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# Studying the Impact of Personality Traits on Team Performance for Construction and Engineering

Arlys S. Payne[1] and Christofer M. Harper[2]

[1]Ph.D. Candidate, Bert S. Turner Department of Construction Management, Louisiana State University, Baton Rouge, Louisiana, USA E-mail: asilv19@lsu.edu
[2]Assistant Professor, Department of Construction Management, Colorado State University, Fort Collins, Colorado, USA, E-mail: chris.harper@colostate.edu **(*corresponding author)**

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**ABSTRACT**

There has been an increased interest in personality traits and its impact on team performance. The construction industry can benefit from such studies to predict the team performance in construction projects. Since team performance is an important factor for project success in the construction industry, there is the need to determine the mean correlation value of the Big Five Factors (BFF) of personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience) that assist with predicting construction project team performance based on the personalities of team members. The research methodology for this paper comprises a meta-analysis of existing team performance studies that focus on personality traits linked to team performance, teambuilding, team efficiency, teamwork, job performance, and collaboration for construction project teams. The findings, from the 33 studies used in the meta-analysis, show that conscientiousness has the highest correlation mean and neuroticism has the lowest correlation mean for team performance, while extraversion and agreeableness do not share a common correlation mean, making these traits heterogeneous. Conscientiousness, neuroticism, and openness to experience share a common correlation mean, making these traits homogeneous. Overall, the results of the study show that personality traits do influence team performance, and that a mean correlation value can be determined from published studies. However, it also confirms that further research is needed on this topic as it relates to the construction industry.

**Keywords:** Team building, Team Performance, Personality Traits, Meta-Analysis

## INTRODUCTION

The construction industry is a labor-intensive business, which implies that collaboration, cooperation, and team integration on construction projects can be very beneficial in solving common issues and achieving project goals. Therefore, the team member selection process should be one that takes into account team building and collaboration. Moreover, with the complexity of construction projects and the need for project team integration, there is a requirement for people who have different skills, fields of studies, and management principles, but simultaneously work in a team to exchange information and accomplish common goals [1]. Based on this, the personality characteristics of each team member can have an impact on team effectiveness [1, 2, 3].

Teams in construction projects are either inter-organizational or intra-organizational [4]. This paper focuses on

the inter-organizational project team, composed of representatives from the project owner, designer, primary contractor, consultants, and subcontractors. These are the project team members who have a direct impact on team effectiveness and project success. Therefore, the team building process requires team members to collaborate to meet project goals [4]. Team building assists with team cohesion and collaboration by developing a common purpose, sharing common goals/objectives, creating trust among members, and promoting problem-solving characteristics among all team members [4]. A team building process is highly efficient but could be an issue if the project team members are unwilling to work together due to personality differences.

A team can be defined as a group of individuals with individual characteristics such as personality, demographic, attitudes, and culture, which impact team performance and efficiency depending on the type of task and project location [5]. As this paper focuses on personality traits, the authors conducted a review of the Big Five Factors (BFF) for personality traits to investigate how they might assist or impede the team member selection process during the procurement of project team members.

## BACKGROUND

Personality methods are tools used to identify the individual's traits to assess their personality characteristics further. Personality refers to the assortment of characteristics or qualities that shape a person's distinguishable character. The personality method is a process that attempts to describe and understand the different features of human behaviors and the variability of how humans think, perceive, learn, and emote in various environments such as personal and professional life [6]. This observable variability of personalities between people distinguishes their personality characteristics, known as traits [6].

The focal point is the individual as they exhibit the personality variability researchers' study [7]. Therefore, different personality characteristics become inferences of the observer when interacting in social environments where these characteristics govern the interaction [6]. These personality variabilities are the significant factors to observe and understand about a person. It is this variability that gives each human being their unique character or individuality, which governs how a person interacts in any social event.

The ability to measure the variability in personality characteristics should assist in assessing a candidate in terms of the degree of creativity and problem-solving skills [6]. The measured value can be used to understand the capabilities of a person and accordingly place a person in a situation in which they will be more effective team members. Sarason & Holzman [6] provide an example of how different personality characteristics surface depending on the environment the candidate is interacting with and how this could be an asset or a liability:

*"Personality makeup can be either an asset or a liability depending on the situation. For example, some people approach evaluative situations with fear and foreboding, while others seem to be motivated in a desirable direction by competitive pressures associated with performance" [6].*

The point the authors are making here is that depending on the personality characteristics a person possesses, the goal is to understand what makes the person fearful or enthusiastic. Knowing how the person feels about a certain kind of work environment can prove advantageous when that person interacts with the rest of the team.

The measuring method used is as important as personality characteristics. Many methods and techniques to measure personality characteristics exist; selecting an adequate method is a critical step [6]. Psychological investigators have developed the following personality scales and traits 1) Adjective Check List (ACL), 2) BFF, 3) California Psychological Inventory (CPI), 4) Five-Factor Model (FFM), 5) Goldberg Five Factor Markers (GFFM), 6) Goldberg International Personality Item Pool (IPIP), 7) Myers Briggs Type Indicator, and 8) Neo-Personality Inventory (NEO-PI). This research focuses on Big Five Factor personality scales and inventory as it is a more commonly used method for personality assessment. The remaining methods will be used as a reference for comparison of various facets for validity purposes.

## The Big Five Personality Traits

Between 1958 and 1961, personality scales and inventories experienced a rebirth as many psychological researchers agreed to group-specific personality scale factors into the Big Five personality traits [8, 2]. Consequently, the Big Five Factors (BFF) scale was created and clustered into the following five factors 1) openness to experience, 2) conscientiousness, 3) extraversion, 4) neuroticism, and 5) agreeableness [2]. Table I provides a description of the factors, and Table II details the facets of each factor.

**TABLE I.** DESCRIPTION OF THE BIG FIVE FACTORS

| Factors | Description |
|---|---|
| Extraversion (EX) | The ability of a person to engage with the external world; the opposite is introversion. |
| Agreeableness (AG) | Demonstrates how people are different regarding cooperation and social harmony; the opposite is disagreeableness. |
| Conscientiousness (CO) | The capability of a person to manage, regulate, organize, and direct emotions or impulses; the opposite is easy going, disorderly, and with no self-control. |
| Neuroticism (NE) | Describes how a person experiences negative feeling; the opposite is being emotionally stable |
| Openness to Experience (OP) | Describes and distinguishes people's creativity and intellectual awareness; the opposite is not accepting change, being traditional, liking familiar routines, and a narrower choice of interests. |

According to Goldberg [2] and Soldz and Vaillant [9], experts in psychological research and personality traits accepted the BFF because the findings of several investigations revealed that similar five-factor structures could be found in other personality methods such as the ACL and others. Another essential aspect that facilitated the acceptance of the BFF was that the personality characteristics found in self-reported trait testing could be found in personality testing when performed on participants who know the person being evaluated [9].

**TABLE II.** FACETS OF EACH OF THE BIG FIVE FACTORS

| Extraversion | Agreeableness | Conscientiousness | Neuroticism | Openness to Experience |
|---|---|---|---|---|
| 1) Friendliness | 1) Trust | 1) Competence | 1) Anxiety | 1) Fantasy/Imagination |
| 2) Gregariousness | 2) Compliance/ Morality | 2) Orderliness | 2) Angry Hostility | 2) Aesthetics |
| 3) Assertiveness | 3) Altruism | 3) Dutifulness | 3) Depression | 3) Feelings |
| 4) Activity | 4) Cooperation | 4) Achievement-Striving | 4) Self-Consciousness | 4) Adventurousness |
| 5) Excitement-Seeking | 5) Modesty | 5) Self-Discipline | 5) Immoderation | 5) Ideas/Intellect |
| 6) Cheerfulness | 6) Sympathy | 6) Cautiousness | 6) Vulnerability | 6) Liberalism |

It is common knowledge that behavior substantially affects work performance, especially when personality characteristics conflict with job performance criteria and team criteria. According to Goldberg [2], research to find a correlation between personality characteristics and job performance is a critical step to assist the recruitment of employees. Goldberg [2] concluded that analysis, procedures, and reliable measurements should be performed to match personality with job and team criteria. Building on Goldberg's [2] conclusion, this research presents a literature review on team building and personality traits to find the aspects linked to job performance, team building, and collaboration for construction project teams.

## METHODOLOGY

With an abundance of research and information on personality traits, it is critical to review some of these personality studies to determine how useful personality can be as a team selection tool. Construction professionals' behaviors are the result of various events that have shaped their character into the person they are at present. These behaviors are manifested in the social environment, and they coexist as interactions of personal and professional opinions or beliefs. It is these interactions in social settings that have been analyzed by many researchers to understand why humans behave differently from each other, which could assist in predicting who is successful and who is not. In the construction industry, a considerable amount of technology and funds are available to complete a project. However, there is a need to determine a better way of selecting team members to increase the project's success.

The meta-analysis methodology was selected for this study as it offers an opportunity to investigate previous studies by utilizing the statistical integration of evidence collected from the selected studies [10]. The meta-analysis is a type of synthesis that takes the results of previous studies to help researchers understand the results in the context of the studies selected. In other words, it measures if the effect size of the studies is consistent among the published results of the studies. The meta-analysis also helps to address and understand the accuracy and the variation of the effect size among the selected studies [11, 12]. The meta-analysis procedure combines the chosen studies and tests for differences by using correlation coefficient measures [12]. The critical aspect when conducting a meta-analysis is that the studies share a standard measurement that can be tested for the relationship being studied because the studies are independent of each other [12]. The guideline used in this paper for the meta-analysis is derived from the

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), which specifies the objectives and the purpose of conducting meta-analysis procedures [13]. The PRISMA guideline was adopted because it ensures that the study is undertaken systematically to utilize the necessary data from previous investigations.

Even though meta-analyses have been widely used in the social science and health science, the meta-analysis process has been applied to many studies in other sectors including construction and business since 1980s and continues to increase in use [10]. Based on a review of previous studies using the meta-analysis procedure, it was determined that studies utilizing personality traits and/or social characteristics used Pearson's r correlation coefficient to calculate the effect size of the selected studies that investigated personality traits linked to team performance, team building, and collaboration within project teams. The meta-analysis procedure ensures that necessary statistical methods are used to analyze and summarize the relevant studies to determine which personality traits and scales correlate to team building and project team performance [12]. Therefore, the main objective of this meta-analysis is to summarize, appraise, and analyze traits that relate to team building/team performance and to answer the following question:

- What are the personality traits and their mean effect size that are most frequently associated with teambuilding/ team performance for project teams?

The hypothesis of this study is therefore: The selected studies from the literature review demonstrate that personality traits are consistently related and there is no difference between the mean effect sizes.

## Collecting studies related to team performance and personality traits

In this paper, studies investigating the relation between team building/team performance and personality traits will be used for the meta-analysis. The electronic databases used to obtain the related studies were Science Direct, American Society of Civil Engineers library (ASCE Library), the Transportation Research Board's (TRB) Transportation Research Record (TRR), PubMed, PsycINFO, Psychological & Behavioral Science Collection (PBSC), Business Source Complete (BSC), MEDLINE, PsycARTICLES, and JSTOR Journals. The keywords were utilized in a combination style to find the studies. The keywords “personality,” “personality traits,” and “personality behaviors” were interconnected to “team,” “team building,” “team performance,” “construction projects,” and “construction team” to ensure that appropriate studies are selected. To avoid unrelated studies, the keywords were searched for in the title, abstract, keywords, and in journals dating from 1990 to the year the study was conducted, which is 2018. Table III presents the searches used and the number of articles found. When completing the research of related studies, a total of 640 relevant studies were found. After reviewing each paper and its relation to team building/team performance, the total number of articles was reduced to 72. After that, the inclusion criteria process resulted in a further reduction to 33 studies (See Table IV) that met the criteria for inclusion in the meta-analysis procedure.

**TABLE III.** RESULTS OF DATABASE SEARCHES FOR JOURNAL ARTICLES

| Database | Keywords Combinations | Total Articles |
|---|---|---|
| ASCE | "personality traits" and "team performance" | 49 |
| ScienceDirect | (Personality traits) and ("construction team" OR team building OR team performance OR job performance) AND LIMIT-TO (, "article type - peer reviewed,, behavioral science, research & organizational behavior, the leadership quarterly, personality and individual differences, current opinion in psychology, and educational research review") | 235 |
| TRB | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 2 |
| PubMed | Personality traits and (team) | 33 |
| PsycINFO | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 158 |
| PBSC | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 104 |
| BSC | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 39 |
| MEDLINE | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 9 |
| PsycARTICLES | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 6 |
| JSTOR | personality behavior and (team OR "team performance" OR teamwork OR "team efficiency") | 5 |

**TABLE IV.** STUDIES SELECTED FOR THE META-ANALYSIS

| Study | Year | Author | Title |
|---|---|---|---|
| 1 | 2010 | Martha Juhasz | Influence of personality on Teamwork behaviour and communication |
| 2 | 2010 | Thomas A. O'Neill and Natalie J. Allen | Personality and the Prediction of Team Performance |
| 3 | 2003 | Susan Mohammed and Linda C. Angell | Personality Heterogeneity in Teams: Which Differences Make a Difference for Team Performance? |
| 4 | 2013 | Priyanko Guchait, Katherine Hamilton, and Nan Hua | Personality predictors of team taskwork understanding and transactive memory systems inservice management teams |
| 5 | 2013 | Bret H. Bradley; Anthony C. Klotz; Bennett E. Postlethwaite; Kenneth G. Brown | Ready to Rumble: How Team Personality Composition and Task Conflict Interact to Improve Performance |
| 6 | 2015 | Christine A. Toh and Scarlett R. Miller | Creativity in design teams: the influence of personality traits and risk attitudes on creative concept selection |
| 7 | 2004 | Tricia Varvel, Stephanie G. Adams, Shelby J. Pridie, and Bianey C. Ruiz Ulloa | Team Effectiveness and Individual Myers-Briggs Personality Dimensions |
| 8 | 2013 | Jinny Rhee, David Parent, and Anuradha Basu | The Influence of Personality and Ability on Undergraduate Teamwork and Team Performance |
| 9 | 2012 | Guido Alessandri and Michele Vecchione | The higher-order factors of the Big Five as predictors of job performance |
| 10 | 2008 | Robert R. Hirschfeld, Mark H. Jordan, Christopher H. Thomas, and Hubert S. Field | Observed Leadership Potential of Personnel in a Team Setting: Big Five traits and proximal factors as predictors |
| 11 | 2014 | Amit Kramer, Devasheesh P. Bhave, and Tiffany D. Johnson | Personality and group performance: The importance of personality composition and work tasks |
| 12 | 2006 | Aaron U. Bolin and George A. Neuman | Personality, process, and performance in interactive brainstorming groups |
| 13 | 2005 | Frederick P. Morgeson, Matthew H. Reider, and Michael A. Campion | Selecting Individuals In Team Settings: The Importance Of Social Skills, Personality Characteristics, And Teamwork Knowledge |
| 14 | 2003 | Jeffrey A. LePine | Team Adaptation and Postchange Performance: Effects of Team Composition in Terms of Members' Cognitive Ability and Personality |
| 15 | 2009 | In-Sue Oh and Christopher M. Berry | The Five-Factor Model of Personality and Managerial Performance: Validity Gains Through the Use of 360 Degree Performance Ratings |

**TABLE IV.** STUDIES SELECTED FOR THE META-ANALYSIS (CONTINUED)

| Study | Year | Author | Title |
|---|---|---|---|
| 16 | 1999 | George A. Neuman, Stephen H. Wagner, and Neil D. Christiansen | The Relationship Between Work-Team Personality Composition and the Job Performance of Teams |
| 17 | 2011 | Līva Van Scotter, Dīna Aleksandra Šillers, and Viesturs Reņģe | A Multi-Level examination of supervisors' and subordinates' personality and role behavior: Implications for work group effectiveness |
| 18 | 2003 | Christopher O. L. H. Porter, John R. Hollenbeck, Daniel R. Ilgen, Aleksander P. J. Ellis, Bradley J. West, and Henry Moon | Backing Up Behaviors in Teams: The Role of Personality and Legitimacy of Need |
| 19 | 2014 | Erik Gonzalez-Mulé, David S. DeGeest, Brian W. McCormick, Jee Young Seong, and Kenneth G. Brown | Can We Get Some Cooperation Around Here? The Mediating Role of Group Norms on the Relationship Between Team Personality and Individual Helping Behaviors |
| 20 | 1997 | Bruce Barry and Greg L. Stewart | Composition, Process, and Performance in Self-Managed Groups: The Role of Personality |
| 21 | 2008 | Miranda A. G. Peeters, Christel G. Rutte, Harrie F. J. M. van Tuijl, and Isabelle M. M. J. Reymen | Designing in teams: Does personality matter? |
| 22 | 2000 | Jill Kickul and George Neuman | Emergent Leadership Behaviors: The Function of Personality and Cognitive Ability in Determining Teamwork Performance and KSAS |
| 23 | 2005 | Terry Halfhill, Tjai M. Nielsen, Eric Sundstrom, and Adam Weilbaecher | Group Personality Composition and Performance in Military Service Teams |
| 24 | 2017 | Jia Hu and Timothy A. Judge | Leader−team Complementarity: Exploring the Interactive Effects of Leader Personality Traits and Team Power Distance Values on Team Processes and Performance |
| 25 | 2011 | Kevin Tasa, Greg J. Sears, and Aaron C. H. Schat | Personality and teamwork behavior in context: The cross-level moderating role of collective efficacy |
| 26 | 2017 | Stephen H. Courtright, Brian W. McCormick, Sal Mistry, and Jiexin Wang | Quality Charters or Quality Members? A Control Theory Perspective on Team Charters and Team Performance |
| 27 | 1998 | Mitchell J. Neubert and Michael K. Mount | Relating Member Ability and Personality to Work-Team Processes and Team Effectiveness |
| 28 | 2012 | Michaela C. Schippers | Social Loafing Tendencies and Team Performance: The Compensating Effect of Agreeableness and Conscientiousness |
| 29 | 2007 | Dishan Kamdar and Linn Van Dyne | The Joint Effects of Personality and Workplace Social Exchange Relationships in Predicting Task Performance and Citizenship Performance |
| 30 | 1997 | Michaela Harris Bond and Winnie Yin-Fong Shiu | The Relationship Between a Group's Personality Resources and the Two Dimensions of Its Group Process |
| 31 | 1999 | George A. Neuman and Julie Wright | Team Effectiveness: Beyond Skills and Cognitive Ability |
| 32 | 2015 | Xiaoshan Li, Mingjie Zhou, Na Zhao, Shanshan Zhang, and Jianxin Zhang | Collective-efficacy as a mediator of the relationship of leaders' personality traits and team performance: A cross-level analysis |
| 33 | 2016 | Nadiah Maisarah Abdul Ghani, Nor Sara Nadia Muhamad Yunus, and Norliza Saiful Bahry | Leader's Personality Traits and Employees Job Performance in Public Sector, Putrajaya |

## Inclusion of the studies selected

The authors evaluated each selected study to confirm its relevance to the objective of this paper. After the study's identification process, a study flowchart was created to demonstrate the selection process shown in Figure 1. Subsequently, for studies to be included in the meta-analysis, they had to meet the following inclusion criteria:

- Only published materials such as peered reviewed journals, conferenced papers, and dissertations.
- The subject in the published material consisted of teams in the following industries 1) construction, 2) business/corporations, 3) military, and 4) educational institutions.
- The meta-analysis included only papers that are published in the English language.
- The focus of the study is to evaluate personality traits that correlate to team building and team performance.
- Studies were published between January 1990 to January 2018 so that the meta-analysis considers relatively recent studies.
- Studies were published in North America, Europe, or Asia.
- The studies reported estimates either in Pearson's r or Cohen's d with corresponding sample size for teams or individuals.
- The quality of the study was determined by evaluating the results and conclusions.

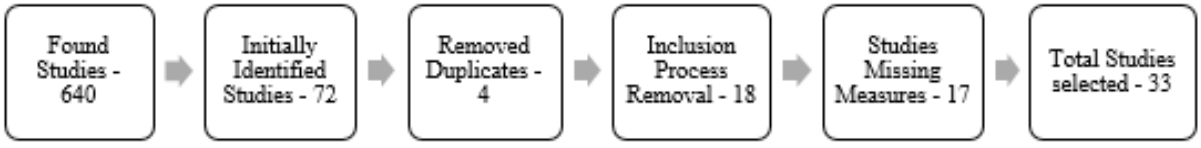


FIGURE I. STUDY SELECTION FLOW CHART

## Coding process

The coding of the meta-analysis consists of enumerating the studies to simplify the source and the authors. The coding also assisted the authors in creating a manageable database that has the necessary information in a single area [12, 14]. Table V details the coding of each of the 33 studies based on the following definitions:

- Study: k = 1, 2, 3,⋯,33
- Year: Published year
- Subject: Construction = 1, Business = 2, Engineering = 3, Students = 4, and Military = 5
- Personality Method implemented: NEO-PI = Neuroticism, Extraversion, Openness Personality Inventory, IPIP = International Personality Item Pool, MBTI = Myers-Briggs Type Indicator, FFM = Five-Factor Model, BFQ = Big Five Questionnaire, NEO-FFI = Neuroticism, Extraversion, Openness − Five-Factor Inventory, PCI = Personal Characteristics Inventory, NEO-PI-R = Neuroticism, Extraversion, Openness Personality Inventory-Revised, WBI = Work Behavior Inventory, IPIP-NEO = International Personality Item Pool − Neuroticism, Extraversion, Openness, PA-CPI = Personal Audit − California Psychological Inventory, and BFI = Big Five Inventory.
- Location: North America = L1, Europe = L2, Asia = L3, and Mixed = L4
- Team Sample Size: $N_t$ will be used for the team sample size for N individuals
- Total Sample: N will be used for the total sampled population of all individuals

- Personality Traits: Extraversion (EX), Agreeableness (AG), Conscientiousness (CO), Neuroticism (NE), and Openness to Experience (OP)

**TABLE V.** SELECTED META-ANALYSIS STUDIES WITH CORRESPONDING PEARSON'S R VALUES

| Study | Year | Subject | PM | Location | N | Nt | EX (r) | AG (r) | CO (r) | NE (r) | OP (r) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2010 | 1 | NEO-PI | L2 | 90 | 17 | 0.221 | 0.250** | 0.267 | 0.050** | 0.160** |
| 2 | 2010 | 3 | IPIP | L1 | 129 | 26 | 0.020 | 0.010 | 0.270 | -0.050 | -0.160 |
| 3 | 2003 | 3 | NEO-PI | L1 | 267 | 59 | 0.300 | 0.060 | 0.270 | -0.080 | 0.210 |
| 4 | 2013 | 3 | IPIP | L1 | 178 | 27 | 0.120** | 0.290 | 0.367 | 0.050** | 0.160** |
| 5 | 2013 | 3 | IPIP | L1 | 562 | 117 | 0.120** | 0.250** | 0.240** | 0.224 | 0.265 |
| 6 | 2015 | 3 | IPIP-NEO | L2 | 37 | 11 | 0.098 | 0.341 | 0.291 | 0.186 | 0.128 |
| 7 | 2004 | 3 | MBTI | L1 | 193 | 7 | 0.242 | -0.012 | 0.171 | 0.050** | 0.137 |
| 8 | 2013 | 3 | FFM | L1 | 121 | 5 | 0.533 | -0.215 | 0.240** | -0.229 | 0.160** |
| 9 | 2012 | 3 | BFQ | L2 | 101 | * | 0.340 | 0.345 | 0.430 | 0.360 | 0.160** |
| 10 | 2008 | 4 | NEO-FFI | L1 | 472 | 39 | 0.340 | -0.050 | 0.300 | 0.180 | 0.280 |
| 11 | 2014 | 3 | NEO-FFI | L1 | 184 | 46 | 0.300 | -0.030 | -0.140 | 0.050** | 0.160** |
| 12 | 2006 | 3 | NEO-FFI | L1 | 312 | 78 | 0.018 | -0.040 | -0.048 | -0.130 | 0.173 |
| 13 | 2005 | 2 | PCI | L1 | 90 | * | 0.210 | 0.180 | 0.210 | 0.170 | 0.160** |
| 14 | 2003 | 3 | NEO-PI-R | L1 | 219 | 73 | 0.153 | -0.153 | 0.367 | 0.050** | 0.233 |
| 15 | 2009 | 2 | WBI | L1 | 261 | * | 0.200 | 0.035 | 0.155 | 0.175 | 0.155 |
| 16 | 1999 | 2 | PA-CPI | L1 | 328 | 82 | 0.090 | 0.180 | 0.170 | 0.080 | 0.100 |
| 17 | 2011 | 2 | NEO-PI-R | L1 | 252 | 31 | 0.175 | 0.355 | 0.240 | 0.055 | 0.365 |
| 18 | 2003 | 3 | FFM | L1 | 284 | 71 | 0.170 | 0.120 | 0.190 | -0.230 | 0.160** |
| 19 | 2014 | 2 | NEO-FFI | L1 | 1061 | 102 | 0.450 | 0.380 | 0.240** | 0.050** | 0.160** |
| 20 | 1997 | 3 | FFI | L1 | 289 | 61 | -0.120 | -0.050 | -0.090 | -0.080 | -0.100 |
| 21 | 2008 | 3 | FFPI | L2 | 128 | 26 | 0.120** | -0.150 | 0.340 | 0.050** | 0.160** |
| 22 | 2000 | 3 | GACL | L1 | 320 | 67 | -0.210 | 0.250** | 0.300 | 0.050** | 0.020 |
| 23 | 2005 | 4 | NEO-FFI | L1 | 422 | 47 | 0.120** | 0.280 | 0.340 | 0.050** | 0.160** |
| 24 | 2017 | 2 | BFI | L3 | 338 | 71 | 0.200 | 0.260 | 0.246 | -0.054 | 0.184 |
| 25 | 2011 | 3 | IPIP | L1 | 434 | 114 | 0.120** | 0.180 | 0.230 | 0.050** | 0.160** |
| 26 | 2017 | 3 | FFI | L1 | 768 | 239 | -0.060 | 0.250** | 0.100 | -0.050 | 0.160** |
| 27 | 1998 | 2 | PCI | L4 | 652 | 51 | 0.120 | 0.340 | 0.260 | 0.240 | 0.160** |
| 28 | 2012 | 3 | IPIP | L4 | 644 | 209 | 0.120** | 0.250** | 0.085 | 0.050** | 0.160** |
| 29 | 2007 | 1 | NEO | L1 | 230 | * | 0.120** | 0.230 | 0.340 | 0.050** | 0.160** |
| 30 | 1997 | 3 | BFF & CPI | L3 | 102 | 17 | 0.260 | 0.250** | 0.240** | 0.270 | -0.280 |
| 31 | 1999 | 2 | NEO-PI-R | L1 | 316 | 79 | 0.060 | 0.360 | 0.270 | -0.120 | -0.010 |
| 32 | 2015 | 2 | BFI-10 | L3 | 562 | 79 | 0.520 | -0.130 | 0.270 | -0.160 | 0.050 |
| 33 | 2016 | 2 | BFPT | L3 | 150 | * | 0.504 | 0.594 | 0.546 | -0.113 | 0.499 |

(*) = Team sample size was not provided; (**) = Missing value replaced with Bell (2007) meta-analysis

It is important to emphasize that during the search of studies related to personality traits and team performance, it

was determined that there are limited studies in the existing literature investigating personality traits correlated with predicting team performance in the construction industry. Therefore, the inclusion criteria included industries such as construction firms, businesses/corporations, engineering firms, educational institutions, and military studies. However, from the 33 selected studies detailed in Table V, 55% belong to educational institutions, 33% business/corporations not related to construction, 6% engineering not related to construction, and 6% related to military studies. It is excellent that personality studies predicting team performance are being conducted in various industries, but it also demonstrated a lack of research in the construction industry in personality traits and team performance.

Some studies did not report correlation values for all the personality traits. Three options were available to deal with the missing values. The first option was to ignore the missing value and proceed with the studies that reported measurements for all five personality traits, but this would have resulted in a lower count of studies to include in the meta-analysis. The second option was to treat the missing data as zero, but it could change the standard error of the studies. The third option was to find a meta-analysis study related to this study and utilize the overall estimate as fillers for the missing data. This option was considered the best choice for the missing values. Therefore, the meta-analysis by Suzanne T. Bell [15], "Deep-Level Composition Variables as Predictors of Team Performance: A Meta-Analysis," was selected as the adequate study to fill in the missing values. Her meta-analysis was adequate because of incorporated field setting type teams, meaning that the studies utilized in her meta-analysis conducted personality research on an actual work environment and not a lab recreated setting. Bell's (2007) overall correlation for field type setting teams are as follows: EX r = 0.12, AG r = 0.25, CO r = 0.24, NE r = 0.05, and OP r = 0.16. Table V above illustrates the imputed values with two asterisks.

There were six studies (study 9, 13, 15, 29, and 33) that did not report the team size sample but did report the individual sample size. To deal with the missing team size values for these studies, the authors assumed that construction teams have a minimum of five team members on a particular project representing the principal stakeholders, which are the owner, designer, prime contractor, consultant, and engineer. Therefore, the individual sample size was divided by five to obtain a team size sample.

## Data Analysis

### Calculating mean effect size

According to Cooper [12] and Ellis [14], the effect size is defined as "the degree to which a phenomenon is present in the population." Effect size is calculated by first converting the r-values into z-scores to normalize the data. Second, the statistical difference is computed to determine the overall relationship between independent studies. Finally, the z-scores obtained in the statistical difference are converted back to r-values for reporting. The statistical calculations used by the authors include the Metafor procedure for conducting meta-analysis in R [16, 17]. The Comprehensive R Archive Network, also known as CRAN, is an open-source software available to researchers to conduct statistical analysis procedures. The study utilized the R script for meta-analysis written by

Quintana [10], who utilized the Metafor created by Viechtbauer [17] along with “robumeta” created by Fisher and Tipton [18]. Robumeta is an R package with functions to perform meta-analysis regressions with small and large sample sizes. It delivers estimates such as effect size, standard errors, hypothesis testing, variability, and bias of the effect size. The R software comprises elaborate formulas and procedures to conduct the meta-analysis for fixed and random methods.

Ellis [14] provides a method to calculate the mean effect size of the studies collected using the effect size estimate of Pearson's r statistic by calculating the weighted mean effect of each study by their respective sample size. Calculating a sample mean on the estimates of the selected studies will most likely be a biased result. Therefore, weighting the selected estimates is an enhanced way to place more weight on the selected studies that have larger sample sizes. The formula to calculate is shown in equation 1.

$$(\bar{r}_{wa}) = \frac{\Sigma \frac{r_i}{\sqrt{\alpha}} * n_i}{\Sigma n_i} \tag{1}$$

Where, $r_i$ is the estimated measure of each selected study, $n_i$ is the sampled size of each study, is the sum of all the selected studies sampled size or N, and ($a$) is the error value.

## Computing statistical significance of the mean

As the studies did not involve the same sample size and had distinct characteristics and methods with which they were analyzed, Quintana [10], Cooper [12], Ellis [14], and Viechtbauer [17] recommended the random-effects model because it accords less weight to studies with larger sample sizes and less variance. Hence, statistical significance in this study will be performed by converting the results into z-scores and determining if the probability of getting a z-score is less than the alpha of 0.05 [10, 12, 14, 17]. To obtain the z-score, the standard error (SE) has to be determined for the related mean effect size of the selected studies. A sampling distribution has certain spread or variability, and SE helps explain what that value might be. Therefore, the SE of the weighted estimate (SE.) is shown in equation 2, where $k$ is the total number of studies in the meta-analysis, and $v_r$ is the correlation sample variance. Subsequently, the conversion from r-score to z-score is shown in equation 3. This conversion is used to normalize the sample size as the estimate values vary in the sample size. However, to report the results, the z-scores have to be converted back to correlation values or r-scores.

$$SE.\bar{r}_w = \sqrt{\frac{v_r}{k}} \tag{2}$$

$$z = \frac{\left|\bar{r}_w\right|}{SE.\bar{r}_w} \tag{3}$$

## Examining Variability

Variability examines the heterogeneity of the selected studies. Heterogeneity describes the variation of the mean estimate between the selected studies [10, 19]. The $Q$ statistic and the $I^2$ measurements are recommended by Quintana [10], Cooper [12], Ellis [14], and Viechtbauer [17] for reviewing heterogeneity. The $Q$ statistic test is the weighted squared deviation providing an estimate of the differences between the selected studies in the meta-analysis [19]. $Q$ does not depend on the effect size; it assumes the affect size is common and variation observed is due to sampling error among the selected studies. Thus, $Q$ is a standardized estimate and is simply the degrees of freedom (*df*), in which $df = n_i - 1$ and $n_i$ is the numbers of selected studies [11]. Equation 4 provides the calculation for $Q$, where is the sample size of the corresponding selected studies and the weighted mean effect size estimate .

However, the $Q$ statistic might not perceive variability with a small number of studies selected. Therefore, the $I^2$ test was used to reaffirm the findings of the $Q$ statistic. The $I^2$ test calculates variance as a percentage due to heterogeneity among the selected studies or the true variations between the selected studies [20]. The $I^2$ test also serves as the percentage of unexplained variance in the mean effect size estimate [19]. The $I^2$ test calculates variance as a percentage due to heterogeneity among the selected studies or the true variations between the selected studies [10, 11, 12, 19]. The $I^2$ test also serves as the percentage of unexplained variance in the mean effect size estimate; similar to signal noise [19]. $I^2$ does not depend on the estimate of the effect size nor on the number of selected studies [11]. $I^2$ limits have been suggested with 25, 50, 75% indicating low, moderate, and high variation [10, 11, 12, 19]. $I^2$ is represented by equation 5 where *df* is $n_i - 1$, $n_i$ is the number of selected studies, and $Q$ is the ratio of observed variation [10, 11, 12, 19].

$$Q = \Sigma(n_i - 1)*(r_i - \bar{r}_w)^2 \tag{4}$$

$$I^2 = (\frac{Q - df}{Q})*100 \tag{5}$$

## Publication Bias

Publication bias is important to address because the meta-analysis results will reflect the bias results of the selected studies [11, 12]. Ideally, when performing a meta-analysis, the researcher will try to include all relevant studies from the literature to calculate the mean effect size. However, there is a chance that some studies will not be found and consequently not included in the meta-analysis [11, 12]. Borenstein [11] states that if the missing studies happen by random, the results of the analysis will have lower estimates. However, Borenstein [11] argues that if the missing studies are systematically different from the selected studies, then the meta-analysis results will be biased. According to Quintana [10], publication bias occurs when more studies with strong effect sizes are published and included in the meta-analysis procedure. A strong effect size indicates that a particular independent study has higher r-values for the studied variables than the rest of the studies investigating the same variables in the sample

size. Therefore, the meta-analysis does offer options to assess publication bias of the selected studies.

Quintana [10] recommends the use of the funnel plot to determine potential publication bias visually. It will help determine how the individual studies' effect size compares to the mean effect size of the sample size. According to Cooper [12], studies that have a small sample size will be scattered at the bottom of the plot, while studies with a larger sample will be close together at the top, which indicates precision. Therefore, if the funnel plot illustrates a symmetrical structure (studies equally distributed on both sides of the centerline), there are no indications of publication bias [10]. The RStudio software generated the necessary funnel plots for review. Furthermore, visually assessment can be difficult to make with a larger sample size. Therefore, the Kendall's Tau, The Egger, and the Fail-safe N Calculation using the Rosenberg Approach tests will be used to further assess the symmetrical structure of the selected studies [10, 11, 12]. The Rosenberg approach will help to determine how many studies are needed to have a significant change in the mean size effect [12].

## RESULTS

The literature review revealed that 33 studies fit the inclusion criteria investigating the correlation between personality traits and team performance. The mean team sample sizes range from 5 to 239 with a median team size of 47, a mean of 56, a standard deviation of 55.54, and a total of 1,851 teams. The literature review reported 122 total correlations, and 44 correlations had to be imputed for missing values with 166 correlations. Table VI presents the descriptive statistics of the team sample size ($N_t$) taken from the 33 studies.

**TABLE VI.** DESCRIPTIVE STATISTICS FOR EACH PERSONALITY TRAIT BY TEAM SAMPLE SIZE (NT)

| Mean | Median | Standard Deviation | Variance | Kurtosis | Skewness | Range | Standard Error |
|---|---|---|---|---|---|---|---|
| 56.09 | 47 | 55.54 | 3,085.02 | 3.71 | 1.71 | 239 | 9.67 |

Statistical analysis was conducted for each personality trait considering the team size to obtain a meaningful result. The following is the presentation of the results. Tables VII and VIII detail the meta-analysis results for the five personality traits.

**TABLE VII.** RANDOM-EFFECT MODEL & MODEL RESULTS OF PERSONALITY TRAITS (k=33)

| | Random Effect Model | | | | | | Model Results of Personality Traits | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trait | $\tau^2$ | $\tau$ | $I^2$ | $H^2$ | Q | p-value | Estimate | SE | z | p-value | CI-LB | CI-UN |
| EX | 0.018 | 0.133 | 50.21% | 2.01 | 61.31 | 0.0014* | 0.1633 | 0.0353 | 4.6291 | < 0.0001* | 0.0945 | 0.2325 |
| AG | 0.015 | 0.121 | 45.41% | 1.83 | 54.40 | 0.0080* | 0.1735 | 0.0336 | 5.1595 | < 0.0001* | 0.1076 | 0.2394 |
| CO | 0.004 | 0.065 | 19.37% | 1.24 | 35.02 | 0.3268 | 0.2111 | 0.0268 | 7.8627 | <0.0001* | 0.1585 | 0.2637 |
| NE | 0.001 | 0.034 | 6.13% | 1.07 | 27.63 | 0.6877 | 0.0197 | 0.0241 | 0.8176 | 0.4136 | -0.0275 | 0.0669 |
| OP | 0.000 | 0.000 | 0.00% | 1.00 | 21.70 | 0.9152 | 0.1508 | 0.0228 | 6.6046 | < 0.0001* | 0.1061 | 0.1956 |

**TABLE VIII.** PUBLICATION BIAS TESTS RESULTS

| Personality Trait | Regression Test z-score | Regression Test p-value | Kendall's Tau | p-value | Egger Test t-score | Egger Test p-value |
|---|---|---|---|---|---|---|
| EX | 1.1300 | 0.2585 | 0.2493 | 0.0423* | 1.5347 | 0.1350 |
| AG | -0.2095 | 0.8341 | -0.0895 | 0.4661 | | |
| CO | 2.0064 | 0.0448* | 0.0629 | 0.6089 | 2.1855 | 0.0365* |
| NE | 0.9061 | 0.3649 | 0.0210 | 0.8646 | | |
| OP | -0.2808 | 0.7788 | -0.2724 | 0.0266* | -0.3363 | 0.7389 |

## Extroversion

The estimated model of coefficient (effect size) for the extraversion trait was statistically significant with a p-value of < 0.0001 at alpha 0.05 with a z-value of 4.6291 (see Table VII). Moreover, zero is not included in the confidence interval. The confidence interval is another way to assess statistical significance of the effect size. A confidence interval that excludes zero, indicates the effect size is statistically significant [14]. As discussed above, the effect size should assist in determining whether the differences between the studies are real or not. For extraversion, it can be concluded that the mean effect size is significant across the 33 studies selected for the meta-analysis.

The mean estimated correlation for extraversion Cochran's Q is significant at the 5% level (see Table VII), which indicates that the mean estimates correlation for extraversion is heterogeneous. The $I^2$ value further indicates that there is 50.21% of variation reflected in the actual differences in the population mean, which supports the heterogeneity of the extraversion.

A Baujat plot provided the authors with the studies that are contributing to the overall heterogeneity for extraversion. Studies that have a more common effect size are found in the bottom left of the Baujat plot and those

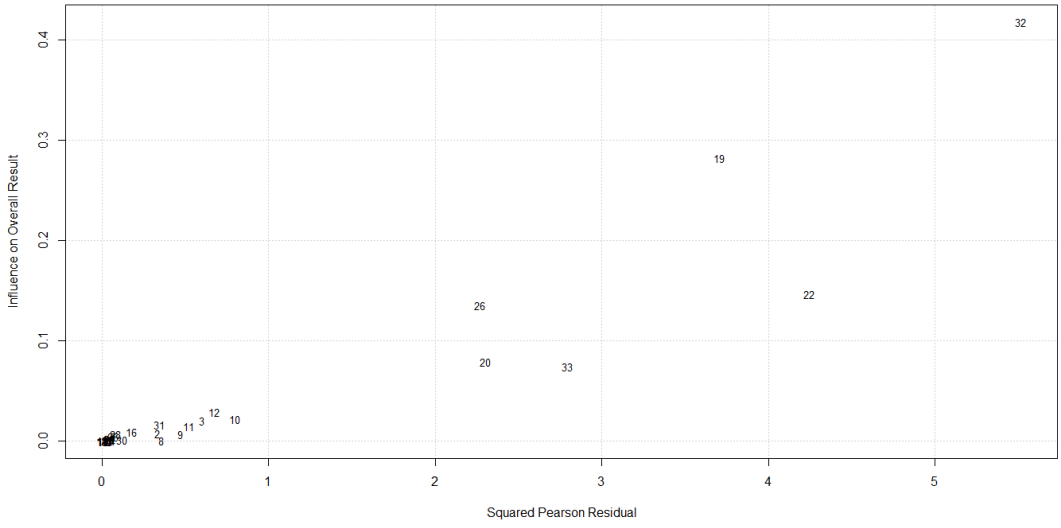


**FIGURE II.** EXTRAVERSION BAUJAT PLOT

studies that are in the top right of the plot are more influential and may be potential outliers. Furthermore, studies can be potential outliers if there are only a few in the top right quadrant. The Baujat plot results, shown in Figure II, reveals that studies 19, 22, and 32 are in the top right quadrant, meaning these three studies are outliers, while the remaining 30 studies show they have a common effect size since they are grouped in the lower left of the plot.

The funnel plot for extraversion, shown in Figure III, does not show publication bias as it has a symmetrical shape. Neither the regression nor the rank correlation test for individual samples show any indications of publication bias (see Table VIII). However, Kendall's test p-value (0.0423) for team sample shows some indication of publication bias. Therefore, the Egger Test was performed to test for Funnel Plot Asymmetry utilizing the standard error as the predictor. Eggers Test did not show any significance (p-value = 0.135), thus one can assume that there is no publication bias for extraversion.

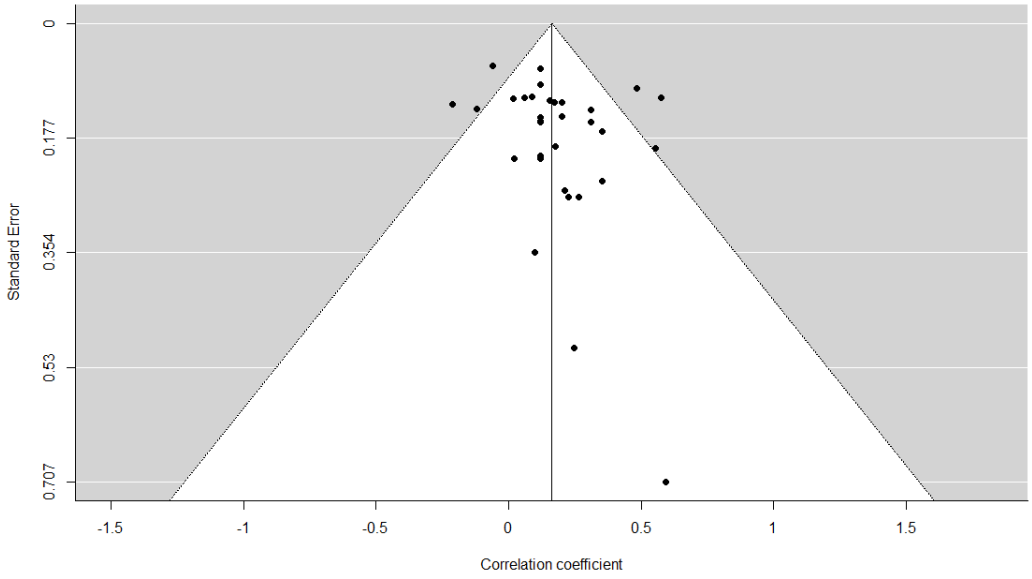


FIGURE III. FUNNEL PLOT OF PUBLICATION BIAS FOR EXTRAVERSION

## Agreeableness

The effect size for agreeableness was statistically significant with a p-value of < 0.0001 at alpha 0.05 and a z-value of 5.1595. Zero was not included in the confidence interval shown in Table VII. As discussed previously, the effect size should assist in determining if the differences between studies are real or not. For agreeableness, it can be concluded that the mean effect size estimate is significant across the 33 studies selected for the meta-analysis.

It can be observed that the mean estimated correlation for agreeableness has a Cochran's Q of 54.40 with a p-value = 0.0080, presented in Table VII, which indicates that the mean estimates correlation for agreeableness is heterogeneous. The $I^2$ indicates that there is 45.41% of variation reflected in the actual differences in the population mean, which supports the heterogeneity of agreeableness. Then, from the Baujat plot in Figure IV, studies 14, 32, and 33 are in the top right quadrant, which are outliers compared to the remaining studies 30 studies grouped in the

lower left of the plot.

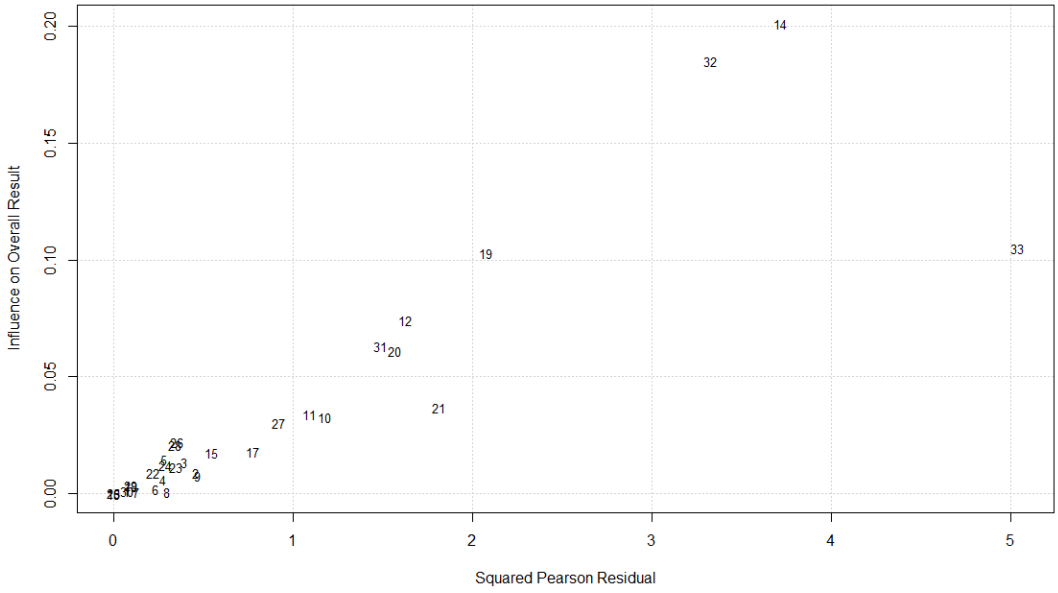


**FIGURE IV.** AGREEABLENESS BAUJAT PLOT

Figure V provides the funnel plot for agreeableness to investigate publication bias, which is not evident by the symmetrical shape. The results of the regression test z-score and Kendall's Tau, as shown in Table VIII, also provide evidence of no publication bias present.

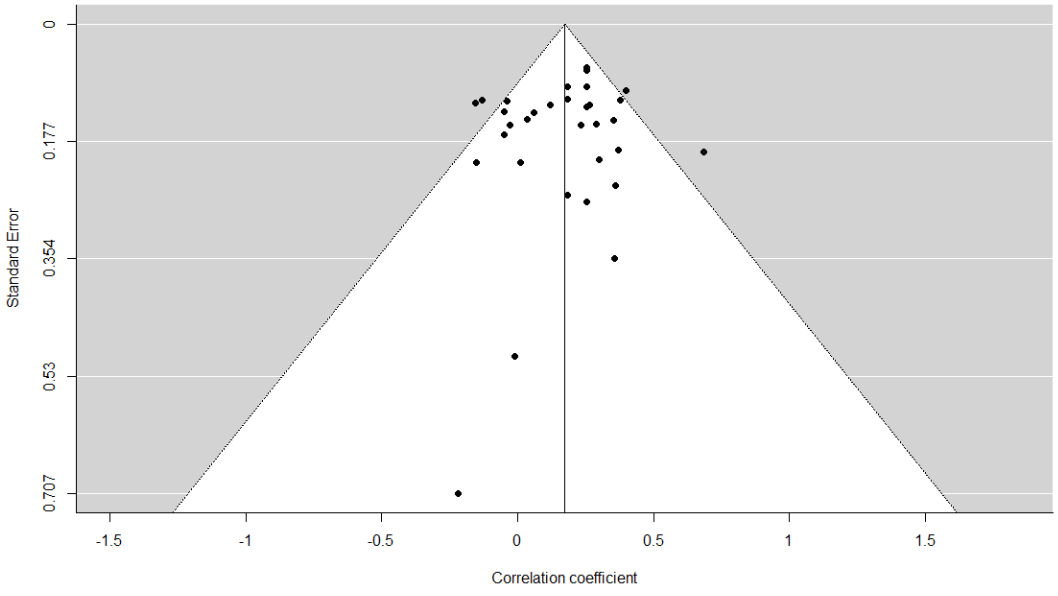


**FIGURE V.** FUNNEL PLOT FOR PUBLICATION BIAS OF AGREEABLENESS

## Conscientiousness

The estimated model of coefficient or effect size for conscientiousness was statistically significant, with a p-value of < 0.0001 at alpha 0.05 and a z-value of 7.8627. Moreover, zero was not included in the CI, as seen in Table VII. As discussed previously, the effect size should assist in determining if the differences between studies are real or not. For conscientiousness, it can be concluded that the mean estimate is not the same across the 33 studies selected for the meta-analysis.

Furthermore, according to Table VII, conscientiousness has no significant Q statistic at the 5% level. The Q statistic indicates the mean estimates correlation for conscientiousness is homogeneous. The $I^2$ suggests 19.37% of variation reflected in the actual differences in the population mean. The $I^2$ further supports the homogeneity of conscientiousness. A Baujat Plot was created to illustrate which studies are contributing to the overall homogeneity for conscientiousness. Figure VI illustrates that studies 12, 33, 20, and 11 are in the top right quadrant.

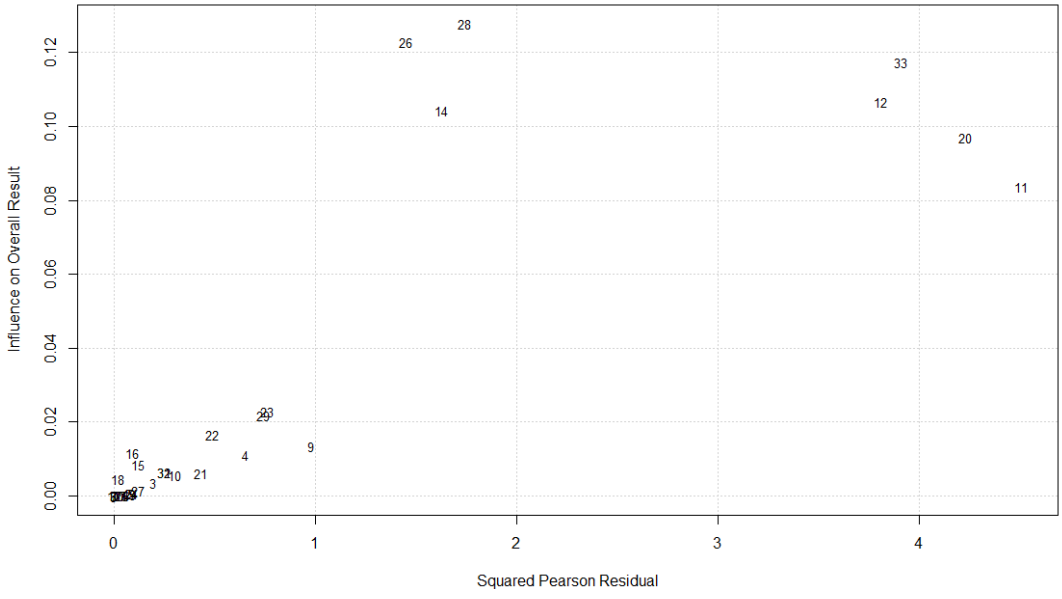


**FIGURE VI.** CONSCIENTIOUSNESS BAUJAT PLOT

In terms of publication bias for conscientiousness, the funnel plot in Figure VII shows an asymmetrical distribution of studies. Moreover, in reviewing the publication bias test results in Table VIII, the p-value for the regression test z-score is significant, suggesting that this test provides evidence of potential publication bias for all three tests.

To assess publication bias further due to the asymmetrical distribution, a trim and fill was conducted. The trim and fill produced an estimated eleven missing studies on the left side, and an estimate of 0.1592, which is smaller than the original estimate of 0.2111 (see Figure VIII). The 0.1592 estimate is an effect size produced by the eleven missing studies. It approximates the mean effect if eleven studies were added to the meta-analysis. The confidence interval for the trim and fill did not include zero as it ranges from 0.1083 to 0.210. According to Cooper [14], if the

confidence interval of the recalculated estimate does not include zero, it provides more confidence that the results would not have changed dramatically if the missing data was found. However, to obtain more assurance, a Fail-safe N Calculation using the Rosenberg Approach was used [14]. The Rosenberg Approach revealed that 628 studies are required to change the mean effect size significantly. Therefore, sufficient evidence exists to conclude that there is no publication bias in the conscientiousness trait.

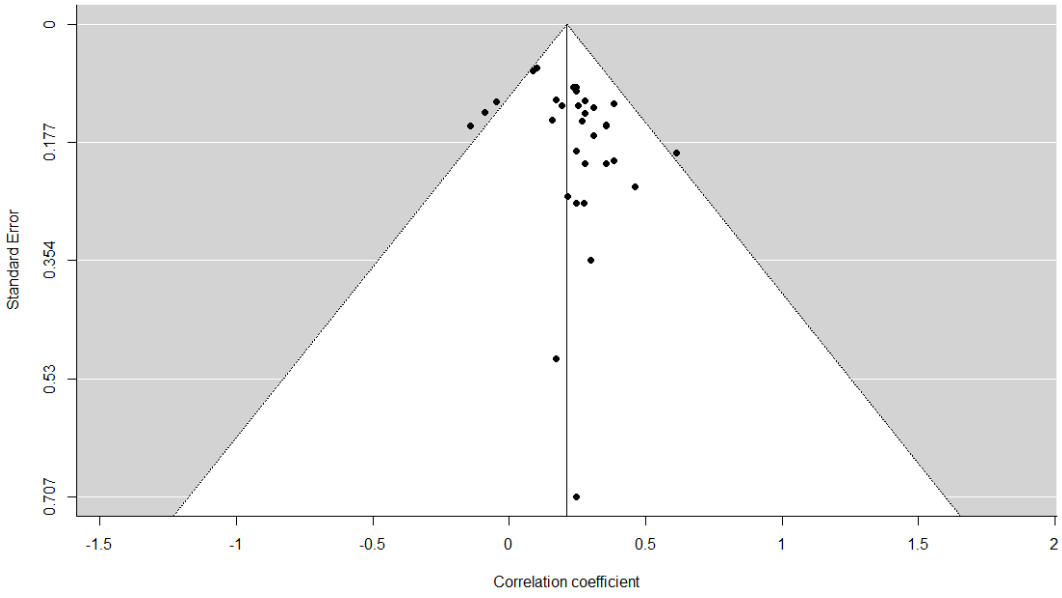


**FIGURE VII.** FUNNEL PLOT FOR OBSERVING PUBLICATION BIAS FOR CONSCIENTIOUSNESS

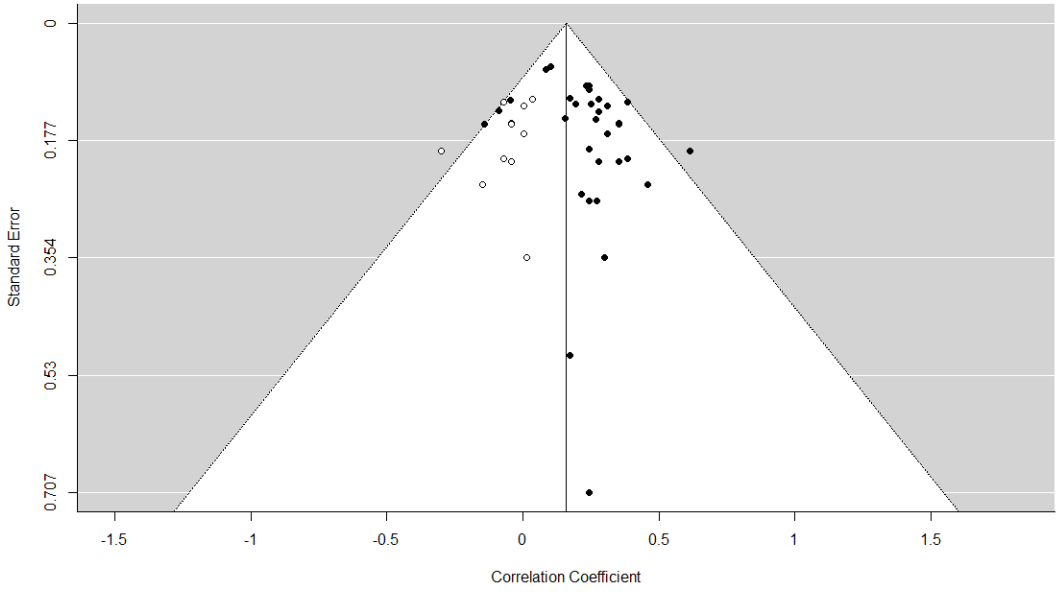


**FIGURE VIII.** TRIM AND FILL META-ANALYSIS FUNNEL PLOT FOR CONSCIENTIOUSNESS

## Neuroticism

The effect size for neuroticism was not statistically significant with a p-value of 0.4136 at alpha 0.05 and with a z-value of 0.8176. Results also show that the confidence interval, shown in Table VII, includes zero. This means that for neuroticism, it can be concluded that the mean estimate is not significant across the 33 studies selected for the meta-analysis. One possible explanation for not finding significance with neuroticism is that there is a lack of studies focusing on the negative aspects of team personality, which has led to insufficient reporting of coefficient correlation estimates.

One can observe that mean estimated correlation for neuroticism has a Cochran's Q of 27.63 with a p-value = 0.6877 (see Table VII), which indicates that the mean estimates correlation for neuroticism is homogeneous. The $I^2$ indicates that there is 6.13% variation reflected in the actual differences in the population mean, which supports the homogeneity of neuroticism. Then, the Baujat Plot was created and studies 18 and 5 were found to be in the top right quadrant, denoting these two studies as outliers with the remaining studies in the lower left of the plot (see Figure IX).

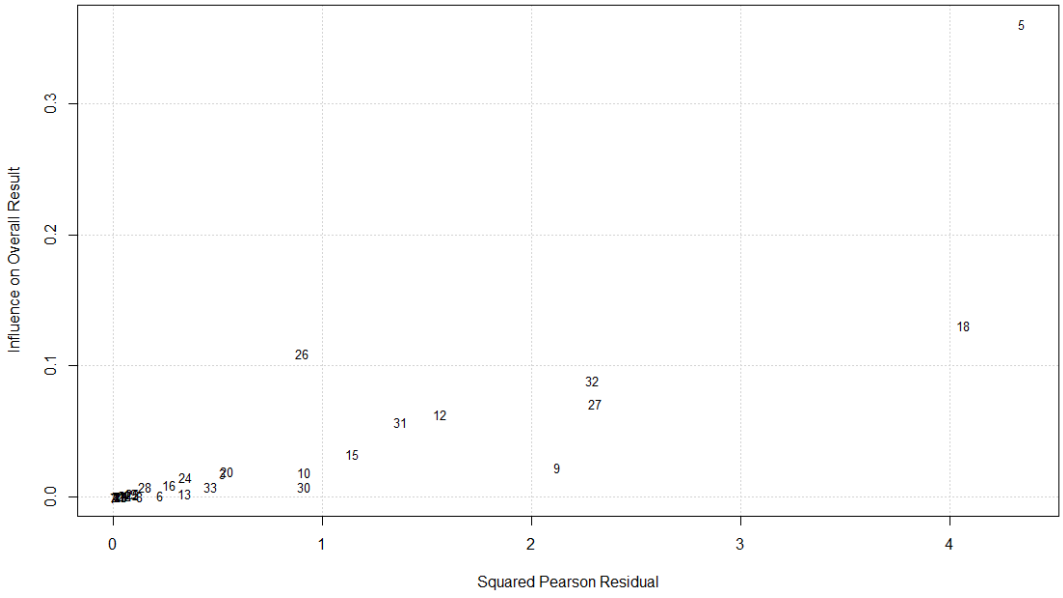


**FIGURE IX.** FUNNEL PLOT FOR NEUROTICISM

For publication bias, the funnel plot in Figure X shows signs of publication bias due to lack of symmetry in the plot. Moreover, the publication bias tests in Table VIII show that Kendall's Tau is significant and lends itself to possible publication bias. The funnel plot is slightly asymmetrical, but neither the regression nor the rank correlation test was statistically significant, which indicates that there is no evidence of publication bias for neuroticism. .

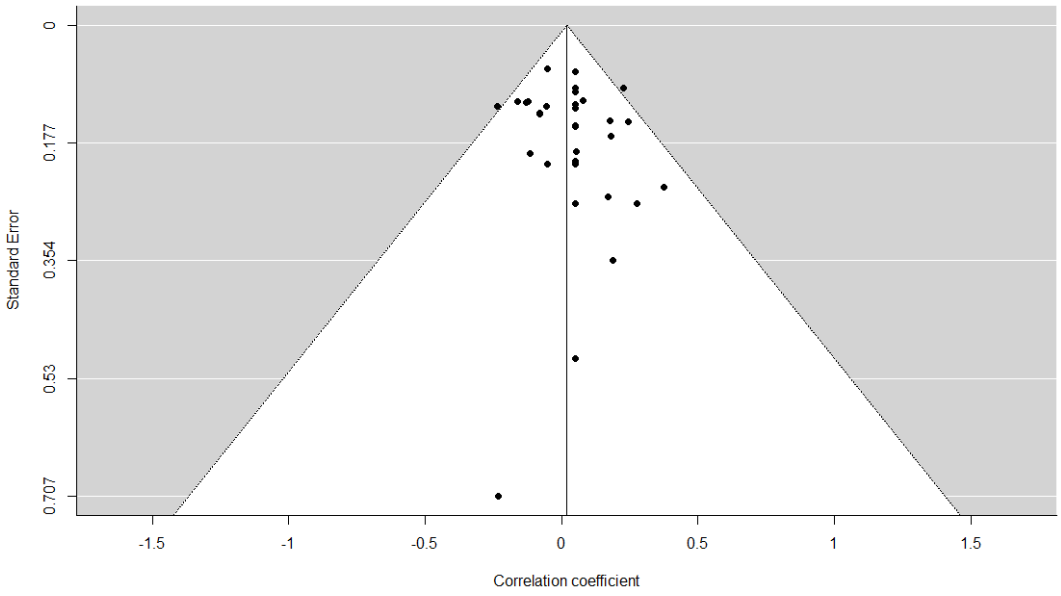


FIGURE X. FUNNEL PLOT FOR NEUROTICISM

## Openness to Experience

The estimated model of coefficient or effect size for open to experience trait was statistically significant with a p-value of < 0.0001 and a z-value of 6.6046. The confidence interval is from 0.16 to 0.190 and does not include zero. Therefore, one can conclude that that the mean estimate is significant across the 33 studies selected for the meta-analysis.

Table VII shows that the mean estimated correlation for openness to experience has a Cochran's Q of 21.70 with

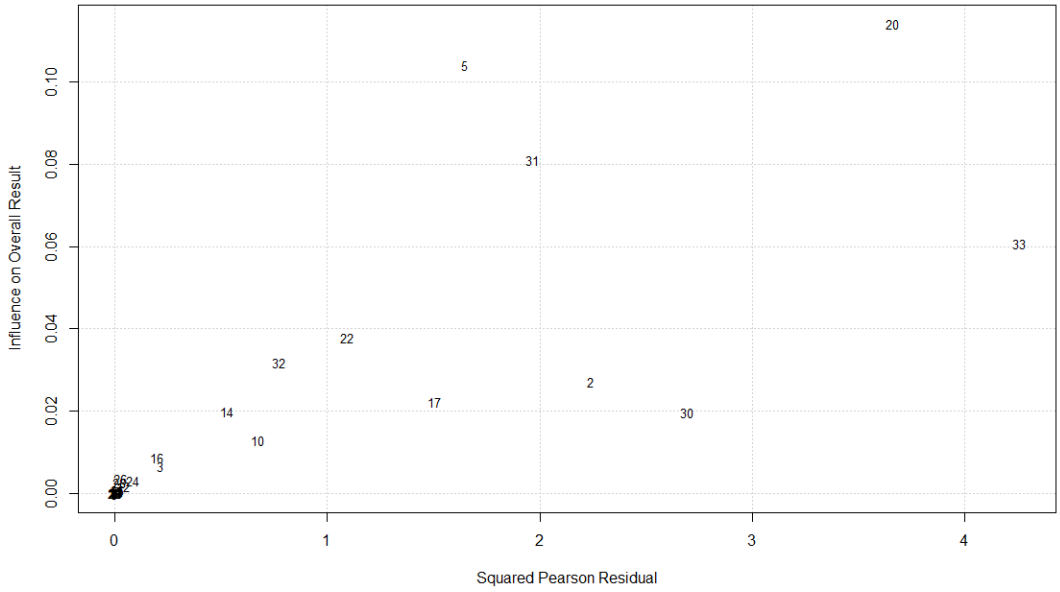


FIGURE XI. BAUJAT PLOT FOR OPENNESS TO EXPERIENCE PERSONALITY TRAIT

a p-value = 0.9152, which indicates that the mean estimates correlation for open to experience is homogeneous. The $I^2$ indicates that there is 0.00% of variation reflected in the actual differences in the population mean, which also supports the homogeneity of openness to experience. The Baujat Plot denotes that studies 20 and 33 are shown as outliers in the top right quadrant, with the remaining studies scattered on the left side of the plot (see Figure XI).

In observing for publication bias, the funnel plot for openness to experience in Figure XII shows a symmetrical shape, which is an indication of no publication bias. Furthermore, the regression test statistics in Table VIII also show no signs of publication bias due to the non-significant value. However, Kendall's Tau has a p-value less than 0.05, which is an indication of publication bias. Therefore, Egger test was implemented to further assess the potential issue. The Egger test p-values were statistically significant, which concludes that there is no evidence of publication bias for openness to experience.

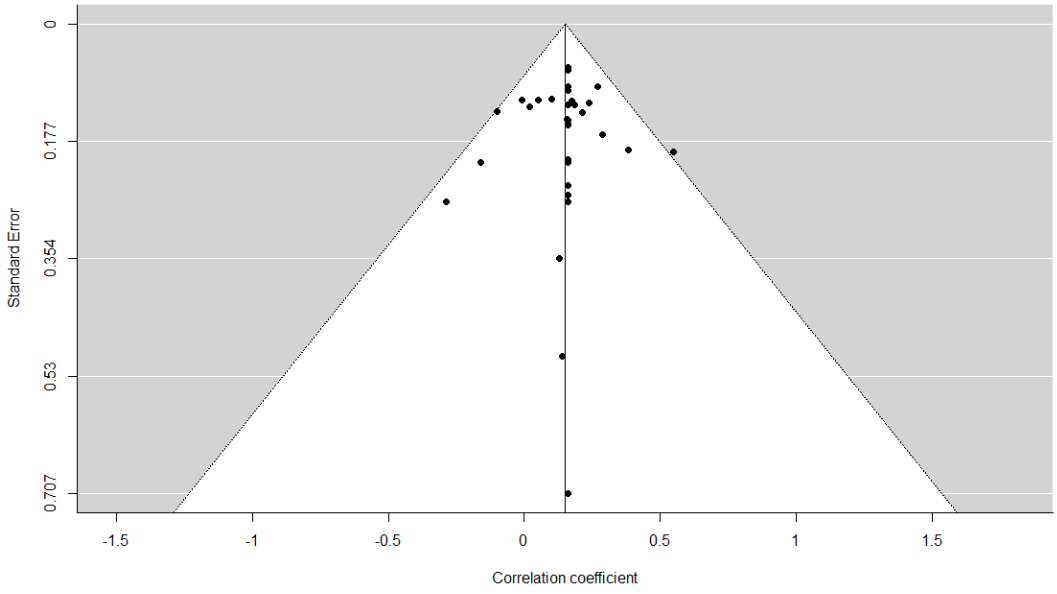


FIGURE XII. FUNNEL PLOT FOR OPEN TO EXPERIENCE

## DISCUSSION

The meta-analysis estimated mean correlation for the personality traits of extraversion, agreeableness, conscientiousness, and open to experience was found to be statistically significant with neuroticism found to not be statisitically significant. Overall, conscientiousness was found to have the highest meta-analysis estimate value of 0.208 for the team sample, followed by agreeableness, extraversion, openness to experience, and neuroticism, as shown in Table IX. The mean effect size estimates obtained from the meta-analysis can serve as control points that can be used to help understand the impact of these personality traits on team performance. For example, teams that show high conscientiousness, moderate agreeableness and are extraverted and open to different experience should perform better than a team that shows high neuroticism and low conscientiousness.

Conscientiousness was found to have the highest correlation for personality and team performance in the meta-analysis and conscientiousness coefficient correlation measures reported in the selected studies share a common effect size. The literature also indicated that conscientiousness could be higher as an individual score because it has facets that deal with performance at the individual level [21]. Moreover, Juhász [22] mentioned that conscientiousness could be positively related to team performance only when both the team and the team leader's level of conscientiousness are high. Overall, conscientiousness is a significant personality trait needed for a project team to perform successfully as people that are competent and self-disciplined tend to positively impact the performance of a team [22].

On the other hand, neuroticism had the lowest correlation (0.020) for personality traits and team performance, which was expected as most of the studies found that neuroticism should be low for team performance, which was also observed in this meta-analysis. These results show that people with anxiety and depression and show hostility toward others can negatively impact the performance of a highly skilled project team.

**TABLE IX.** META-ANALYSIS MEAN ESTIMATE CONVERTED BACK TO PEARSON'S R-VALUES (k = 33)

| Personality Trait | Meta-Analysis Estimate | Confidence Interval | Pearson's r Confidence Interval |
|---|---|---|---|
| EX | 0.162 | 0.094 − 0.228 | -0.107 − 0.408 |
| AG | 0.172 | 0.107 − 0.235 | -0.073 − 0.397 |
| CO | 0.208 | 0.157 − 0.258 | 0.073 − 0.336 |
| NE | 0.020 | -0.028 − 0.067 | -0.062 − 0.101 |
| OP | 0.150 | 0.106 − 0.193 | 0.106 − 0.193 |

Team size was also tested to see if it had evidence of significantly moderating the observed correlation for each study. It was found that team size did not have evidence of significantly moderating the observed correlation for EX, AG, CO, and OP as all p-values were greater than 0.05. However, neuroticism had a p-value less than 0.05, which is evidence of significantly moderating the observed correlation. This could be because team performance is adversely affected by negative emotions as demonstrated in past investigations and resulting in lower correlation values as mentioned above.

## CONCLUSION

In this study, a meta-analysis model was applied to investigate which of the BFF personality traits of project team members are significant towards influencing team performance. The meta-analysis was applied to determine a mean estimate correlation from previous related studies that can be used to predict project team performance. Overall, the authors found that extraversion and agreeableness are heterogenetic, while conscientiousness, neuroticism, and openness to experience are homogeneous across the 33 selected studies measuring team performance. It was also found that conscientiousness has the highest correlation with most studies indicating it is a highly influential trait

for positive team performance. On the other hand, neuroticism was confirmed to have a negative effect on predicting team performance because it has the lowest correlation value across the selected studies.

The authors encountered limitations in this analysis. Limitation one was the sample size of the meta-analysis. As the keywords used were specific to personality traits and team performance, this resulted in a low number of studies. The second limitation is the lack of construction team studies on personality traits and team performance. The focus of this paper is construction and engineering teams, but due to lack of studies, other studies outside of the construction industry, but from simliar industries, had to be included in determining the mean effect size. There is a possibility that construction teams might observe different correlation values for personality and team performance. The third limitation has to do with the subjects used to conduct the studies. Most of the studies used university students to determine correlation values. However, there is a difference in experience, age, and environment between classrooms and industry. Therefore, more research needs to be conducted with construction professionals to determine the actual correlation values in predicting team performance based on personality traits.

Overall, the findings of this study revealed that personality traits could impact team building and team performance. The impact observed is due to the relationship that exists between personality traits of team members, which further affects communication, goals, trust, and collaboration between these team members. The findings are helpful for ongoing/future research related to construction teams and how personality traits affect overall project performance and overall success. Finally, the meta-analysis was successful in providing a mean estimate/mean effect size of the personality traits that can predict team performance. Even though the findings will not eliminate certain dysfunctions between team members during the construction phase, it does provide insight to project managers that performance can be influenced by positive and negative personality traits.

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