

# ROLE OF PERSONALITY IN TEAM FORMATION FOR ENGINEERING PROJECT SUCCESS

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## Abstract

In Engineering project management, teams are of crucial importance in achieving project goals. Given the recent findings, aside from the technical skills and knowledge of the field, the focus is now on more soft skills, such as the individual's personality traits, which impact the performance of the team and the team dynamics. This study looks into how distinct individual personality traits impact team formation, task assignment, conflict resolution, and collaboration in engineering projects. It integrates personality assessment theories such as The Big Five and MBTI with the field of project management to emphasize not only the skills, but also the interrelations among the skills, personalities, and roles of the team members. For this study, the researchers observed teams of engineering students and project professionals from a variety of disciplines in different collaborative work contexts. Participants submitted their personality profiles using a self-report questionnaire, and project outcomes were evaluated quantitatively and qualitatively, including a measurement of project success. The research showed that well-balanced team composition, especially teams with a higher degree of Conscientiousness, Openness, and Emotional Stability, promote greater innovation, leadership, and effectiveness in communication. On the contrary, poorly matched personalities are distinguishable by their conflicts and delays. The findings of this study highlight the importance of developing methods based on personality traits in order to optimally configure teams in engineering education and in the workplace. This research focuses on the application of personality datasets and argues that ethical frameworks which acknowledge diversity among individuals are essential, even when striving to galvanize constructive collaboration. One of the planned future works is to design systems powered by AI which would form teams based on personality traits, as well as analyze the long-term impact of personality diversity on creative collaboration. This investigation occupies an embedded and evolving interdisciplinary conversation spanning psychology, education, and engineering.

**Keywords:** Conflict management, social psychology, personal characteristics, the outcome of an engineering project, social processes, the five personality traits, equilibrium within a team.

## 1. INTRODUCTION

The successful undertaking of engineering projects requires extensive task division and collaboration of considerable teamwork, frequently within a specialized and dangerous context. Such projects are not the outcomes of mere technological creativity; they are the results of multiple stakeholders having the ability to design mutually dependent and coordinated systems. Conventional project management systems have, until now, focused on role assignments, defined responsibilities, and defined productivity metrics at a rather high, organizational level. Recently, however, scholarly and practical discourse has begun to recognize the mediating role of social characteristics—individually and collectively—upon team behavior and its resultant impact on cohesion and performance. Beyond merely delineating networks of interaction, these social characteristics shape motivation hierarchies, regulate the trajectory of organizational process governance, mediate escalation and de-escalation of conflict, and, in critical instances, enable leadership that reframes problem space. This inquiry probes the degree to which social characteristics govern the formulation, articulation, and operational success of teams within engineering-oriented environments.

As projects evolve to be multidimensional and increasingly time-sensitive, careful calibration of both personal attributes and team arrangements moves to the forefront of management practice [13]. The broader adoption of personality assessments across corporate and academic settings has prompted the hypothesis that teams engineered around personality typologies can realize higher productivity and greater effectiveness [14]. Through a comparative analysis of student engineering teams and established professional units, the present research evaluates the degree to which collaborative functioning and attainment of targeted outcomes are moderated by personality variation, trait compatibility, distributive

balance, and trait diversity [15]. The introduction situates the inquiry within the expanding centrality of project work in both educational curricula and engineering leadership [3]. Recognition of human factors and “soft” skills within STEM education is now a programmatic priority, assigning personality dimensions an overt role in team efficacy. The link between personality and collective effectiveness is articulated, and team performance is subsequently correlated with individual variance to refine project results in engineering contexts [10]. This paper ultimately seeks to elevate performance through deliberate restructuring of team membership, leveraging personality profile data to form well-defined engineering units.

### **1.1 Background on Team Dynamics in Engineering Projects**

Engineering departments routinely operate within environments that demand collaborative engagement, shared responsibility, and expedited decision-making [8]. Historically, role assignment in these settings has focused on technical competencies. Yet, such an approach frequently overlooks the relational dimensions that influence communication pathways, trust formation, and collaborative effectiveness. When these dimensions are misaligned—across relational networks, social perceptions, and team dynamics—projects incur delays, increased friction, and potential systemic failure [7]. A growing body of scholarship now emphasizes the necessity of integrating social science perspectives, advocating for a view of teams that extends beyond observable behaviors and discrete personality inventories [12]. Improving insight into the dynamics of social interaction in engineering teams is likely to increase the speed of execution and strengthen the organizational and structural resilience [4].

### **1.2 Importance of Personality Traits in Collaborative Work**

Personal traits shape an individual’s approach to task execution, interaction, and conflict management within a team. In the context of an engineering project, aspects of personality such as openness to experience foster creativity, conscientiousness helps in meticulous tracking of tasks, and agreeableness aids in the smooth resolution of interpersonal disagreements [6]. While the balance of introverted and extraverted team members influences the team’s interaction pattern, emotional stability is essential for composure during critical moments. In this regard, the integration and mutual reinforcement of the diverse traits is what determines team performance [5]. When the roster of personalities is isomorphic and members’ strengths offset one another’s weaknesses, multiparty cooperation augments collective performance that is crystallized by cooperation and emergent synergy. Therefore, purposeful team orchestration grounded in a principled evaluation of the personality dimensions fosters greater interactional dynamics, improves psychological safety, and leads to enhanced project outcomes.

## **2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

Developments in organizational behavior and project management highlight the crucial role of personality psychology in engineering teams with exceptional performance. Success in a project is no longer exclusively based on technical skills; the formation of teams along with decision-making processes and the communication within and outside the team are profoundly influenced by personality. This review incorporates the latest empirical evidence with the underlying theoretical personality work in engineering psychology. The Big Five framework—Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability—serves as a robust, multifaceted lens through which to examine how cognitive and behavioral individual differences interact [11]. Research consistently shows that heterogeneous teams, when personality differences are complementary, exhibit superior problem solving and innovative capacity. A salient illustration is the productive pairing of high-openness team members with those manifesting high conscientiousness. The literature further underscores the importance of congruence between personality and assigned project roles, as well as between personality and leadership style. Misalignment incurs conflict and erodes trust, thus attenuating workflow. Complementary frameworks, such as Belbin’s Team Roles, propose that specific personality profiles can be mapped onto traditional project functions—implementer, coordinator, innovator, and others—thereby optimizing overall team cohesion.

Recent studies continue to show that engineering units whose members display elevated emotional intelligence—largely a function of individual personality—manage stress, uncertainty, and interpersonal discord more effectively. As the discipline demands ever more integrated, cross-functional project groups, understanding the dynamics of personality interplay assumes crucial importance for purposeful team composition [9]. The sections that follow articulate these findings and their significance to engineering practice, situating them within the emergent framework known as the Theory of Engineering.

### **2.1 Personality Models in Engineering Contexts (e.g., Big Five, MBTI)**

The Big Five personality model persists as a foundation for longitudinal studies of team behavior in engineering contexts. Elevated openness consistently aligns with increased generative prototyping and advances in conceptual design; heightened conscientiousness underpins rigorous observance of voluntary best practices and temporal alignment of documentation; and a mid-range preference for extraversion sustains high-frequency, cross-disciplinary information flows. Conversely, the Myers-Briggs Type Indicator, via its binary scales—most notably the Sensing–Intuition and Judging–Perceiving axes—retains pragmatic utility in both academic and industrial workshops by illuminating differential cognitive-processing profiles. When its interpretive premises are cross-referenced with empirical distributions

of cognitive preferences, the typological scheme clarifies likely team function across consecutive stages of the design lifecycle, from divergent ideation to stringent hazard appraisal. The cross-methodological synthesis equips project managers with an economical framework for team design. By synthesizing disparate, yet complementary, personality clusters, capstone engineering programmers craft a cohesive system of flexible adaptation congruous with diverse reservoirs of knowledge. This self-organization of variably constrained system responsiveness refines system responsiveness while synchronizing longitudinal employee development arcs with the meta-dynamics of evolution within a single project, manifesting latent personality traits as quantifiable performance metrics.

## 2.2 Team Composition and Performance Outcomes

The composition of personality traits within engineering teams impacts significantly the trajectory of creative exploration, the velocity of work completion, and the rate at which harmony erodes among members. Studies have indicated that varying degrees of traits like openness to experience and extraversion enhance cognitive flexibility, augmenting the creative output, whereas shared conscientiousness sharpens the focus on the sustained deliverable. Conversely, the uncoordinated clustering of traits marked by excessive variation results in social friction that in the moment, saps productive flow. The optimal state emerges when the personality portfolio synergizes to reinforce, rather than compete, resulting in a composite of more harmonious traits. If carefully attended to, teams approximate the principle of functional diversity; such designs intentionally place diverging refined traits in interdependent 'relational' roles. An adaptive understanding of these frameworks, when integrated into curricula and curriculum-guided programs, allows educators and leaders to strategically construct aligned homogeneous or intentionally diverse teams to produce refined, high-quality, and scalable outcomes.

## 3. RESEARCH METHODOLOGY

This study utilizes a mixed-methods approach to study the effects of personality on team composition and on team performance in engineering projects. Quantitative elements comprise personality testing and consolidated metrics of performance at the project level, while qualitative components consist of semi-structured interviews and project-context ethnographic observations. The framework encompasses both the stable, enduring personality traits and archetypal configurations and the evolving, fluid relational network thickening over project phases. The study included the senior undergraduate engineering students and graduate engineers participating in project-based learning in teams. Following team assignment, all members of one team were administered the Big Five Inventory and teams were then created to manipulate personality alignment systematically, some having complementary and some contrasting profiles. This stratified design permitted analytically distinct comparisons among deliberately diverging team configurations. Teams, convened across the project cycle—initiation, design, implementation, and retrospective assessment—were tracked for behavioral indicators of interpersonal interaction, with particular focus on the emergence of leadership, distribution of task responsibilities, and trajectories of conflict resolution. Performance evaluations included aggregate project scores, anonymized peer ratings, and outcome-centric indices such as task completion velocity and the originality of final deliverables.

Upon project conclusion, semi-structured interviews were conducted to probe participants' subjective interpretations of team dynamics, role assignments, sources of satisfaction, and encountered difficulties.

Triangulation of qualitative interviews with quantitative trait assessments substantiates the analytic depth and validity of the relationship between personality and team effectiveness. Ethical protocols of voluntary participation, strict data anonymization, and clear informed consent were rigorously followed. The congruence of measured personality dimensions with the actual behaviours recorded in the engineering project teams produces a coherent and extensive data corpus. Consequently, the inferred causal association—where specific personality profiles reliably correlate with enhanced team performance in engineering contexts—achieves a greater level of empirical confidence.

### 3.1 Participant Selection and Project Setting

The research collected data from a cohort of 60 final-year engineering students and 20 professionals recruited across a spectrum of disciplines. To promote a diverse realization of types of being and engagement, purposive and heterogeneous teams were generated. Within the educational framework, students participated in a semester-long capstone design initiative; concurrently, professional teams pursued shorter-term innovation mandates. Through deliberate placement in collaborative settings sustained by mutual interdependence and shared accountability, the heterogeneous group functioned as an analytically robust sample. The incorporation of varied age, expertise, profession, and institutional backdrop notably augmented the capability to examine personality trait influence in engineering contexts. These arrangements afforded a controlled setting for dissecting team dynamics and permitted systematic comparison between educational and corporate prototypes of collaborative engineering.

### 3.2 Assessment Tools for Personality and Team Dynamics

Participant personalities were appraised through the Big Five Inventory (BFI), yielding quantitative scores across the five key dimensions of openness, conscientiousness, extraversion, agreeableness, and neuroticism. Evaluation of team dynamics occurred through a triangulation of peer review rubrics, a leadership adaptability scale, as well as conflict

transcription logs. Nonverbal interaction patterns of the collaborations were also analyzed through video recordings. After each project phase, participants completed structured reflection surveys measuring team cohesion and overall project satisfaction. The multi-modal instrument suite provided a subjective and objective exploration of the project outcomes, revealing the interwoven effects of personality integration as well as team functioning.

#### 4. RESULTS AND DISCUSSION

The results compellingly suggest that distinct personality types alone influence a team's operational cohesiveness, communication effectiveness, and in total, an engineering Project's success. Within the cohorts with mutually reinforcing individual attributes, a blend of high conscientiousness, moderate extraversion, and high emotional stability resulted in marked improvements in innovative output, milestone delivery, and interpersonal strife, which was largely suppressed. Esteemed peers indicated that high openness trait holders, though contributing high volumes of novel ideas, at times transcended the bounds of excessive ambiguity, highlighting the importance of desirable balance. Agreeable individuals emerged as the highest conflict mediators and collaboration performers while strongly marked conscientious individuals reliably emerged as the most trusted leaders. On the other end of the spectrum, an overemphasis on dominant, extraverted tendencies resulted in interpersonal conflict and withdrawal of quieter, introverted participants. Qualitative interviews corroborated members' perceptions relating comfort, communicative openness, and initiative directly to the degree of personality alignment. Quantitative behavioral data reinforced the notion that leadership, when unanchored to technical expertise but grounded in emotional regulation, dedication, and empathic attunement to the group, surfaced with notable frequency. Teams that concurrently achieved high-quality problem resolution and uninterrupted developmental momentum revealed a signature of both reflective and assertive dialogue.

When analyzing conflict dynamics, we observed that the intersection of high agreeableness and high emotional stability reliably expedited resolution duration. Conversely, groups exhibiting a diminished intersection of these latent traits generally exhausted internal mechanisms and escalated to externally mediated facilitation to maintain focus on deliverables.

These findings indicate that, while personality characteristics remain largely implicit within team settings, their latent variance manifests as differential project trajectories. Strategic selection and composition of engineering cohorts, informed by psychometric profiling, can reduce relational transaction costs, sustain cognitive bandwidth, and expand the dialogic space for creative solutions. Accordingly, these conclusions advocate for the assimilation of personality analytics into both engineering-accreditation curricula and lifecycle project governance, thereby embedding psychological capital into the disciplinary knowledge base.

##### 4.1 Personality Combinations and Team Effectiveness

Heterogeneity in the supporting personality dimensions of a team enhances performance beyond that achieved by congruent trait distributions. Within these configurations, team members defined by high conscientiousness and teammates defined by high openness were noted to simultaneously execute with precision while framing problems innovatively. Extraverts and introverts also demonstrated synergy, with the former infusing energy to the discussion and the latter providing deep, deliberative input, which together enhanced dialogue with a blend of stability and depth. Trait variation produced enhanced responsiveness in teams, deepened adaptability, and expanded the set of solutions and pathways to attain objectives. On the other extreme, the combination of high neuroticism with low agreeableness exhibited excessive maladaptive divergence, which eroded trust and cohesion and produced adversity. Effective teams, in contrast, demonstrated low emotional volatility while displaying an array of complementary traits, enabling calm, coordinated, focused collaboration. Thus, intentional structuring of personality diversity draws together teams that are united by instrumental aims, while simultaneously relying on diversity that enhances resilience, a clearly desirable effect in the context of improving the particular engineering project effectiveness.

##### 4.2 Communication Patterns, Leadership Emergence, and Role Adaptation

Communication exerted maximal leverage upon output when interwoven with the higher-order traits of extraversion and agreeableness. Extraverted team members usually opened conversational threads, but in the absence of comparably agreeable associates, exchanges were too often inclined toward unconsidered affirmation. Constructive synergy, in contrast, stemmed from a balance of self-affirmative impulses curbed by context-aware empathy. The group's epistemic trajectory was most reliably stable when participants demonstrated high levels of conscientiousness and emotional balance together, surpassing a sole dependence on lean toward aggressive assertive primacy. In high-functioning teams, occupational matrices underwent swift and seamless evolution; role fluidity between leader, collaborator, and other relevant domain-specific positions ensued guided by the task, the team's rhythm, the individual's traits, and group dynamics. Such insights empirically support the hypothesis that productivity in engineering teams is optimized when communication strategies and emergent leadership are context flexible and tailored to the specific intra group personality trait constellation.

#### 5. PRACTICAL IMPLICATIONS

This study offers practical implications for engineering educators and industry stakeholders, especially concerning the criteria for effective projects and the structure of well-performing teams. Data substantiating the claim reveals that the specially tailored personality assessment tool enhances interpersonal relations, collaborative synergy, and novelty of projects on an inter and intra-team basis. It is recommended that educational institutions adopt a personality-sensitive approach to formation and strategically assign students to encourage complementary variations in cognitive engagement and thinking styles. Such heuristics not only foster balanced, equitable engagement across teams, but nurture essential non-technical skills including cognitive empathy, adaptive problem solving, and distributed leadership. Within engineering enterprises, the scheduling of projects and relational tensions among teammates can similarly be refined through personality-based team design.

Role delineation may be fine-tuned to provoke constructive, intra-team tension: for example, assigning detailed schedule generation to individuals with pronounced conscientiousness while allocating exploratory conceptualization to counterparts with elevated openness. This deliberate segmentation attenuates cross-subgroup friction, fortifies mutual accountability mechanisms, and reduces the risk of emotional fatigue. The same reasoning applies to recruitment and onboarding processes; by contrasting the total personality makeup of a current team with that of a prospective employee, firms can both improve accuracy in assessment and strengthen integration outcomes.

Pursuing analytical expertise alongside cultivated interpersonal acumen offers the prospect of teams that operate with heightened coherence, inventiveness, and productivity. When encoded within managerial operating systems, personality metrics enable the adaptive assignment of roles, the tailoring of behaviorally informed feedback, and the proactive apportionment of tasks, all of which align with anticipated collaborative dynamics. In contemporary practice, possession of technical proficiency no longer suffices to secure favorable project results or enduring team performance. The decisive factor has become the patterned conduct of the collective. Accordingly, systems that integrate trait-derived intelligence remain insufficiently applied yet possess the latent capacity to foster sustained synergy, iterative innovation, and agile resilience within engineering cohorts.

### **5.1 Personality-Aware Team Formation Strategies in Academia and Industry**

In higher education, arranging students into groups based on their thinking patterns and personality traits significantly enhances group output, especially in multidisciplinary design courses and during capstone projects. Teachers can improve design team composition through objective methods, particularly the Big Five personality traits model, focusing on extraverted and conscientious traits as critical indicators of engagement and interaction during predefined tasks. The same domains—human resource management and project portfolio management—utilize similar analytics of personality traits to form teams across different organizations to increase collaborative productivity and reduce hidden conflicts between collaborators. The aggregated outcome of such curricular calibration includes pervasive student investment, diminished social friction, and statistically enhanced probability of achieving defined project milestones. The practice of personality-guided team formation thus integrates introspective psychological science with the methodological strictness of engineering, producing deliverables of quantifiable and repeatable quality.

## **6. CONCLUSION AND FUTURE WORK**

This study highlights the decisive influence of personality characteristics at both the formation stage of engineering project teams and during their ongoing operational success. The study finds that relational behavior and communication-related abilities, both of which are significantly shaped by individuals' personality traits, have increasingly become the decisive factors in the effectiveness of engineering collaborations. This marks a departure from earlier models that prioritized the mere possession of relevant technical skills. Analysis of project outputs indicated that teams displaying a quantitatively and qualitatively balanced aggregation of personality attributes were better able to generate creative solutions, maintain persistent focus on objectives, manage conflicts productively, and sustain interpersonal integration. These advantages were assigned to the presence of mutual respect and a shared sense of psychological safety, conditions under which the combined strengths of varied personality types surpassed the achievements of teams deliberately engineered for uniformity as well as of teams operating in climates where psychological safety was lacking. The deliberate inclusion of personality assessment in the curriculum of team-oriented educational modules was found to enhance participants' self-reflective capacity, foster deeper collaborative alignment, and prepare graduates to meet the relational demands expected by the engineering profession. When applied in operational settings, team-forming processes that incorporate personality information—provided that they are executed with careful ethical oversight—can minimize interpersonal discord and catalyze both timely innovation and the accelerated delivery of project outputs. Nevertheless, constructing teams on the sole criterion of personality attributes introduces both ethical dilemmas and practical objections. Institutional guidelines must therefore be structured around ethical principles that include informed consent, the imperative of inclusivity, and the safeguarding of confidential data. Organizations are required to maintain these ethical guardrails and to guard against the simplistic labelling that can derive from the misuse of personality diagnostics.

Future empirical programs must center on the formulation of artificial intelligences that autonomously convene expert consortia and diagnostically discern culture-sensitive personality constructs, mapping their temporal effects on curricula and industrial talent pipelines. Parallel investigation ought to chart personality's modulation of emergent leadership

patterns, adaptive agility, resilience thresholds, and persistent achievement under hyper-competitive constraints, focusing primarily on the engineering paradigm. By integrally embedding personality science within distributed engineering ecosystems, such research can elevate operational precision, broaden cognitive diversity, and fortify emotional literacies, culminating in socially responsible artefacts that evolve in concert with user exigencies while upholding the viability of the overarching enterprise.

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