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1 The Effect of Project Manager's Management Style on Project Delivery Success in
2 Construction Projects

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6 **Abstract**

7 This study explores the type of management styles adopted by construction project managers
8 (PM) in Iran and the relationship between the styles chosen and project success. A sample of
9 139 project management practitioners participated, and the results were analysed using robust
10 statistical methods. The results show that although most of the PMs tend to take determined
11 approaches, the rate of adoption of this management style slightly differs from that of the
12 other styles. The results also present that the four dimensions of management style, namely
13 interaction, flexible, proactive and external, would lead the projects to achieve better
14 outcomes and increase the likelihood of success. The findings form an insight into the current
15 practice and may be useful for PMs to improve their management abilities and skills.

16 **Keywords:** *Project Success; Management Style; Project Management; Competency*

17 **1. Introduction**

18 Does the PM's management style affect project performance in achieving success in
19 construction projects? Construction project performance is dependent on its project
20 management, hence different competences and skills are now required from project
21 management practitioners (Garel, 2013; Ramos et al., 2016; Demirkesen & Ozorhon, 2017).
22 The implementation of methods and techniques of project management has radically
23 expanded in many construction companies around the world, implying the necessity for
24 effective project management styles (Fortune et al., 2011; Mir & Pinnington, 2014).
25 To many researchers, PM's role is more complicated compared to functional managers' job,
26 and their management style can affect project success (Müller & Turner, 2010; Vittal S
27 Anantatmula, 2010). The traits that form the competencies of PMs and their effect on
28 construction project success has continuously been investigated in the literature (Dziekoński,
29 2017; Zuo et al., 2018).

30 A PM's role in the project is often complicated and challenging since they encounter various
31 issues that are needed to be dealt with most appropriately so that project objectives can be
32 accomplished (Karlsen et al., 2020). When doing so, their management style may

33 significantly affect their decisions and performance in these situations, which will influence
34 the project and the stakeholders' interests.

35 Recent research by Ramos et al. (2016), provides a good starting point for this research. They
36 identify the current management styles adopted by the PMs and the style that might lead to
37 better project outcomes. They have conducted an exploratory study of current management
38 styles adopted by Brazilian PMs. In that work, the traits of PMs regarding different
39 management styles are explored to realise if there is an adoption of, or preference for, a
40 particular style (Ramos et al., 2016). This study follows the same method of data collection
41 that Ramos et al. (2016) have chosen and obtains the opinions of 139 qualified project
42 managers using questionnaires. But more importantly, this study undertakes further
43 investigation in order to discover the effect of current professional PMs' management style
44 on project success. The management style questionnaire was originally created by (Ramos et
45 al., 2016), based on the four dimensions of management styles introduced by Klijn et al.
46 (2008). Langston's (2013) 3D Integration Model is utilised for measuring project success,
47 retrospectively, in Iranian construction projects.

48 This study aims to understand how different management styles can lead the project towards
49 its planned goals and stakeholders' interests with an overarching focus on construction
50 projects where usually massive investments are involved. By using the collected data, this
51 study focuses on finding empirical evidence to address two research questions: (1) which
52 forms of management style(s) do construction PMs usually draw upon in practice? And (2)
53 which management style had often been used in more successful projects?

54 **2. Context to the study**

55 The literature includes several studies on the behaviour and competencies of PMs regarding
56 the project success (Kocher et al., 2013; Zhao et al., 2016; Tabassi et al., 2016; Maqbool et
57 al., 2017; Dziekoński, 2017; Chaudhry et al., 2019). PM's performance, knowledge,
58 experience, competency, leadership and management style and, in general, all personal
59 attributes and human skills can influence project success (Mazur et al., 2014).

60 *2.1. Management Style Model*

61 'A management style is a way of life operating throughout the enterprise and permits an
62 executive to rely on the initiative of the personnel of an entity (Nwadukwe & Court,
63 2012:199)'. Utilising an effective management style by the managers when interacting with
64 their subordinates is of high importance to team success in any hierarchical organisation

65 (Kocher et al., 2013). However, few studies have been undertaken to investigating the effect
66 of management styles on project success in construction projects.

67 Several models of management styles have been created and developed by researchers in the
68 literature (Ramos et al., 2016). The latest one is proposed by Olmedo-Cifuentes & Martínez-
69 León (2014), which includes two types of management styles, namely directive and
70 participative, as the two main sets of behaviours that PMs might adopt. The former is
71 adopted when managers make decisions and set performance criteria, and the latter takes
72 place when managers benefit from subordinates' views and ideas in the decision-making
73 process (Northouse, 2019).

74 Although all those models in the literature can be useful, this study adopts Klijn et al. 's
75 (2008) models since it has been proven to hold the capacity of exploring the project
76 managers' specific characteristics (Ramos et al., 2016). Back in 2008, in a survey conducted
77 on public-private projects, Klijn et al. (2008) identified four aspects of management style
78 based on the literature and their previous investigations. This model was then adopted by
79 Ramos et al. (2016) in research aiming to explore Brazilian PMs' management styles:

- 80 • *Results–interaction*: Actions are mainly aimed at achieving results or at achieving
81 good relations.
- 82 • *Internal–external*: The orientation is more internal (the project organisation itself) or
83 external (other actors involved).
- 84 • *Reactive–proactive*: The manager is more likely to react to other initiatives or take
85 the initiative themselves.
- 86 • *Flexible–determined*: The PM has clear goals or adapts to new circumstances (Ramos
87 et al., 2016:904).'

88 Also, Chaudhry et al. (2019) adopted this framework to examine the PMs' management
89 styles in the software industry in Oman. The model is now being used in this research to
90 understand how the different management styles adopted by construction PMs can impact
91 their projects.

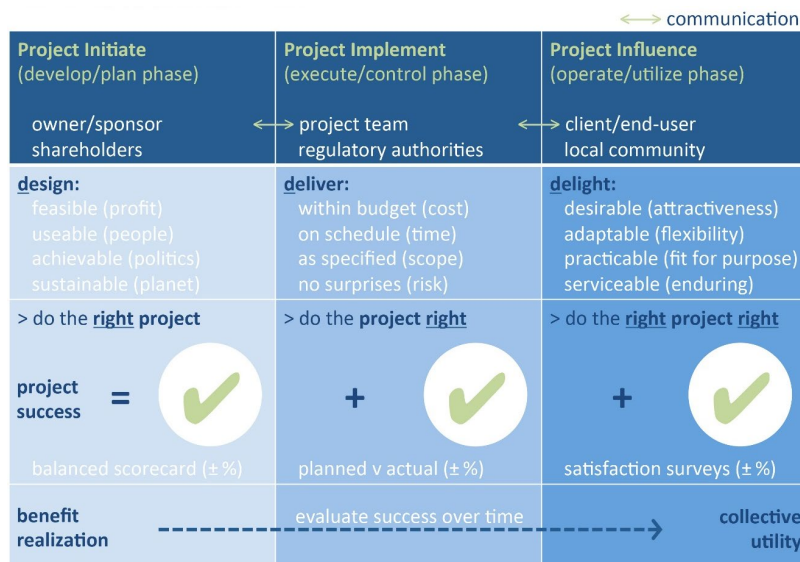
92 2.2. Project Success Model

93 Competency in leadership and management has been proven to be a success factor in the
94 construction area (Blaskovics, 2014; Zhao et al., 2016; Tripathi & Jha, 2019). For the
95 purpose of this study, the success of the sample PMs should be measured using a project
96 success model. Many authors have proposed different types of frameworks to advance a

97 more solid technique to comprehend project success and what standards are dependable to be
 98 applied during these considerations (Albert et al., 2017).
 99 Each organisation or sector, project team or manager possibly can create their own definition
 100 of project success (Turner & Zolin, 2012). For some scholars, success is a skewed
 101 occurrence and is reliant on the view of those who are gauging it since intangible
 102 benchmarks imply different facets to different people. However, Davis (2014) determined
 103 that PMs are potentially the most influential factor for project success attainment.

104 *2.3. 3D integration model*

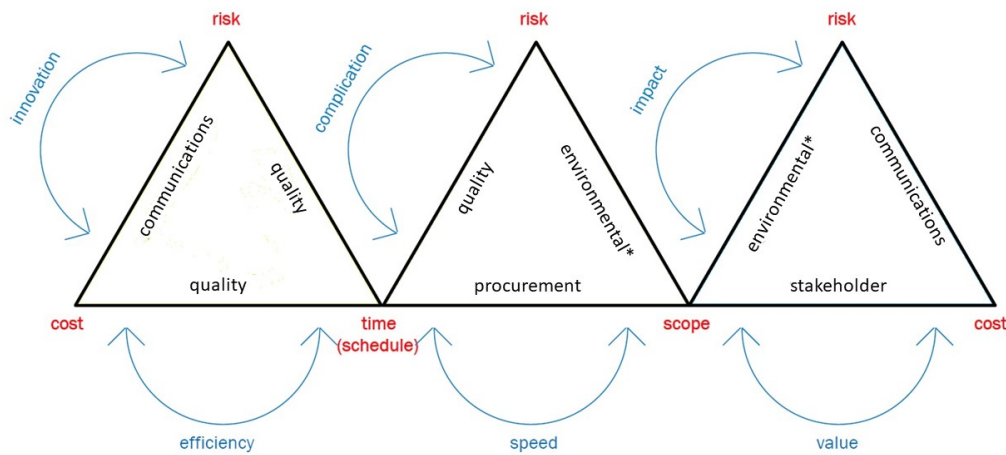
105 Langston et al. (2018) proposed a method for measuring project success over time suitable
 106 for use on any type of project regardless of size, location or date. In their model, known as
 107 *i3d3*, time serves an essential role in judging project success. The *i3d3* model shown in
 108 Figure 1 comprises three common stages of ‘initiate’, ‘implement’, and ‘influence’, and three
 109 common targets of those stages, namely design, deliver, and delight. Stakeholder
 110 communication across these phases is crucial for guaranteeing that shared vision and purpose
 111 is sustained. During each stage, different collections of stakeholders have greater influence
 112 and interest than others regarding the project success dimension (Jiang, 2014).



113
 114 Figure 1. The *i3d3* model framework (Langston et al., 2018)

115 For the purpose of measuring success in this paper, the middle part of *i3d3* which is called
 116 ‘3D integration model’ shown in Figure 2 is used which has previously been introduced,
 117 developed and validated in other papers (Langston, 2013; Langston & Ghanbaripour, 2016;
 118 Ghanbaripour et al., 2017; Langston et al., 2018). The 3D integration model is made in the
 119 form of a tetrahedron and based on the ten knowledge areas of *PMBOK Guide* plus a new

120 area of Environmental Management. It can be used to measure the performance of the project
 121 in delivering successful outcomes at various stages in the project lifecycle through the
 122 identification of core project constraints (occupying the four vertices of the model) and six
 123 aforementioned KPIs (represented by the edges of the model) (Ghanbaripour et al., 2017).
 124



* not included in PMBOK Edition 6©

125

126 Figure 2. 3D integration model adopted from (Ghanbaripour et al., 2017; Langston, 2013)

127 In 3D integration model, success criteria are assessments of being on budget, on schedule, as
 128 specified and with no surprises by use of the six key performance indicators (Langston,
 129 2013). These KPIs include value, efficiency, speed, innovation, complication, and impact
 130 described in Table 1. They can be applied to all projects at any given time in any given
 131 country and on any scale, whether large or small. Value, efficiency, speed, and innovation
 132 are maximised, whereas complication and impact are reduced (minimised).

133 Table 1. Six generic KPIs of the 3D integration model (Ghanbaripour et al., 2017)

KPI	Definition and the related <i>PMBOK Guide's</i> knowledge area
Value	the ratio of scope over cost (objective: maximise). Value is a function of project <i>stakeholder management</i> , namely meeting expectations and fostering engagement. Scope is treated as an output and cost is treated as an input, so the more utility per unit of cost the greater is the value for money;
Efficiency	the ratio of cost over time (objective: maximise). Efficiency is a function of project <i>resource management</i> , namely team performance and leadership. Cost, in this case, is treated as an output (value of work completed) and time as an input, so the more money spent per unit of time the more efficient is the delivery process;
Speed	the ratio of scope over time (objective: maximise). Speed is a function of project <i>procurement management</i> , namely outsourcing strategies and parallel supply chains. Scope is treated as an output and time as an input, so the more utility provided per unit of time the faster is the delivery process;

Innovation	the ratio of risk over cost (objective: maximise). Innovation is a function of project <i>communications management</i> , namely knowledge management and research informed learning. Risk is treated as an output (innovation leads to development risks) and cost as an input, so a higher level of risk per unit of cost reflects the search for better ways of doing things;
Complication	the ratio of risk over time (objective: minimise). Complication (originally termed complexity) is a function of project <i>quality management</i> , namely excessive quality-assurance paperwork and engineering over design. Risk is treated as an output and time as an input, so a higher level of risk per unit of time is a sign of project difficulty that should be avoided
Impact	the ratio of risk over scope (objective: minimise). Impact is a function of project <i>environmental management</i> , namely adverse sustainability outcomes and unnecessary resource consumption. Risk is treated as an output and scope as an input, so a higher risk level per unit of utility reflects unwanted environmental disruption.

134 Note 1. a new area of project environmental management has been added to the *PMBOK Guide*'s existing
135 knowledge areas to recognise the emerging importance of sustainability in modern projects (Ghanbaripour et
136 al., 2017)

137 Since it is not possible to optimise all KPIs, an equation has been derived by Langston
138 (2013) that is used to determine the best mix of success factor performance. To calculate the
139 project delivery success (PDS), both planned and actual performance are considered. The
140 percentage change is worked out after the completion of delivery. Overall success (calculated
141 as the change in PDS between planned and actual performance) is given by the following
142 formula (Langston, 2013):

$$143 \text{ Project delivery success (PDS)} = \frac{s^3}{CTR}$$

144 Where c (cost) = the cost of implementing the project, t (time) = the duration of the project
145 from start to finish, s (scope) = a measure of the size or extent of the project, r (risk) = the
146 $\sqrt{\text{mean risk level (probability x consequence)}}$ of all risk events.

147 A successful project is one that delivers more scope for less cost, time and risk as per the
148 equation ($PDS = \frac{s^3}{CTR}$). In that case, the PDS is higher.

149 **3. Methodology**

150 *3.1. Questionnaire Development*

151 To explore the PMs' management style, a questionnaire designed by Ramos et al. (2016) is
152 utilised to measure the respondents' tendency to each management style based on the model
153 in (Klijn et al., 2008). Since a good number of generic statements have been made in this
154 questionnaire which has already been proven to be capable of obtaining valuable data
155 (Hyman et al., 2006) regarding the management styles, however, its reliability and validity
156 are tested within the current context of Iranian projects. This structured questionnaire

157 includes questions asking how managers would deal with various situations using one or
158 more of the four dimensions of management styles: Results x Interaction, Reactive x
159 Proactive, Internal x External, and Flexible x Determined, using a 5-point Likert scale. The
160 first section of the questionnaire collects descriptive data about respondents and their
161 experience within the industry. The next section observes the managers' management style
162 and asks the respondents whether they agree or disagree with the given statements within the
163 context of the project management attributes in their organisations. The second section of
164 the questionnaire is an opinion-based 5-point Likert survey of the PMs with the values of 1–
165 5, where 1 indicates strongly disagree, and 5 indicates strongly agree. There are 2 for
166 disagree, 3 for neutral and 4 for agree in between.
167 The second questionnaire will only obtain the planned and actual values (for cost, time,
168 scope, and risk) of the latest project that each PM has undertaken and finished.

169 3.2. *Validity and Reliability*

170 In this study, the construct validity of the variables is tested to ensure accurate assessment of
171 the management style of the construction PMs. The development of the questionnaire is
172 based on a review of the literature, and specifically, the approaches that are taken by Klijn et
173 al. (2008) and Ramos et al. (2016), however, it is still vital to assess the validity as the
174 questionnaire is being distributed among a sample of managers in a completely different
175 context. Therefore, a pilot questionnaire test is conducted.

176 Nine professional PMs were asked via interview to complete the questionnaire and to present
177 a critique of the questions. Those professionals reviewed the statements one-by-one and did
178 not rule out any of the proposed variables. Then the Cronbach's alpha coefficient is used to
179 determine the responses' reliability.

180 3.3. *Survey Sample*

181 Purposive sampling was used in this study. The target population of this study was
182 construction PMs who were involved in managing medium-sized construction projects;
183 hence the sample comprises the views of a group of professional PMs. The authors intended
184 to hold the interview meetings in person instead of sending out the questionnaires. Hence
185 112 prominent construction companies were randomly selected and contacted, and 42 of
186 them that had construction projects running in Tehran agreed to participate in the study. An
187 acceptable response rate of 37.5 per cent (Yong & Mustafa, 2012) was achieved, and all 45
188 cooperating firms were well-known construction contractors. This process led to a sample

189 that encompassed 139 construction PMs. One of the authors travelled to all the construction
190 sites in which those PMs were based and conducted face-to-face interviews. That author also
191 gathered and investigated archival material to collect data on both management style and
192 project delivery success areas. To obtain data on project success, planned and actual
193 performance of the most recent project, managed by each construction PM was investigated.
194 A diagnosis of PM attributes, performance, and management style can help practitioners to
195 organise and coordinate projects in a clear way. We identified the style and performance of
196 this group to understand which attribute led these projects to better outcomes comparing to
197 others.

198 3.4. *Analysis Method*

199 The analysis comprises of four sections. First, the demographics of the respondents is
200 presented. In the second section, the internal consistency reliability using Cronbach's alpha
201 coefficients is measured to assess the appropriateness of the questionnaire. In the third
202 section Confirmatory Factor Analysis (CFA), which is one of the powerful Structural
203 Equation Models (SEMs) is applied to assess the relationship between different management
204 styles, and also to assess the loading of each question in each style. These loadings are
205 valuable measures to determine the degree of importance of a question in a questionnaire.
206 This research investigates the hypothesised effect of adopting different management styles
207 by PMs on project success; hence the following hypotheses are developed:

208 **H1:** The orientation of management styles have a significant effect on project success

209 **H2:** Mentioned management styles are independent.

210 In order to test H1, multiple linear regression (MLR) is used to find the strength of the
211 management style's effect on project success, and to test the independence of the styles (H2)
212 we anchor to the results of CFA analysis. Any correlation between the styles will show
213 dependence and violation of the latter hypothesis.

214 The goodness of fit (Hoelter, 1983) of the parameters is presented to evaluate the strength of
215 the model. Also, a histogram to measure the distribution of studied managers across the four
216 styles is presented.

217 In the last section, multiple linear regression is utilised to measure the cumulative effect of
218 the four styles on the success ratio of the PMs. A stepwise method is used to remove variance
219 inflation from the styles, as there is a significant correlation between all the styles.

220 4. **Analysis and Discussion**

221 4.1. Respondents' Demographics

222 Descriptive statistics of the respondents' background has been summarised in Table 2.

223 Table 2- Demographics of the respondents

Items	Construction	
Age		
Less than 25 years	-	-
25 to below 35 years	25	18.3%
36 to below 45 years	74	52.9%
More than 46 years	40	28.8%
Experience in Subway Construction Project Management		
Less than 2 years	7	4.8%
2 to below 5 years	20	14.4%
6 to below 10 years	12	8.7%
More than 10 years	100	72.1%
Educational Background		
Bachelor of Science	80	57.7%
Master of Science	39	27.9%
MBA/ DBA	7	4.8%
PhD	13	9.6%

224

225 It reveals that slightly over half of those who responded to the survey (approximately 53%)
 226 are between 36 to 45 years old. Some researchers suggest that the approach the managers
 227 take and the decision they make may be affected by their age (Chaudhry et al., 2019; Swiery
 228 & Willitts, 2012). Most of the respondents have been involved with construction projects for
 229 more than a decade, and all of them have tertiary education.

230 4.2. Questionnaire reliability

231 Results of Kaiser's measure of sampling (KMO) adequacy are presented in Table 3.

232 Questions Q6 and Q27 showed a coefficient lower than 0.5 and were removed from the
 233 analysis.

234 Table 3. Kaiser's Measure of Sampling Adequacy (KMO)

Result vs Interaction		Reactive vs Proactive		Internal vs External		Determined vs Flexible	
Q1 [†]	0.845	Q10 [†]	0.81	Q17 [†]	0.757	Q23	0.921
Q2 [†]	0.798	Q11	0.807	Q18	0.818	Q24	0.893
Q3 [†]	0.758	Q12 [†]	0.829	Q19	0.772	Q25	0.86
Q4	0.845	Q13	0.772	Q20 [†]	0.69	Q26	0.829
Q5	0.802	Q14 [†]	0.85	Q21	0.738	Q27*	0.356
Q6*	0.488	Q15	0.815	Q22 [†]	0.736	Q28 [†]	0.875
Q7	0.818	Q16	0.723			Q29 [†]	0.852

Q8	0.845
Q9 [†]	0.869

235 †: These questions were reversely coded

236 *: Questions 6 and 27 were removed as a result of low KMO coefficient

237

238 Results of the Cronbach's Alpha shown in Table 4 reveal that two questions in the
 239 questionnaire cannot explain the idea behind their associated management styles. As for Q6
 240 asking about 'Result vs Interaction', it led to a low alpha value of 0.703 (Bonett & Wright,
 241 2015). This question is removed, and the calculated alpha has increased significantly to
 242 0.786. A look at Q6, 'I follow the activities delegated by me', shows whether a manager is
 243 result-oriented or interaction-oriented. She or he might follow the activities delegated to
 244 anyone, as these activities can both have an effect on the conclusion and at the same time,
 245 need interaction

246 Regarding the fourth style, 'Determined vs Flexible', removing Q27 also triggers a
 247 substantial improvement to the reliability of the questionnaire. With the deletion of this
 248 question, Cronbach's alpha of the fourth style increases from 0.709 to 0.79. This question
 249 states 'I believe the project will be completed despite the obstacles' which can receive the
 250 same answer from both Flexible and Determined managers. The variance of this question
 251 was very low, and both groups of managers (Flexible and Determined) selected choice 3 or
 252 above.

253 Table 4. Cronbach's alpha of the four studied management styles

Management Style	Cronbach's Alpha
Result vs Interaction	0.786*
Reactive vs Proactive	0.8
Internal vs External	0.753
Determined vs Flexible	0.79*

254 Note 2. Cronbach's alpha of the two management styles were 0.733 and 0.729 before the removal of Questions
 255 6 and 27, respectively

256 4.3. Management style relations and adoption rate

257 Goodness of fit statistics in Table 5 shows that the model is well fitted. The Chi-square
 258 model is significant at 0.001 level, and the number of filled questionnaires (139) are well
 259 above the Hoelter's critical N index (Hoelter, 1983) that suggests a minimum of 125
 260 questionnaires. The standardised root means square residual (SRMR) is also below 0.08,
 261 which shows good fit. However, the AGFI criteria are below 0.9, indicating that the
 262 questionnaire needs more improvements to get better results.

263 Table 5. Fit parameters of Confirmatory Factor analysis

Baseline Model Chi-Square	1314.111
Degrees of Freedom	351
P-value	0.001
Hoelter Critical N	125
Standardised RMR (SRMR)	0.0649
RMSEA Estimate	0.043
Adjusted GFI (AGFI)	0.8004

264

265 Factor loadings in Table 6 illustrate that each factor (style) can define more than 50% of each
 266 question variance. Except for questions 1 and 22, more than 60% of the variance of the
 267 remaining questions were well defined by the factors. Questions 5, 10, 11, 13, 20, 23, and 25
 268 can extract the style of the PMs very well as their factor loadings are above 80%.

269 Table 6. Factor loading of questions in each style (All loadings are significant at 0.001 probability level)

Result vs Interaction	Reactive vs Proactive	Internal vs External	Determined vs Flexible
Q1 0.581	Q10 0.841	Q17 0.739	Q23 0.892
Q2 0.785	Q11 0.865	Q18 0.785	Q24 0.686
Q3 0.63	Q12 0.779	Q19 0.763	Q25 0.865
Q4 0.722	Q13 0.865	Q20 0.806	Q26 0.791
Q5 0.841	Q14 0.78	Q21 0.793	Q28 0.783
Q7 0.645	Q15 0.707	Q22 0.505	Q29 0.793
Q8 0.7868	Q16 0.644		
Q9 0.663			

270

271 Factor correlation analysis shows a significant correlation between all the studied
 272 management styles. Using Confirmatory Factor Analysis (CFA) instead of Exploratory
 273 Factor Analysis (EFA) enabled the research to measure the correspondence strength between
 274 the styles. The fourth style, 'Determined vs Flexible' had the highest correlation with other
 275 styles, especially 'Result vs Interaction' and 'Reactive vs Proactive'. This high
 276 correspondence shows that there is a close relationship between these styles. In other words,
 277 those managers who are more flexible, also tend to be more interaction-oriented and
 278 proactive, and a bit more external-oriented leaders (Table 7).

279 Table 7. Factor correlation coefficients (All coefficients are significant at 0.001 probability level)

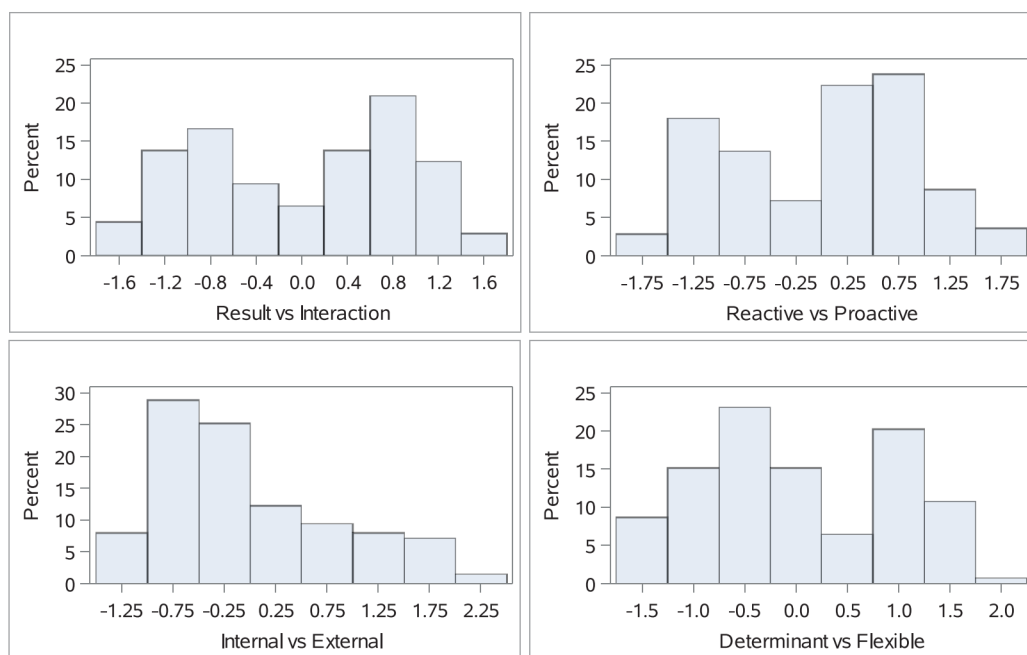
	Result vs Interaction	Reactive vs Proactive	Internal vs External	Determined vs Flexible
Result vs Interaction	1			
Reactive vs Proactive	0.351	1		

Internal vs External	0.361	0.337	1	
Determined vs Flexible	0.696	0.738	0.563	1

280

281 Since there is no definite border between the two dimensions in all four styles, these should
 282 be analysed in a spectrum to investigate the tendency of managers to each style. A histogram
 283 in Figure 3 indicates the distribution across the spectrum in all four styles. Based on the
 284 results, roughly around 7% of the managers were neither result-oriented nor interaction
 285 oriented; however, 44% of the managers are result-oriented, out of which, about 5% are
 286 extremely result-oriented. On the other hand, 49% of the managers are interaction-oriented,
 287 out of which, about 3% are extremely interactive. The highest proportion of managers (21%)
 288 were moderately interaction-oriented.

289

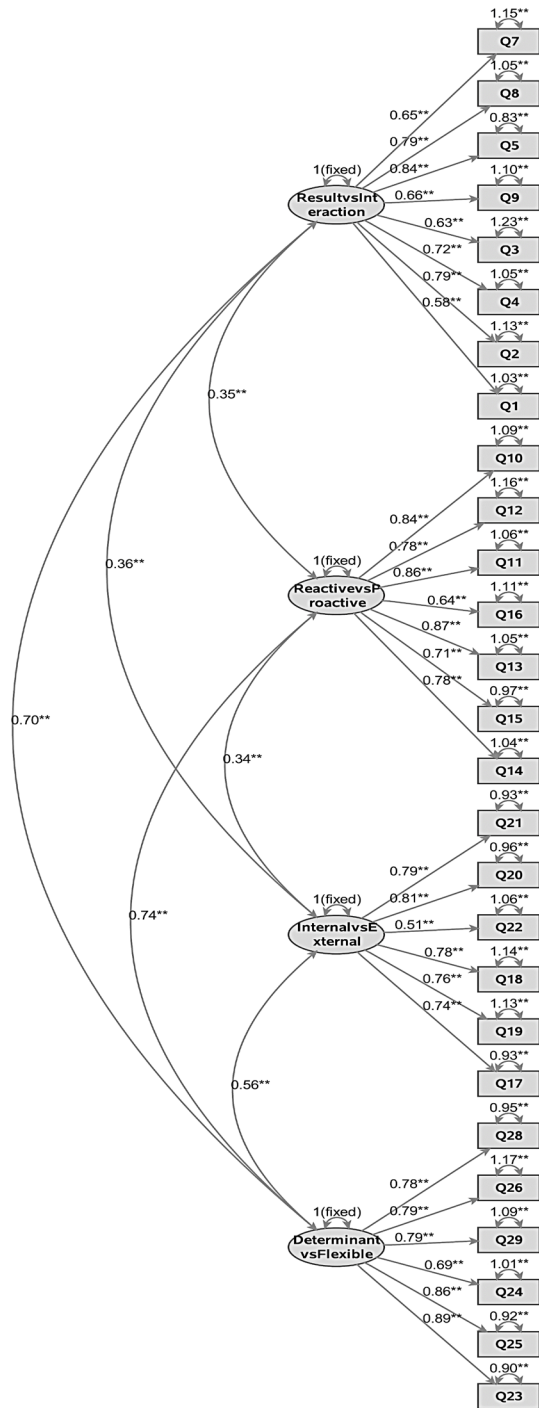


290

291 Figure 3. The adoption rate of the management styles by the sample PMs

292 ‘Reactive vs Proactive’ histogram shows that most of the managers are moderately proactive
 293 (47% in two columns of 0.25 and 0.75), and 13% are highly proactive. The remaining 40%
 294 are reactive managers. The third histogram, ‘Internal vs External’, shows that most of the
 295 Iranian managers tend to focus on internal matters of the project. About 54% of the managers
 296 are moderately internal-focused managers; however, the skewness of the data shows that a
 297 minor fraction of the managers (2%) extremely focus on external factors of the project and a
 298 small portion of them (7%) are highly external-focused. In total, 62% of the managers were
 299 internal, and 38% were external. The final histogram shows that a considerable portion of the

300 managers are neither Determined nor Flexible (15%), however, the highest proportion the
 301 managers were mildly Determined (23%) and 24% of the managers are moderately to highly
 302 Determined. On the other hand, only 6% of Iranian PMs are mildly Flexible, and about 32%
 303 are moderately to highly Flexible. In total, most of the managers are Determined. Figure 4
 304 Depicts the path diagram of the management styles.



305

306 Figure 4. Path diagram of CFA analysis (**: statistically significant coefficients at 0.01 alpha level)

307 4.4. Relationship between Management Style and project success

308 This section investigates the effect of the management styles adopted by the PMs on the
 309 project delivery success. Many researchers have shown that appropriate behaviours, the
 310 leadership and the management style of the PMs affect the project success (O Sheedy &
 311 Sankaran, 2013; Sebastian-Ion Ceptureanu, 2016; Aga et al., 2016).

312 As mentioned before Langston’s 3D integration model is used to measure the project
 313 delivery success (PDS) score for each of the sample projects. Table 8 shows an example of
 314 calculation of the PDS score for one of these projects. The main element of scope for this
 315 project was 2500 m² of floor area, and it was supposed to be constructed within 12 months
 316 with a planned \$8 million of budget. The risk number was retrieved from the risk register by
 317 taking the square root of the average risk level of all the risk events.

318 Table 8. Example of PDS calculation

INPUTS	PLANNED	ACTUAL	UNIT
Scope (s)	2500	2500	m ² (floor area)
Cost (c)	8,000,000	8,760,000	USD
Time (t)	12	11	months
Risk (r)	2.19	1.85	√mean risk level
<i>Good job! (PDS ≥ 0)</i>		PDS	= 17.94%

319 Factor correlation with the success rates (PDS scores) shows that the ‘Reactive vs Proactive’
 320 style has the highest positive effect on management success. In other words, PMs with more
 321 proactive style achieved better outcomes compared to the managers who mostly adopted a
 322 reactive style. Similarly, managers who are more flexible in their projects turn out to be more
 323 successful in their projects. The same pattern applies to the managers with interaction-
 324 focused leadership style. Finally, managers with higher external attitude have a slightly
 325 higher success rate compared to the internal ones, and the relationship is weaker than the
 326 former styles.

327 Looking at the results of the CFA analysis, negative factor values are considered for the
 328 right-hand side of each style (Result, Reactive, Internal, Determined) and vice versa. Table 9
 329 shows that for managers with result-oriented style, the average success of the project is
 330 26.3% compared to 59.2% in interactive managers. Furthermore, reactive managers have
 331 roughly 43% lower success in their project compared to proactive managers which is the
 332 highest difference among the four styles. Internal and rigid managers also have 21 and 40%
 333 lower average success, respectively.

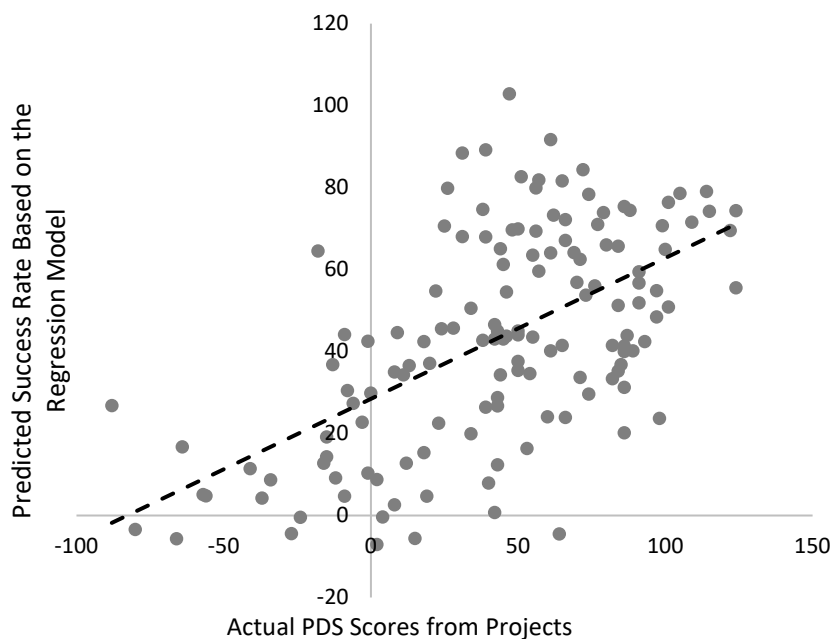
334 Table 9. The average PDS score of PMs in each style

Average Success Rate (PDS Score)			
Result =>	26.3%	59.2%	<= Interaction
Reactive =>	18.2%	61.3%	<= Proactive
Internal =>	35%	56.1%	<=External
Determined =>	24.9%	65%	<=Flexible

335

336 The multiple regression results in Table 9 shows that the management styles can explain 34%
 337 of the successfulness of a PM. The model was significant at 0.0001 level with an F value
 338 (The F value is the ratio of the mean regression sum of squares divided by the mean error
 339 sum of squares) of 18.76. The positive correlation between success and all four styles are
 340 shown in Figure 5. As can be seen, with an increase in the style scores towards the positive
 341 ones (Interaction, Proactive, External, Flexible), the success rates increase significantly.

342



343

344 Figure 5. Scatter Plot of Actual against Predicted Success Rate.

345 *4.4.1. Results x Interaction management style*

346 The results from Table 9 suggest that those PMs who had adopted an interactive management
 347 style did better in delivering their projects. The results are in line with the outcome of many
 348 other studies. Prabhakar (2004) undertook research on 153 projects across 28 countries and
 349 concluded that PMs who were relationship-oriented generated more successful projects. As
 350 the business environment becomes more competitive, PMs must deal with more complex

351 projects. Hence, interactive management styles relying on strong group interactions among
352 the project team are required to effectively deal with new interconnected, non-linear and
353 difficult-to-define problems (Thamhain, (2013). In construction projects that are generally
354 massive and complex, a PM that inspires and motivates the team members is more likely to
355 achieve success (2019).
356 PMs spend approximately 90% of their time on communicating and interacting with internal
357 and external stakeholders of the project and to ensure a successful project effective and
358 interactive management to build better relationships are required (Maqbool et al., 2018).
359 Additionally, adopting an interactive management style may lead to more successful projects
360 as it enables a trustful interaction between individuals and boosts team-building by
361 establishing more effective communication among the team members (Aga et al., 2016)
362 Apart from the strong connection it generates internally between superiors and subordinates,
363 an interactive project management style helps to develop a collaborative relationship with
364 external stakeholders of the project to ensure that the outcomes are what they require
365 (Rasmussen et al., 2013).

366 *4.4.2. Proactive x Reactive management style*

367 Table 9 indicates that similar to interactive management style, being proactive makes a
368 significant difference in terms of successful delivery of the project since it is a key success
369 factor especially in dealing with complexities and ambiguity (Hagen & Park, 2013; Larson &
370 Gray, 2014; Maqbool et al., 2018). For instance, PMs can be proactive by providing the team
371 with adequate training, responding to issues and risks systematically, clarifying expectations
372 and setting the goals and standards to maintain consistent performance improvement to
373 secure project success (Bond, 2015). Chaudhry et al. (2012) state that the project team
374 automatically adopt a proactive style of the PM which will be beneficial to the project's
375 performance. Looking at the role of the PMO in organisations, implementing proactive
376 processes can help projects run more efficiently, finished within budget and up to the
377 standards. Also a proactive PM maintains open communications with stakeholders which is a
378 key factor to mitigating the project problems and to managing their expectations before
379 surprising and detrimental change requests are proposed (Cuthbert Andy, 2012).

380 *4.4.3. Internal x External management style*

381 According to Klijn et al. (2008) project management is mainly focused on controlling the
382 project internally and is less concerned with a continual interaction with the external

383 environment. Various internal and external factors affect construction projects which can
384 significantly affect their performance (Adeleke et al., 2019). Some researchers hold the
385 opinion that a PM should undertake the project both efficiently and effectively. The former
386 refers to internal requirements such as cost, asset utilisation, etc. while the latter comprises
387 satisfying or exceeding the stakeholders' requirements (Sundqvist et al., 2014). Zhao et al.
388 (2016) explored the leadership characteristics of PMs in Singapore and suggested that these
389 two styles should be adopted together to achieve better outcomes in projects.
390 The study's results show that focusing more on external factors of the project may slightly
391 improve the project's outcomes, and this difference is not significant. Peters & Waterman
392 (2015) revealed that successful large companies had achieved better outcomes by focusing
393 on the internal processes and the development of intrinsic motivation of the employees.
394 Similarly, in research focusing on factors contributing to the organisational success of the
395 construction subcontractors, Thomas Ng et al. (2009) concluded that the top five of the
396 critical success factors are all internal factors on which the most of the PM and team's
397 attention is required. However, the impact of the external factors on project success can be
398 significant, which may cause cost and time overruns leading the project to failure (Gunduz &
399 Yahya, 2015). For instance, early termination of a project, no matter why it has been
400 terminated, can be deemed as a failure. The external factors contributing to this theoretical
401 failure may include legal, political, environmental or social setbacks (Nixon et al., 2012).

402 *4.4.4. Flexible x Determined management style*

403 As can be seen from the results, managers with more Flexible management style have
404 achieved better outcomes. Flexible management style is recognised as a prominent
405 characteristic of effective project management (Pace, 2019). Researchers have listed several
406 advantages of this kind of management style including but not limited to: creating a common
407 sense of responsibility among team members for success; generating more effective
408 communications among all internal and external stakeholders; easier implementation
409 processes due to earlier identification of the issues; developing creativity and innovation;
410 better access to information; more acceptance to beneficial changes, etc. (Kaufman, 2011).
411 This type of management style has been adopted by emotionally intelligent leaders who
412 utilise it to create an environment where team members feel their innovations and initiatives
413 are embraced by the managers (Brinia et al., 2014).

414 A Flexible project management style from a long-term perspective can be considered as
415 critical success factor that will improve the overall effectiveness of the projects as well as the
416 stakeholders' satisfaction (Shahu et al., 2012).

417 **5. Conclusion**

418 A thorough review of the literature in this paper reflected that the PM's management style
419 could affect project success either positively or negatively. The purpose of this research was
420 to explore the management styles adopted by PMs in construction projects in Iran and more
421 importantly, to investigate the relationship between the four types of management style and
422 project success based on the Klijn's management dimensions (Klijn et al., 2008) and the
423 Langston's 3D Integration Model (Langston, 2013) respectively. Generally, in diverse
424 situations and circumstances, managers might adopt different styles (Kocher et al., 2013).

425 The results of this study indicated that although there is no single 'best' choice of
426 management style and it is difficult to discover the main style adopted by the target
427 managers, one of the dimensions of each style had led the project to considerably better
428 outcomes comparing to the other dimension. However, the analysis of the histograms in
429 Figure 3 indicates that the 'determined' style is the favourite style of most managers.
430 Conversely, the second part of the research identified 'Flexible', 'Proactive', 'External' and
431 'Interaction' dimensions as the better management styles in achieving more successful
432 outcomes in construction projects.

433 The results of this research can contribute to the advancement of the knowledge in both
434 academic field and professional practice since the findings of the management styles leading
435 to better project outcomes are relevant to understanding the most effective project
436 management methods. From a professional point of view, the findings of this study can be
437 utilised by the construction PMs should they are keen to improve their management skills
438 and look for better performance to increase the likelihood of success in their projects.

439 Management style remains an exciting topic for the construction sector; hence further studies
440 to investigate its impact on project performance in various countries is suggested. Also, other
441 management style models can be adopted in future studies to compare the results with those
442 of the Klijn et al.'s (2008) model. This will enable managers to take better decision making
443 approaches and adopt more effective management styles that more consistently lead to better
444 outcomes.

445 **6. Limitations**

446 The limitations of this study stem from the data collection process. Firstly, all the planned
447 and actual data obtained to measure project success were related to the last project that each
448 PM had conducted and finished. The authors tried to ask the respondents about the
449 management styles they normally adopt; however, a few PMs might have changed their
450 attitudes and methods since the last project. Secondly, although the authors attempted to
451 maximise generalisation of the results, the number of PMs working in the construction
452 industry in Iran were not clear. Thus the study could not select a sample based on the
453 probabilistic methods, so the authors reached out approximately 250 professionals via
454 telephone and 139 opted voluntarily to participate. However, the number of respondents is
455 sufficient for the statistical methods used.

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460

461

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