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Comparison of Personality Traits among Estimators, Project Managers, and the Population

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Comparison of Personality Traits among Estimators, Project Managers, and the Population

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1 **Comparison of Personality Traits among Estimators, Project**
2 **Managers, and the Population**

3

Dr. Alan Atalah, PhD, PE¹

4

ABSTRACT

5 The intuitive hypothesis that Construction Management Professionals (CMP) must have a high
6 level of people skills implies that they should be different than the population at large in terms of
7 people skills. In addition, estimators do not deal with as many people as project managers;
8 therefore, they may not have/need as high of people skills as project managers. The researcher
9 tests these hypotheses through the analysis of 47 personality traits of 102 experienced applicants
10 for construction management positions and compares this analysis to the traits of the overall
11 population. The results of the analysis suggested that (1) CMP were different from the general
12 population in 34 traits, and they were not different in 13 other traits; (2) construction estimators
13 and project managers were not different except in two traits: human services and gregariousness.

14 **Keywords:** Project Manager, Estimator, Personality Traits, Pre-employment
15 Tests.

16

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17 McMaster (1910), quoting Thomas Jefferson, stated, “No duty the executive had to perform was
18 so trying as to put the right man in the right place”. The performance of the employee is a major
19 determinant of the success of an organization in achieving its goals and developing a
20 competitive advantage over its rivals. The employee’s performance is a function of the ability of
21 the individual and the effort that individual puts forth. The employee’s abilities have two
22 components: technical knowledge/skills and personal abilities. The employee’s effort is a
23 function of internal, organizational, and environmental factors (Wright, et al. 1995). The
24 fit/match between the strategic goals of the firm and the abilities of its employees is the key for
25 the successful execution of the firm’s strategic plan. The primary purpose of the selection
26 process is to enhance the probability of hiring motivated employees that perform well for the
27 organization. The interests of the employee and the employer have to be satisfied in the hiring
28 process for optimal results. Rapid turnover, lower performance levels, and friction between the
29 employee and the organization are the consequences of a mismatch of these interests.

30 It is apparent that technical knowledge and skill are not the sole determinants of job performance.
31 Other factors that determine job performance: training programs, appraisal and feed-back, goal
32 setting procedures, financial compensation systems, work design strategies, supervisory
33 methods, organizational structure, decision-making techniques, work schedules, and
34 sociotechnical work system design. However, these factors are dependent on good employee
35 selection at the hiring phase. (Katzell and Guzzo 1983). Many current management philosophies
36 such as quality management, employee involvement, and autonomous work teams require
37 designing the work to be accomplished by teams. The success of the organization is dependent
38 not only on the technical abilities of the individuals, but also on the interaction abilities of the

39 team members. The personality characteristics of many experienced workers seem to be
40 essential for job performance (Gatewood and Feild 2001).

41 Numerous research studies demonstrate that personality traits or preferences are factors that
42 influence the job performance of an employee (Carr, An investigation of the relationship
43 between personality traits and performance of engineering and architectural professionals
44 providing design services in the construction industry - PhD dissertation 2000). Personality is
45 the unique organization of thoughts, feelings, and behavior combined distinctly in each person
46 that defines and determines the person's pattern of interaction with the environment, which
47 includes both human and nonhuman elements (organizational demands, work conditions, and
48 physical environment). A trait is a continuous dimension on which individual differences may be
49 quantitatively measured by the amount of attributes the individual exhibits (Gatewood and Feild
50 2001). Temperament may be viewed as a biologically determined subset of personality.

51 Character, however, may be better thought of as the person's adherence to the values and
52 customs of the society in which he or she lives. In addition to an interview, pre-employment tests
53 are written examinations administered to prospective employees during the hiring process to
54 measure their personality traits. Such tests are usually accompanied by a face-to-face discussion,
55 which is conducted by a consulting psychologist (Hacker 1998). Many companies utilize pre-
56 employment tests in the hiring process to aide in the selection process, long-term retention, and
57 better job fit. Others utilize these tests to determine the training needs of individuals, work
58 groups, departments, or the company as a whole. During the selection process, tests can be used
59 to help identify applicants who have the behavioral and cognitive traits that are required for the
60 position being filled (SelectiveHiring.com 2009).

61 Enhancing the probability that a construction firm hires motivated Construction Management
62 Professionals (*CMP*) is vital. *CMP* make critical decisions regarding the competitive strategy,
63 finance, markup, equipment, material, subcontractors, and so forth for their firms. They represent
64 owner, architect, consultant, contractor, subcontractor, and suppliers who have to work as a team
65 to complete the project in time and within budget. Therefore, selecting the most suitable *CMP*
66 for their roles is an essential part of good management, and every effort should be made to select
67 the right person for key construction positions. In addition to having the needed education,
68 knowledge, and experience, *CMP* should have the personality traits that assist them in
69 performing their duties. For example, because *CMP* continuously deal and communicate with
70 many different individuals, the traits related to the desire and ability to work and deal with
71 people are indispensable (Atalah 2009).

72 Construction projects require a significant amount of communication and coordination among
73 the owner, engineer, architect, sub-designers, construction management consultant, general
74 contractor, subcontractors, and suppliers. The representatives of these organizations have
75 different priorities, motivations, personalities, and background which complicate this
76 communication and coordination. Additionally, during the construction phase, many projects
77 encounter unforeseen conditions or changes that require negotiating fair and acceptable
78 resolutions and settlement. *CMP* should have the personality traits that enable them to navigate
79 and thrive in such an environment (Atalah 2009).

80 If human resource (HR) managers use personality traits in selecting new employees, they must
81 identify these traits before the selection process to avoid legal and ethical questions and disputes.

82 This paper attempts to define the range of personality traits of *CMP* and identify the traits that
83 differentiate them from the population at large; it also compares the personality traits of

84 estimators and Project Managers (PMs). In addition, construction management students and
85 professionals can benefit from the identification of the personal traits of CMP. Students who are
86 considering construction as a career can be guided regarding their suitability for the construction
87 industry. Both construction students and CMP can identify the personality traits that they need to
88 enhance to increase their chances of success. If the individual's personality traits are matched
89 with the needs of the job that he or she performs, both the employer and the employee will
90 benefit. These matching benefits lead to increased job satisfaction and productivity and reduced
91 turnover (Atalah 2009).

92 The most valuable resources for construction firms are their human intellectual capital especially
93 at the upper and middle management levels. Many firms compete for the same pool of material,
94 equipment, and subcontractors, and to a good extent, they may have equal opportunity to acquire
95 these resources from the market. Material and equipment have specifications and performance
96 compliance criteria that are more defined than human. Identifying and selecting the CMP who
97 match the needs of their firms is crucial to the survival and prosperity of the firm (Dumarche
98 2005). Human resource researchers found that personality data, when gathered appropriately, are
99 a valuable additional contribution for making better selection decisions (Gatewood and Feild
100 2001).

101 **Personality Traits in the Construction Management Literature**

102 In the construction management literature, there are few published works about the traits of
103 CMP. These few works focus primarily on the traits of CMP who work for owners, architects,
104 and engineering firms. There is almost no literature about the traits of CMP who work for
105 general contractors or subcontractors. This paper adds to the body of knowledge regarding the
106 traits of CMP who work directly for contractors.

107 Singh (2002) surveyed 51 construction and design engineers at the Hawaii State Department of
108 Engineering Construction (*SDEC*) to assess their preferred modes of cognitive processing
109 orientations. He found that construction engineers were predominantly left-brained; whereas
110 design engineers were predominantly right-brained. This difference in orientation partially
111 explained why the design and construction engineers in the same organization were unable to
112 agree on issues concerning the implementation of drawings. Left hemisphere dominant engineers
113 (construction engineers) desired more organizational changes than did their right hemisphere
114 dominant counterparts (design engineers). Left-brained individuals were usually analytical;
115 whereas right-brained individuals were usually holistic. The right-brain persons were spatial,
116 visual, intuitive, psychic, instantaneous, and artistic. The left-brain persons were analytical,
117 scientific, methodical, linear, timely, verbal, and logical (Singh 2002).

118 Carr (2000) suggested that the team with participants who have diverse personality traits was
119 more useful during the conceptual and schematic phase of the project than the team with
120 homogeneous traits. The team with diverse traits was more suited to consider all aspects of the
121 building and evaluate all potential solutions than was the team with homogeneous traits. These
122 considerations and evaluations of all options were essential to successful conceptual and
123 schematic phases. Once the design boundaries are defined, the homogeneous team was more
124 efficient in carrying out the detailed design (Carr, An investigation of the relationship between
125 personality traits and performance of engineering and architectural professionals providing
126 design services in the construction industry - PhD dissertation 2000). The construction phase is
127 similar to the detailed design phase in terms of defined boundaries, except when changes are
128 encountered. Therefore, participants with homogeneous traits might be preferred in order to

129 complete the project successfully; however, changes are almost unavoidable in most construction
130 projects (Atalah 2009).

131 In traditional project delivery, the systematic process of plan, design, construction, and
132 occupancy are performed in sequence and by separate entities. During the construction phase of
133 a project, representatives of the owner, architect/engineer, contractor, subcontractor, and so forth
134 (with different backgrounds and conflicting interests) work together to finish the project on time
135 and within budget according to the project drawings and specifications. Recently in the
136 construction industry, there has been significant momentum for change in the way construction
137 projects are completed. This traditional project delivery system is giving way to alternative
138 approaches such as design-build. This approach, which consolidates groups of people who are
139 traditionally responsible for separate functions in the project's delivery, is resulting in new forms
140 of organizational structures and hierarchy. In order for such projects to be successful, it is
141 essential that the participating organizations be staffed with CMP who can work effectively with
142 one another (Carr, Garza and Vorster 2002).

143 **Research Methodology**

144 Selection Resource (*SRI*), a consulting psychology firm located in Toledo, Ohio, conducted pre-
145 employment testing services for many firms in different industries. Four successful construction
146 companies with more than 400 employees each were among the clients of SRI. Two of them
147 were listed among the "Top 600 Specialty Contractors" in the *Engineering News Record (ENR)*
148 magazine, and another one was listed in the "Top 400 Contractors" in the ENR magazine (Tulacz
149 and Powers 2003). The applicants and the companies (names are withheld for confidentiality)
150 permitted SRI to use their data in a collective manner for research purposes. For each applicant, a
151 psychologist conducted a battery of tests (which took about five to six hours to complete) and

152 summarized the tests in a personality assessment report. The research team filtered thousands of
153 reports down to 206 reports of applicants to the following construction management positions:
154 Estimator, Project Manager, Cost Engineer, Project Controls Manager, Field Project Manager,
155 Superintendent, Department Manager, Project Coordinator, Project Engineer, Vice President,
156 Scheduler, and Site Manager. The reports were further filtered to only 102 reports of applicants
157 who had more than four years of construction experience. This criterion of four years of
158 construction experience was guided by the Associate Constructor certification requirements by
159 the American Institute of Constructors (Dumarche 2005).

160 The research team reasonably argued that the 102 reports were of established CMP because they
161 were pre-selected by their employer and they considered themselves qualified for these positions.
162 Due to the cost of the assessment, the employers sent only the applicants who had the technical
163 education, knowledge, and experience to fulfill the needs of the vacant jobs.

164 These research subjects were further divided into two groups: Estimators and PMs according to
165 the positions, for which they applied and were considered. The PM group included project
166 managers and superintendents. The objective of the grouping was to check the possibility of
167 statistical significant differences between the means of the personality traits of the two groups. A
168 statistically significant result is unlikely to have occurred due to chance (Statistical Assessment
169 Service at George Mason University 2012). The numbers of subjects for the estimators and PMs
170 groups were 18 and 58, respectively. The remaining 26 applicants applied for other positions or
171 for both positions (Dumarche 2005).

172 **Evaluated Personality Traits**

173 The 102 prospective employees were evaluated using the following eight pre-employment
174 instruments: SRA Nonverbal Form, Kuder Career Search, Supervisory Index, How Supervise,

175 Leadership Opinion Questionnaire, Sales Potential Inventory, NEO Prediction Indicator-Revised,
176 and Teamwork. Table 1 provides the description of the 47 personality traits derived from these
177 instruments. The reliability and validity of these pre-employment instruments are measurable as
178 presented in the next paragraph. Reliability is defined as the extent to which a test is dependable,
179 stable, and consistent when administered to the same individuals on different occasions.

180 Technically, it is a statistical term that defines the extent to which errors of measurement are
181 absent from a measurement instrument. Validity refers to “the extent to which a test measures
182 what it was intended to measure. Validity indicates the degree of accuracy of either predictions
183 or inferences based upon a test score” (Wu 2004). The reliability and validity numbers in the
184 next section are percentages expressed on a scale from 0 to 1 (the higher the better).

185 The SRA Nonverbal Form is designed to measure general learning ability with a reliability factor
186 of 0.89 and a construct validity ranging from 0.17 to 0.89 (McMury and King 1973). The Kuder
187 Career Search determines the employee’s vocational preferences with a reliability measurement
188 range from 0.79 to 0.92 and predictive validity range from 0.43 to 0.51 (Zytowski 1991). The
189 Supervisory Index measures the supervisor’s attitude toward management as an entity,
190 supervision as a process, employees as subordinates, and selected human relations practices. The
191 reported reliability ranges from 0.69 to 0.85 and the predictive validity ranges from 0.18 to 0.48
192 (Gekoski and Schwartz 1966). The “How Supervise” tool measures the supervisor’s knowledge
193 and insight concerning human relations and managing people. Its reported reliability is 0.80, and
194 its predictive validity ranges from 0.5 to 0.6 (Quentin and Remmers 1948). The Leadership
195 Opinion Questionnaire measures two leadership dimensions —consideration and structure.
196 Consideration reflects the individual’s likelihood to have job relationships with subordinates
197 characterized by warmth, mutual trust, respect, and consideration. Structure reflects the

198 likelihood of an individual to define and structure his or her own role and those of subordinates
199 toward goal attainment. Reported reliability for this instrument ranges from 0.74 to 0.89, and its
200 validity ranges from 0.15 to 0.39 (Fleishman 1969). The Sales Potential Inventory instrument
201 measures sales-related attitudes, behavioral dispositions, and sales techniques, and it reflects
202 knowledge on how to sell. The reliability for this instrument is 0.61, and its predictive validity
203 ranges from 0.33 to 0.70 (g-Neil HR Assessments 2001). The NEO Prediction Indicator-Revised
204 (PI-R) is a comprehensive and detailed assessment of adult personality based on a Five-Factor
205 Model of personality (Trull and Widiger 1997). This instrument measures factors in three
206 categories: neuroticism, extraversion, and conscientiousness. Neuroticism reflects adjustment or
207 emotional stability, extraversion reflects outgoingness, and conscientiousness reflects attitudes of
208 sympathy and concern for others. The NEO PI-R has a reported reliability between 0.63 and
209 0.92; it has been identified as the “preferred model for personality inventories for the 21st
210 century” (Griffin, Hesketh and Grayson 2004). Reliability and construct validity ranges from
211 0.56 to 0.92 and 0.10 to 0.67 respectively. The Teamwork KSA measures the essential
212 knowledge, skills, and abilities (KSAs) related to working effectively in teams (Stevens and
213 Campion 1995). Reported internal consistency reliability is 0.8, and concurrent validity is 0.81.

214 **Statistical Analysis**

215 The objectives of the statistical analysis were:

- 216 (1) test the hypothesis that there are statistical significant differences between the means of
217 the personality traits of CMP and those of the population at large,
- 218 (2) test the hypothesis that there are statistical significant differences between the means of
219 the traits of estimators and those of PMs, and
- 220 (3) identify the personality traits of the CMP and their subgroups of PMs and estimators.

221 The personality traits for each applicant were measured against the average values of these traits
222 for the population at large (50%). For example, if an applicant was more assertive than the
223 average person, he or she exhibited a high assertiveness level and score more than 50 (the
224 assertiveness level of an average person). The average value of each trait for the population at
225 large was 50; however, the standard deviation (*SDEV*) of the population at large was unknown.
226 The simple sample two-tailed *t*-test was used to test the hypothesis that there were statistical
227 significant differences between the means of the traits of CMP and those of the population at
228 large. Analysis of variance (ANOVA) was used to test the hypothesis that there were statistical
229 significant differences between the means of the traits of estimators and PMs because the *SDEV*
230 for these groups were calculated from the collected data. The statistical analyses were performed
231 with the probability of rejecting a tested statistical hypothesis when, in fact, that hypothesis was
232 true (α) = 0.05 and degree of freedom (*df*) = 101.

233 **FINDINGS**

234 The average and *SDEV* values for the 47 factors are presented in Fig 1. The length of the bar
235 indicates the average for this factor and the length of the thin horizontal line at the end of each
236 bar indicates the magnitude of *SDEV* around the average. The bold vertical line, at the value of
237 50, represents the overall population. It can be concluded that CMP have personality scores
238 within the ranges shown in Fig. 1. In other words, the personality traits of CMP are within plus
239 or minus one *SDEV* from the average value.

240 The statistical analysis indicated that the means of the personality traits of CMP were
241 significantly different from those of general population in 34 factors as shown in Table 2. In
242 contrast, their means were not statistically different from the general population for 13 factors as
243 shown in Table 3. The discriminating criterion for the statistical significant difference was the *t*-

244 test ($t_{\alpha, n-1}$); if the *t-test* was greater than 1.98 or lower than - 1.98, then the CMP differed
245 from the general population for that factor. As shown in Table 2, CMP scored less than the
246 average population in the traits of vulnerability, office detail, angry hostility, impulsiveness,
247 communication, supervision, fantasy, and values. CMP scored higher than the average
248 population in the traits of conceptual ability, teamwork-KSA, conscientiousness, competence,
249 self-discipline, assertiveness, achievement striving, activity, mechanical, extraversion,
250 employees, dutifulness, gregariousness, deliberation, order, altruism, trust, human relations
251 practices, positive emotions, computations, agreeableness, supervisory ability, art, excitement-
252 seeking, warmth, and compliance.

253 Note that all the personality traits shown in Table 2 have positive attributes except the three traits
254 marked with an asterisk. For example, the conceptual ability factor is a positive factor – the
255 higher the score, the better the trait. Impulsiveness, angry hostility, and vulnerability are the
256 only three negative attributes among all the factors, and for these, the higher the score, the worse
257 the trait. Note that the scores of the CMP for these three negative traits were below those of the
258 general population. It is preferable that the CMP score equal to or slightly above the average
259 value for the positive attributes and score equal to or slightly lower than the average for the
260 negative attributes.

261 Table 4 presents the average and SDEV of the 47 traits across the three groups: PMs, Estimators,
262 and PM or estimators. The analysis also indicates that there are not statistical significant
263 differences between the personality traits of PMs or the estimator group and the other two
264 groups. The discrimination criteria for statistical significant difference is the P-value (shown in
265 Table 4); there is statistical significant difference if the P-value is less than or equal to 0.05.
266 There are not statistical significant differences between the personality traits of estimators and

267 PMs except for the following two factors: human services (interest in helping other people) and
268 gregariousness (desire to be around people). The average gregariousness scores for estimators
269 and PMs are 71.47 and 59.74, respectively, whereas the average scores for human services are
270 38.94 and 60.34, respectively. Therefore, estimators scored higher on the human services factor
271 and lower on the gregariousness factor than PMs; i.e. PMs like to be around people less than
272 estimators do, but PMs like to help people more than estimators do.

273 CONCLUSIONS

274 Selecting the right employees for each job is essential for every construction firm, and great
275 effort should be invested in enhancing the selection process of the CMP. In addition to having
276 the needed knowledge, skills, and experience, CMP should possess certain personality traits.
277 This research identifies the personality traits of the CMP as shown in Fig. 1. The research
278 suggests that CMP are different from the general population for 34 traits and are not different for
279 another 13 traits as shown in Tables 2 and 3. The PMs and estimators are not different for 45
280 traits, but they are different for two traits: human services and gregariousness. It is suggested
281 that estimators and project managers can switch jobs without personality constraints because
282 there are not differences between their predispositions for the relevant traits.

283 RECOMMENDATIONS

284 When managers select a CMP, they should consider the education, experience, talents, and
285 personality traits of the applicant. It is almost impossible to find a professional whose
286 personality profile perfectly matches all the recommended averages, but the closer the match for
287 more traits, it is suggested, the higher the chance of success of that professional. It is
288 recommended that the construction firms hire prospective CMP with personality trait scores
289 within the ranges of plus or minus one SDEV from the average values. It is preferable that CMP

290 score equal to or slightly above the average value for the positive traits and score equal to or
291 slightly lower than the average value for the negative ones. The final decision to hire a candidate
292 should be based on how the person collectively suits the job, not on a few personality traits. This
293 research could be augmented and reinforced by the following additional studies:

- 294 • Replication of this study with a larger sample in different parts of the United States and
295 the world to validate the above-cited findings. The larger sample should include more
296 contractors of different sizes and specialties.
- 297 • Comparison of the actual on-the-job performance of current successful CMP based on
298 pre-established success criteria against their scores in the 47 factors cited earlier in this
299 study to confirm the findings.
- 300 • Comparison of the impact of the diversity of traits of the project participants on the
301 success of the different types of construction projects.

302

303

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Table 1
Interpretation of the personality traits (factors)

Instrument	Factor Description
Achievement striving	Aspiration levels.
Activity	Rapid tempo and vigorous movement.
Agreeableness	Altruism.
Altruism	Active concern for others.
Angry hostility	Tendency to experience anger and frustration.
Art	Interest in activities that make beauty.
Assertiveness	Dominance, forcefulness, and social ascendancy.
Communications	Interest in using language, either writing or speaking it.
Competence	The sense that one is capable, sensible, prudent, and effective.
Compliance	Deference to others in reaction to interpersonal conflict.
Computations	Interest in activities that use numbers.
Conceptual ability	Ability to learn job requirements within a reasonable time
Conscientiousness	Planning, organizing, and carrying out tasks.
Consideration	Ability to develop job relationships with subordinates characterized by mutual trust, respect, consideration, and warmth.
Deliberation	The tendency to think carefully before acting.
Dutifulness	Adherence to ethical principles and moral obligations.
Employees	Attitude toward the subordinates; knowing of their motivations and needs.
Excitement-seeking	Craving for excitement and stimulation.
Extraversion	Outgoingness.
Fantasy	Openness to fantasy.
Feelings	Openness to one's own inner feelings and emotions.
Gregariousness	Preference for other people's company.
How supervise	Supervisor's knowledge and insight concerning human relations in industry
Human relations	Supervisor's techniques to handle problems, lateness, apathy, arguments.
Human services	Interest in helping other people.
Ideas	Intellectual curiosity.
Impulsiveness	Inability to control cravings and urges.
Management	Feeling toward top management, pay, company policy, benefits, plant regulations, and other aspects over which the supervisor has little control.
Mechanical	Interest in knowing how things work and using tools to make or repair things.
Nature	Interest in outdoor activities, such as growing or caring for plants or animals.
Office detail	Interest in keeping track of things, people, or information.
Openness	Willingness to try different activities.
Order	Characteristics of organization.
Positive emotions	Tendency to experience positive emotions.

Sales/management	Interest in dealing with people, such as leading a team of workers or selling ideas.
Science/technical	Interest in discovering or understanding the natural or physical world.
Self-discipline	The ability to begin tasks and carry them through to completion.
Straightforwardness	Frankness, sincerity, and ingenuousness.
Structure	Ability to define a person's own role and those of subordinates to achieve goal.
Supervision	Attitude toward the duties and responsibilities of a supervisor; a person's annoyances, desires, and needs; and feelings toward other supervisors.
Teamwork-KSA	Knowledge, skills, and abilities (KSAs) that predict ability to work in teams.
Tender-mindedness	Attitudes of sympathy and concern for others.
Total score	Individual's attitude about being a supervisor.
Trust	Disposition to believe that others are honest and well intentioned.
Values	Readiness to reexamine values.
Vulnerability	Vulnerability to stress.
Warmth	Issues of interpersonal intimacy.

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366 **Table 2**367 *The average and SDEV for the factors that CMP differ from the general population*

Factors	Average	SDEV	t-test
<i>Vulnerability*</i>	33.30	16.40	-10.27
<i>Office detail</i>	36.00	25.40	-5.56
<i>Angry hostility*</i>	37.20	19.20	-6.72
<i>Impulsiveness*</i>	37.70	18.50	-6.70
<i>Communication</i>	43.00	27.20	-2.62
<i>Supervision</i>	44.30	25.40	-2.26
<i>Fantasy</i>	44.80	21.00	-2.50
<i>Values</i>	46.00	17.90	-2.27
<i>Compliance</i>	54.30	20.80	2.07
<i>Warmth</i>	54.70	21.20	2.23
<i>Excitement-seeking</i>	54.90	19.20	2.56
<i>Art</i>	55.40	27.40	1.98
<i>Supervisory ability</i>	55.70	23.50	2.43
<i>Agreeableness</i>	56.10	22.00	2.80
<i>Computations</i>	56.50	29.70	2.21
<i>Positive emotions</i>	57.40	22.40	3.33
<i>Human relations practices</i>	57.50	29.80	2.53
<i>Trust</i>	58.40	18.90	4.47
<i>Altruism</i>	58.70	21.00	4.18
<i>Order</i>	58.80	18.80	4.71
<i>Deliberation</i>	61.40	20.10	5.72
<i>Gregariousness</i>	62.00	17.70	6.83
<i>Dutifulness</i>	62.40	18.50	6.75
<i>Employees</i>	63.60	25.00	5.49
<i>Extraversion</i>	64.20	19.20	7.45
<i>Mechanical</i>	64.50	25.80	5.70
<i>Activity</i>	64.60	19.10	7.72
<i>Achievement striving</i>	65.10	19.20	7.93
<i>Assertiveness</i>	65.40	16.50	9.44
<i>Self-discipline</i>	66.70	16.00	10.54
<i>Competence</i>	67.90	16.50	10.99
<i>Conscientiousness</i>	68.50	16.80	11.11
<i>Teamwork-KSA</i>	69.40	18.70	10.47
<i>Conceptual ability</i>	75.43	25.82	9.95

368 * *Negative attributes*

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372 **Table 3**

373 The average and SDEV for the factors that CMP did not differ from the general population

Factors	Average	SDEV	t-test
Management	46.10	27.20	-1.45
Science/technical	46.80	22.40	-1.45
Consideration	46.90	26.70	-1.17
Total score	48.70	22.80	-0.58
Structure	49.30	30.00	-0.25
Feelings	50.10	22.70	0.05
Ideas	50.40	20.40	0.19
Sales/management	50.80	30.10	0.26
Straightforwardness	51.90	22.60	0.83
Tender-mindedness	52.60	21.40	1.23
Human services	53.20	27.40	1.17
Openness	53.60	21.60	1.68
Nature	54.80	27.30	1.76

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389 **Table 4**

390 The average and SDEV for each factor for the three groups

	<i>Estimator</i>		<i>Estimator/PM</i>		<i>PM</i>		<i>P-Value</i>
	<i>Average</i>	<i>SDEV</i>	<i>Average</i>	<i>SDEV</i>	<i>Average</i>	<i>SDEV</i>	
<i>Conceptual ability</i>	82.39	26.30	76.20	26.24	78.29	18.08	0.37
<i>Nature</i>	50.82	30.36	52.85	8.08	57.74	4.24	0.31
<i>Mechanical</i>	69.82	20.22	62.38	29.13	65.09	18.34	0.74
<i>Science/technical</i>	43.82	28.96	52.35	6.49	45.98	4.95	0.24
<i>Art</i>	66.41	30.08	48.12	6.00	56.36	4.24	0.10
<i>Communication</i>	42.12	27.05	48.54	10.57	41.43	2.83	0.32
<i>Human services</i>	38.94	27.08	48.50	6.05	60.34	7.78	0.00
<i>Sales/management</i>	46.24	26.83	56.73	15.81	50.29	11.31	0.38
<i>Computations</i>	64.35	26.70	63.08	26.06	52.21	27.30	0.19
<i>Office detail</i>	39.82	23.98	39.04	10.70	34.21	1.41	0.55
<i>Total score</i>	41.71	28.34	53.94	34.12	50.08	2.12	0.52
<i>Management</i>	45.24	29.59	47.65	8.52	47.28	2.12	0.88
<i>Supervision</i>	38.09	18.91	46.35	8.69	46.82	9.19	0.51
<i>Employees</i>	62.65	24.35	66.38	30.67	64.83	5.20	0.98
<i>Human relations practices (h)</i>	47.09	32.02	65.94	24.99	58.70	22.65	0.19
<i>Supervisory ability</i>	49.71	26.28	60.86	28.84	56.15	38.73	0.41
<i>Consideration</i>	53.82	27.20	49.08	32.38	44.63	36.35	0.29
<i>Structure</i>	51.76	21.04	48.15	19.18	49.91	0.71	0.98
<i>Angry hostility</i>	34.65	24.32	38.30	8.33	38.16	6.36	0.68
<i>Impulsiveness</i>	31.88	30.57	44.04	21.97	37.12	16.92	0.15
<i>Vulnerability</i>	34.29	31.53	28.37	11.97	35.96	11.31	0.15
<i>Extraversion</i>	66.00	22.72	70.33	8.89	61.86	11.31	0.11
<i>Warmth</i>	57.82	28.52	59.96	23.07	52.21	8.96	0.31
<i>Gregariousness</i>	71.47	30.19	62.96	21.74	59.74	12.66	0.05
<i>Assertiveness</i>	67.06	23.09	67.81	10.09	64.95	8.49	0.44
<i>Activity</i>	66.18	27.98	69.15	29.57	63.05	4.51	0.08
<i>Excitement-seeking</i>	51.24	26.63	57.48	33.33	55.70	17.95	0.80
<i>Positive emotions</i>	55.65	17.83	64.74	32.02	55.40	27.87	0.24
<i>Fantasy</i>	46.88	28.02	45.56	11.72	44.63	5.66	0.89
<i>Feelings</i>	44.88	25.63	56.15	12.30	49.68	6.36	0.37
<i>Openness to new activities</i>	52.53	25.06	55.74	5.34	53.86	1.41	0.91
<i>Ideas</i>	56.47	21.56	53.89	6.67	47.79	2.83	0.14
<i>Values</i>	44.47	32.92	47.85	25.93	46.37	25.06	0.97
<i>Agreeableness</i>	56.94	31.82	55.93	26.05	56.93	11.93	0.85
<i>Trust</i>	62.06	29.16	60.96	34.55	57.04	7.77	0.40
<i>Straightforwardness</i>	47.65	27.30	48.37	10.41	55.67	9.90	0.45
<i>Altruism</i>	65.35	30.89	63.30	9.92	55.54	11.31	0.12
<i>Compliance</i>	51.24	25.64	50.63	28.51	57.86	12.50	0.24
<i>Tender-mindedness</i>	57.06	35.57	56.44	19.76	50.37	6.11	0.40
<i>Conscientiousness</i>	72.00	32.94	71.44	10.46	67.26	0.71	0.19
<i>Competence</i>	69.82	21.13	72.89	7.65	66.16	3.54	0.08

<i>Order</i>	56.71	26.76	60.81	22.40	59.42	12.58	0.66
<i>Dutifulness</i>	70.53	28.30	63.04	8.98	60.68	0.71	0.07
<i>Achievement striving</i>	65.88	21.58	69.07	22.18	64.14	17.78	0.13
<i>Self-discipline</i>	68.88	24.32	71.26	23.41	65.07	2.89	0.12
<i>Deliberation</i>	67.88	32.22	60.00	24.50	61.18	7.77	0.29
<i>Teamwork-KSA</i>	69.11	26.43	66.27	25.89	73.68	6.51	0.77

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Figure
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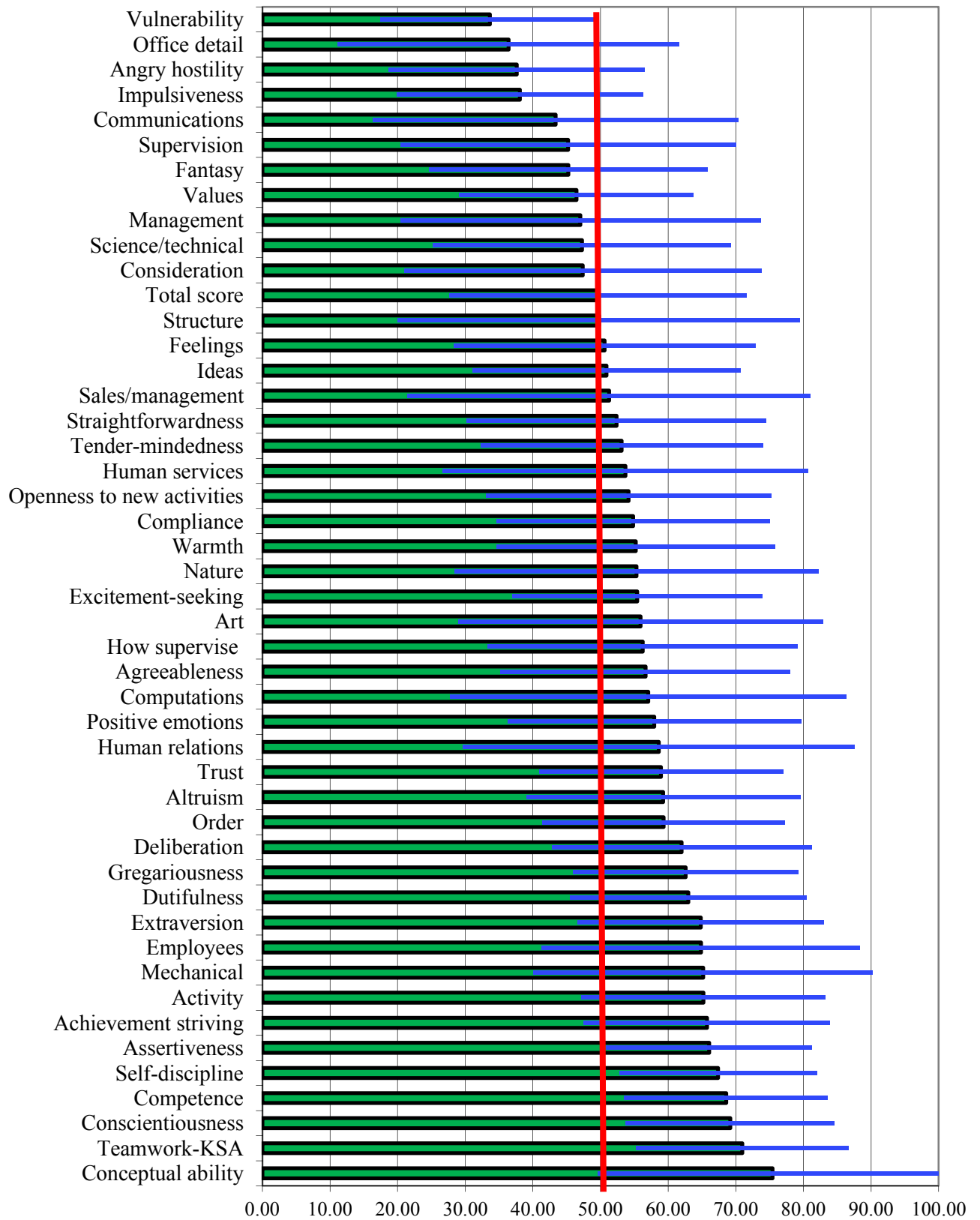


Fig. 1 The average value and SDEV for each personality trait.



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AUTHOR'S COMMENT TO THE REVIEWERS

Thank you reviewers; your contribution definitely significantly improved the paper. All the suggested edits from both reviewers have been made as the reviewers requested except the following modified differently:

- The words significantly or significant was used sometimes in the paper to indicate big difference or level of importance, while, it was intended to be statistically different; i.e. it is the result of chance and there is 95% probability that the difference really exist. I modified the paper to reflect the intended thought by removing the word significant when it was not intended and changing it to be statistical significant difference between the means of the two groups.
- The scope of the research did not include tracing and evaluating the actual performance of the selected ones. This data was not collected, and we did not have means or resources to do it. However, this does not make the paper invaluable to the readers who are interested or practicing selecting and developing CMPs. The paper adds to literature and the state of the art of the selection of CMPs in construction. In addition, in the recommendation section, the author recommends collecting the actual performance data and further the research and the state of the art.
- The author never suggested that these personality traits should be strictly employed or enforced in selecting new CMPs or guiding the construction management students. The author suggests adding another tool in the big tool box of selection. It will be a complete mistake to surrender the judgment of the construction professional to these tests or making these tests the only or even the decisive tool in the selection process.
- The author corrected the error of the Human Services and Gregarines level of the estimator versus project managers. Good catch from reviewer number 2.
- The main conclusion of the paper is that estimators and project managers are similar and they can exchange jobs without any problems; which is completely compatible with the author's experience and intuition. CMP being different from the population at large in some factors seems to be logical and intuitive. The research help us identify and articulate these differences.
- Sometime, the research surprises us with counter intuitive results. While the author does not claiming that this research leads to paradigm shift, having a counterintuitive is not a bad thing in itself. Researchers should let the data and the analysis lead them and avoid making the data confirm their hypothesis or intuition. The relevant part is the accuracy and reliability of the data and analysis. In our case, we believe they were sound.