained.

- Factor Rotation

After extraction, nine latent factors were identified from 39 manifest variables with loadings > .5 as dominant variables. Varimax rotation was used to facilitate interpretation and grouping of variables, as presented in Table 7.

Table 7.
Factor Rotation

Item	Factor	Indicator	Loading Factor
P32	1	Frequency emergence behavior compliance	.826
P33		Impact behavior compliance	.801
P30		Impact behavior conformity	.739
P28		Behavior level conformity	.71
P29	2	Frequency emergence behavior conformity	.698
P34		Behavior level altruism	.684
P7		Emotional level individual	.886
P3		Impact difficulty solution problem	.815
P6	3	Impact difficulty taking decision	.778
P2		Frequency emergence difficulty	.673
P12		Impact problem personality	.671
P24		Impact prejudice	.528
P16	3	Level of creativity in work	.47
P13		Motivation level Work individual	.788
P17		Frequency problem creativity	.704
P15		Impact problem motivation	.651

P10		Level of problem personality	.626
		Frequency emergence	
P8		negative emotions	.603
		Frequency emergence	
P11		problem personality	.534
		Frequency problem	
P14		motivation Work	.532
P21		Impact stereotypes	.477
		Level of problem	
P25		discrimination	.475
		Difficulty level in solve	
P1	4	problem Work	.875
		Frequency difficulty taking	
P5		decision	.767
P36		Impact behavior altruism	.832
P27		Impact discrimination	.623
	5	Compliance level in	
P31		environment Work	.58
P22		Level of problem prejudice	.502
P19		Level of problem stereotypes	.85
P18	6	Impact problem creativity	.792
		Frequency emergence	
P23		prejudice	.573
		Level of effectiveness	
P37		communication Work	.72
		Frequency emergence	
P38	7	problem communication	.664
		Frequency emergence	
P35		altruistic behavior	.647
		Impact communication that	
P39		is not effective	.431
		Frequency emergence	
P26	8	discrimination	.774
P9		Impact condition emotional	.589
		Difficulty level in taking	
P4	9	decision	.651
		Frequency emergence	
P20		negative stereotypes	.553

The results of the varimax rotation produced nine main factors that represent the identification of latent factors related to the problematic mentality of engineers in the dynamics

of sustainable infrastructure project stakeholder organizations, with factor-loaded variables (loading > .5) as the basis for interpretation. The following is an explanation:

Factor 1. Compliance (Variance: 34.531%): The dominant factor representing compliance, conformity, and altruism behavior in the work environment. The highest loading value is found in the frequency of compliance behavior (.826), confirming the dominance of the compliance aspect.

Factor 2. Emotional Condition (Variance: 10.014%): Reflects the individual's emotional condition, with the main indicator of the individual's emotional level (P7) having the highest loading of .886.

Factor 3. Work Motivation (Variance: 6.900%): Describes aspects of work motivation, with the dominant indicator being the level of individual work motivation (P13) and a loading value of .788.

Factor 4. Problem Solving (Variance: 5.851%): Focuses on work problem solving skills, characterized by the level of difficulty in solving problems (P1) with a loading of .875.

Factor 5. Altruism (Variance: 4.417%): Represents altruistic behavior, with the dominant indicator being the impact of altruistic behavior (P36) and a loading of .832.

Factor 6. Stereotypes (Variance: 3.493%): Describes the problem of stereotypes, indicated by the level of stereotype problems (P19) with the highest loading of .850.

Factor 7. Communication Effectiveness (Variance: 3.404%): Reflects the effectiveness of work communication, with the main indicator P37 having a loading of .720.

Factor 8. Discrimination (Variance: 3.255%): Related to the issue of discrimination, it is marked by the frequency of the emergence of discrimination (P26) as the dominant indicator with a loading of .774.

Factor 9. Decision Making (Variance: 3.050%): Represents the difficulty of decision making, with the main indicator being the level of decision making difficulty (P4) and loading .651.

Overall, these results indicate that the problematic human factors in the work context are multidimensional, encompassing behavioral, emotional, cognitive, motivational, and communication aspects, as well as social issues such as prejudice, stereotypes, and discrimination. The dominant factor influencing the mentality of engineers in the organizational dynamics of stakeholders in sustainable infrastructure projects is the Compliance Factor (34.531%).

Qualitative Results and Analysis

Based on in-depth interviews conducted with project owners, consultants and contractors, the following in-depth interview results were obtained:

1. Project Owner

- Mr. MS as PJN 1 Work Unit said that:

"During my time as a work unit, I often couldn't be rigid in making decisions on field issues. Several factors needed to be considered to ensure the project ran smoothly. I currently have dozens of projects. When I wasn't flexible, I became increasingly dizzy and stressed. That's why communicating and coordinating with my subordinates with clear instructions was crucial."

- Mr. AR as PPK said that:

"I often irritated and overthinking until carried away to Mom's house, When I Already do Lots things in the field, time I consumed, time For family also reduced. Still not appreciated by the leadership, with less words comfortable Still just blamed. Well, so I'll just stay home for now."

- Mr. PRH as PPK said that:

"Yes, indeed communication it is very important and needed especially in interact with other stakeholders. In addition, several soft skills need mastered by engineers technique civil."

"Consultants and contractors that sometimes-afraid take decision whereas should be not no need Afraid right Can discussed."

2. Consultant

- Mr. WD as Site Engineer said that:

"uncertainty in take decision, no follow what the PPK wants, then There is concern in self me. And in the project furthermore There is afraid so that Want to not Want to moment take decision No free and available pressure."

"So that time I chatting, earlier Already There is That it turns out ability from PU itself yes means something like this here yes that PU need get input they That expect input from consultant No everything PU decided "

"His competence Already Certain No support because communication No supported by mental courage talk fatal consequences for ability communication supported by a strong mentality"

- Mr. KHS as Site Engineer said that:

"As an SE, I often feel pressured when communicating technical truths. For example, if I want to say A, I can't say A clearly. Because the PP doesn't approve of what I'm technically stating. Even though it's the truth, I follow PP policy. But when it's technically dangerous, sometimes I still speak frankly. If you want to be fired, then just fire me. Rather than poor quality work and harming many people."

"Yes ma'am, I often do too prejudiced to contractors and owners' projects. Often, they meeting myself and I No invited. I also suspect perhaps they also play alone. If that's the case like That Of course No nice If Want to talk about it I'm scared too " Speaking, ma'am."

3. Contractor

- Mr. R as Project Manager said that:

"One of in take decision That if according to I return to the personality concerned. Because we when carry out field work That limited by budget. So how? sufficient the budget that has been given from canter . How maybe ma'am Can decide A, B or C if budget just No Enough. "

" Perhaps if for example consultant meet with PU collusion this. I suspect bad perhaps they want to play alone"

- Mr. ED as Project Manager said that:

" I as contractor Now this is what makes I stressed is communicate to apparatus enforcer law ..."

Based on results of the In-Depth Interview that has been done can know that, there is similarities problems that arise in the third *stakeholders*, namely problem related taking decision . For *stakeholders*, consultants and owners the same project is problem communication. However, it is different with contractor *stakeholders* who become problem main is besides communication and personality. From the interview the We Can know how much importance good communication within A team.

Discussion

The EFA identified nine dimensions and confirmed that engineer mentality cannot be reduced to a single personal trait. The model combines behavioral, emotional, motivational, cognitive, communicative, and intergroup dimensions. The 74.915% cumulative variance indicates that the extracted structure captured a substantial proportion of the observed response pattern, while the KMO of .789, significant Bartlett's test, MSA range of .513 - .883, and communalities of .630 - .872 support the exploratory factorability of the items.

Compliance was the dominant factor, explaining 34.531% of the variance. In construction organizations, compliance can protect quality and safety when it reflects commitment to procedures, but it can become maladaptive when it develops into unquestioning conformity. Safety-climate research shows that rule adherence is shaped not only by personal discipline but also by supervisory consistency, organizational priorities, and communication (Chen et al., 2021; Kadir et al., 2022; Zohar & Luria, 2003). The present findings add an important distinction: strong compliance coexisted with narratives of fear, suppressed disagreement, and reluctance to communicate technical concerns.

This coexistence reveals the central psychological dynamic in the sample. Engineers appeared to manage tension between professional judgment and hierarchical expectations. Overt agreement may preserve role security and short-term coordination, yet it can also silence dissent and delay the communication of field risks. The consultant narrative about being unable to state a technical truth openly illustrates reduced psychological voice. Thus, the dominant compliance

factor should not be interpreted simply as positive rule-following; it may also indicate a relational environment in which personnel protect themselves by conforming.

Emotional condition and work motivation formed the second and third factors. Interview accounts of irritation, overthinking, stress, reduced family time, and withdrawal suggest that project pressure enters both the cognitive and affective domains. Emotional intelligence is relevant because project success depends partly on the ability to regulate emotion, maintain trust, and remain functional under conflict (Rezvani et al., 2016). Motivation is similarly shaped by perceived autonomy, competence, and relatedness (Deci & Ryan, 2000). When engineers feel blamed, excluded from decisions, or unable to use their expertise, motivation may shift from active contribution toward minimal compliance or disengagement.

Problem solving and decision making represent the cognitive-strategic component of engineer mentality. Infrastructure decisions are rarely purely technical; they are constrained by budgets, schedules, authority, risk allocation, and stakeholder interests. The contractor account of insufficient budget demonstrates how structural constraints can narrow the feasible decision space. This is consistent with the view that governance and stakeholder engagement are integral to sustainable-project decisions (Tumpa & Naeni, 2025). Standard procedures remain necessary, but complex field conditions also require transparent reasoning, explicit risk criteria, and the authority to escalate unresolved technical concerns.

Communication emerged repeatedly in the descriptive and qualitative findings. It was the most prominent social problem across determination and degree assessments and had the greatest reported impact among contractors. Poor communication in construction has been linked to conflict, rework, delay, and weak stakeholder integration (Butt et al., 2016; Gamil & Abd Rahman, 2023). The present interviews show that the problem was not merely message frequency. It involved power asymmetry, unclear instructions, restricted feedback, and fear of interpersonal or employment consequences. These conditions explain why technically competent personnel may still fail to transmit essential information.

Creativity was prominent in the preliminary descriptive findings even though it did not form a separate dominant EFA factor. This divergence is theoretically meaningful. Creativity may operate as an observable consequence of several underlying conditions rather than as an independent factor: emotional strain, low autonomy, weak motivation, rigid compliance, and constrained communication can collectively inhibit the generation and expression of new solutions. The result helps explain why participants identified creativity as a visible field problem while the factor structure distributed its indicators across emotional, motivational, and stereotype-related dimensions.

Stereotypes, prejudice, and discrimination demonstrate that engineer mentality also contains a social-identity component. Suspicion that other stakeholder groups are 'playing on their own' reflects attribution across organizational boundaries. Social Identity Theory explains how categorization into owner, consultant, and contractor groups can produce in-group trust and out-group bias (Ashforth & Mael, 1989, 2024; Tajfel & Turner, 1979). In project practice, such bias can reduce information sharing, encourage defensive documentation, and transform technical disagreement into interpersonal distrust.

The novelty of this study lies in showing how these dimensions interact rather than occur independently. Earlier construction research has often isolated safety climate, unsafe behavior, communication, emotion, or stakeholder collaboration (Gamil & Abd Rahman, 2023; Hamdan et al., 2021; Meng et al., 2021; Ye et al., 2020). The present model integrates individual psychology and social-organizational dynamics and triangulates the factor structure with cross-stakeholder experiences. The most distinctive finding is the combination of dominant compliance with suppressed communication and inhibited creativity. This pattern suggests that a project can appear orderly while still containing latent relational and psychological risks.

Practical implications follow directly from this interpretation. Project organizations should establish recurring cross-stakeholder coordination forums with documented decisions, responsible persons, escalation routes, and feedback loops. Supervisors should distinguish constructive technical dissent from disobedience and create safe channels for reporting quality and safety concerns. Training should combine communication, emotion regulation, conflict

management, creative problem solving, and risk-based decision making. Organizations should also review meeting access, information distribution, and performance evaluation practices that may reinforce stereotypes or silence less powerful stakeholder groups.

The study has limitations. The quantitative sample consisted of 77 consultants from a single project context and was smaller than the conventional 5-10 respondents per item. The factor solution should therefore be treated as exploratory rather than final. The descriptive stakeholder percentages and qualitative narratives provide useful triangulation, but they do not replace external validation with a larger, more balanced sample of owners, consultants, and contractors. Future research should conduct confirmatory factor analysis, test reliability and convergent-discriminant validity, and evaluate whether the structure is invariant across stakeholder groups and regions.

Conclusion

This study identified nine interrelated dimensions of engineer-mentality problems in sustainable infrastructure stakeholder relations: compliance, emotional condition, work motivation, problem solving, altruism, stereotypes, communication effectiveness, discrimination, and decision making. Compliance explained the largest proportion of variance, but qualitative evidence showed that its organizational meaning was ambivalent because adherence to hierarchy coexisted with suppressed professional voice, emotional strain, distrust, and inhibited creativity. The findings therefore indicate that project difficulties are shaped not only by technical competence but also by the interaction of individual psychological capacities with power, communication, social identity, and organizational conditions. The resulting exploratory structure provides an empirical basis for subsequent validation of engineer mentality as a multidimensional construct.

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