

## **Human Factors Affecting Project Strategy in Large Scale Complex Projects**

**By**

**Mr. Sarojkant Singh**

Faculty of Management Studies ICFAI University Jharkhand Near, Plot no 2065 Daladali Chowk, Simalia, Ranchi Ring Rd, Ranchi, 835222

**Dr. Hariharan**

Faculty of Management Studies ICFAI University Jharkhand Near, Plot no 2065 Daladali Chowk, Simalia, Ranchi Ring Rd, Ranchi, 835222  
Email ID: [harimti@hotmail.com](mailto:harimti@hotmail.com)

### **Abstract**

Business strategy has been much researched, but *project strategy* still remains in an area of ambiguity and is mostly misinterpreted. Strategy itself is a loosely used term in various references and contexts. The present article attempts to clarify such ambiguities and reveal the correct usage of the term “Strategy”, thereby elucidating *project strategy*. By an exhaustive literature review the article provides the work done in the sector of human factors and their influence on project strategy. The research gaps in the area of human factors are identified and an empirical study is presented to identify the important human factors. A questionnaire survey is conducted with 129 respondents majorly from the project related industry. 16 variables identified from the gaps in the literature survey are analyzed. Principal Component Analysis (PCA) method is applied in order to identify human factors which impact project strategy. The analysis shows 3 independent variables as important. Factor Analysis is carried on this and validity and reliability of the factor is illustrated. Finally through a multivariate multiple regression analysis, the paper concludes that Charisma, Reputation of Project Manager and Trust between client impact project strategy. Data collection is further suggested to study the other variables. The research is a part of an ongoing PhD thesis on project strategy.

**Keywords:** project strategy, human factors, PCA, trust, reputation, R programming

### **Introduction**

The word “Strategy” has been a popular topic of research and many have written books on strategy. The agony of a student of strategy aggravates when he/she finds the term being misplaced in context or gets loosely used. The agony worsens when the term is misused or sometimes abused by eminent leaders, and likely role models! Such a student researcher thus finds solace in the phrase “ignorance is bliss”. This article however has the opposing intent. It attempts to make the world of academia and industry more aware of what the term stands for and its correct usage. This may thus bring forth agony for the illuminated and therefore this disclaimer.

There is a natural tendency in researchers from Indian subcontinent to find equivalents of English words in Sanskrit, and the instinct made the author look into the equivalent for “Strategy” and most of it was related to war. The closest term we can find is the Sanskrit word “Niti”, however this word is better suited to mean “Policy”. The reason for not having the right Sanskrit equivalent is that the usage of the word in business is quite recent. The first work was

done by Michael E Porter in 1985 with is ground breaking article on competitive advantage(Porter, 1985).

In the following section we will exhibit the literature survey to elaborate on the work done on strategy and human factors. This article attempts to bring out the right usage of strategy and its close association with human factors, which becomes extremely critical when implementation of strategy comes into effect. We then extend the clarified understanding to “Project Strategy”. On one hand when strategy is misplaced and misused, project strategy suffers from a non-identity and paucity of research. The article makes an effort to add to the body of knowledge on project strategy.

## Strategy- Use and misuse

While Porter initiated the conceptualization, Richard Rumelt in his book Good Strategy and Bad Strategy explains “what strategy is Not”, illuminating much of its misplaced usages (Rumelt, 2012). The author explains in his book that in 1966 there were just 3 books and no articles on strategy! After 2000, it has become voluminous but adding to the confusion. Rumelt mentions how the word has become a verbal tic in business, education and government. The confusion aggravates when terms like “marketing strategy”, “digital strategy” etc starts getting used. To add to this jumbled state, people equate strategy to success or ambition. Rumelt clearly states that this mistake must be avoided. The author goes on to mention that the words “strategy” and “strategic” loosely used by high officials trickles down the pyramid and gets misused. In this parlance Rumelt informs that strategy is not a standalone goal. The next mistaken or misplaced use is that of assuming strategy as the big picture and overall direction without linking to action. Many executives thus confuse strategy with goal setting.

There is a kindergarten story of 6 blind men and the elephant. Each of the 6 blind men touch the tail, trunk, legs, ears, tusks and the body respectively and come out with a completely different description of the elephant. Similarly when using the word “strategy” some misuse it for goal setting, some for the big picture , some with success and some with standalone goal. Rumelt describes Strategy “as a coherent set of analyses, actions, policies and concepts as a response to high stake challenges” (Rumelt, 2012) introduces to the core of strategy , the hard nut or what he calls the kernel consisting of : First a diagnosis, Second a guiding policy and Third a coherent set of actions to carry out the policy. Missing any part of the kernel leads us to the blind man and elephant situation.

Rumelt further describes bad strategy as consisting of “fluff” or out of proportion blown concepts and floating ideas, failure to accept the challenge and mistaking goals for strategy.

With this in mind and our foundations we look at the works done in strategy.

## Literature Survey

### *Strategy and strategy research*

(Alharthy et al., 2016) cites various definitions of business strategy by AD Chandler (Chandler Jr, 1969), W D Guba (Guba, 1994), W D Guth and E. Gubrium. These are definitions stressing on the goals, guideline, actions and pattern. The diagnosis is not clearly enunciated. The author also cites (Yang, 2010) to further elaborate strategy implementation. (J. Boone Bartholomees, 2012) goes to the history of strategy with its origins in military and highlights how usage on certain terms differ due to context. The author cites the example of

word “passion” which means different in christian context and secular context. The author cites that military and non-military usage of the word has given it a larger interpretation and that the US army uses operations to connote high-level military art which was once called strategy. Boone then gives his view by defining strategy as “simply a problem-solving process”. The missing part of diagnosis as Rumelt mentions thus emerges. (Alexander et al., 1998) provide a perspective on strategy research and the various dimensions of strategy. The author tries to guide strategy studies for the future. The authors mentions six attributes procedural, effortful, willful, essential and facilitative as “how-to” part of strategy from various literature studies. The article elaborates the various dimensions of strategy where these attributes play like General Cognitive studies, Metacognition, Self Regulation, Learning and Instructional. (Silverman et al., 2012) explains how history research methods can be employed in strategy research. The author illustrates “remote sensing” and “Contextualism not Reductionism” as two methods method. Our idea to elaborate the above literature review from business, military art and strategy research is to illuminate how the subject must be approached.

(Simon, 2008) gives a history of strategy and development of strategy systems for which he praises consultants rather than scientists. He cites Michael E Porter’s Competitive advantage of Cost Leadership V/s Differentiation. The article reflects on *Swing of the pendulum*, a phrase used in strategy research and how this highlights the importance of change of focus of business thinkers from internal to external environment of organization to determine strategy. The author then goes on to types of strategies. (Rajendra K. Srivastava, 1998) Present a framework to integrate marketing and business processes, connecting the internal and external factors and thus capturing “value”, the goal of business strategy. It’s called a Customer-Sharerholder Value (CSV) matrix. (Singh, 2021) Provides how system dynamics approach can be utilized to extend this framework in practice.

(ohmae, 2006) Gives a message that successful business strategies result from a *state of mind* not from rigorous analysis, which is only used to stimulate the creative process. He explains the process to be a creative and intuitive process rather than a rational one. This is a critical aspect we shall elaborate in this article.

### **Project Strategy**

Till now we have elaborated on the works in strategy particularly directed to business strategy. Now we move further to map this onto *project strategy*.

Business and projects have a fundamental difference. Financial statements have this difference ingrained in audited reports in the words “ongoing concern” for businesses. The idea is to *outlive decades*. Projects on other hands are *temporal* and with a definitive start and finish. This impact of time on strategy makes project strategy *more akin to the military strategy*. However, the world of war and world of constructive projects are just opposites, while war seeks to destroy and vanquish, projects aim to construct and develop! This fundamental nature of projects makes the dimension *very different from military strategy and more akin to business strategy*. We may thus say that project strategy is the “missing link” between the two. On one hand it has the temporal nature and traits of military strategy, on the other hand constructive aspects of business strategy. (Shenhar et al., 2007) in his work “Project Strategy- a missing link” traces the origin from Sun Tzu’s Art of war to Porter’s work and then elaborates how in competitive and non-competitive contexts competitive advantage may be understood in context of projects. He explains the creation of “value” in both contexts. The author then guides the meaning with (Mintzberg, 1987) Five P’s principle. He explains the 1<sup>st</sup> P – perspective as “why” we do the project. The 2<sup>nd</sup> P – “what” Position that will be achieved after project is completed. The 3<sup>rd</sup> P- Plan on “how” the position will position will be achieved.

The other 2 “ploy” and “pattern” are not so much stressed by the author. What is critical is that we see the connection between Rumelt’s kernel, Raj Srivastav’s CSV matrix, Porter’s 5 forces and Mintzberg’s 5 Ps in context of projects.

Though this research by Shenhar connected the concept of project strategy to that of business strategy, its (Artto et al., 2008) work which hits out at the core difference and uniqueness of project strategy. But before we reveal that, it's important to understand how, in projects the similar theme was discussed as highlighted by Rumelt by informing the pitfalls of misplacing goal setting with strategy. Most research before Shenhar were focused on project success parameters. Shenhar further has coauthored (Patanakul et al., 2012), How project strategy is used in project management, where the authors extend the concept beyond achievement of project goals i.e. remaining within budget, within cost and within time. (Poli & Shenhar, 2003) Project Strategy- The key to project success, article is critical as it links corporate strategy to project strategy. (Hjelmbrekke et al., 2015) illustrate how bureaucratic structures and hierarchy inhibit and ultimately fail projects. There is a distinct connect with corporate strategy here.

Now we are ready to discuss (Artto et al., 2008)- “What is Project Strategy”. This work provides is a groundbreaking direction for understanding project strategy. The author highlights two dimensions on which project strategy depends and its success or failure is affected. Firstly, Degree of Independence and second number of stakeholders. On this basis he categorizes four categories of project strategies viz Innovative Leader, Obedient Servant, Strong Leader and Flexible Moderator. The article cites that these two dimensions determines how the strategies will be formulated and how they will be implemented. The innovative leader strategy has high independence and one stakeholder. The Strong leader has few stakeholders but high independence. The obedient servant has low independence and many stakeholders. Finally the Flexible moderator has high independence but many stakeholders. This article captures how positioning and external environment of project that includes the corporate which runs the project determines the kernel of strategy.

### **Human Factor Research**

We have so far elaborated the works on project strategy and now we will deal with Ohmae’s concept of *state of mind* for strategy building. (Artto et al., 2008) ‘s explanation gets a new dimension when we join it to Ohmae’s state of mind. Despite hurdles in the environment, strategy can be oriented with what Ohmae mentions as insight and a consequent drive for achievement. The author says this often amounts to a sense of mission. Human Factors play an important part in formulating the strategy and subsequently implementation. Decision making and risk perceptions play an important part in defining project strategy.

### **Human Factor and Risk related literature**

(Zwikael & Smyrk, 2015) illustrate that in turbulent environment, trust of the project owner in the project manager is more effective, whereas in a more stable project setting, more control by the project owner of the project management process is a superior management approach. Finally, management role of the project owner is discussed and a project governance model is introduced. (Kahneman 1934- author, n.d.; Kannengiesser & Gero, 2019) provide an explanation of the prospect theory and a framework to apply the same.(Kahneman & Lovallo, 1993) explains how human psychological bias from overconfidence errs decision making.(Flyvbjerg, 2009) illustrates how biases decisions and principal-agent theory plays in large infrastructure projects.

### ***Human Factor and Risk and Complexity***

(Nachbagauer & Schirl-Boeck, 2018) conclude that based on resilience research and Human Factors research, ideal types for managing the most unexpected events in projects. While humans are possible sources of error, they are at the same time the most valuable resource to manage the unexpected successfully.(Andreas G.M. Nachbagauer, 2018) develop a useful framework combining the social dimension comprises the project manager, the project team and the project-oriented organization and the time-related dimension.

### ***Gaps in Human Factor Research***

(PrakashPrabhakar, 2009) inform important factors for project success as effective communication, engagement, flexibility and adaptability, preference for significant initiative and leadership, aggressiveness, confidence, persuasiveness, effectiveness as a communicator and integrator. (Korsakiene et al., 2020) revealed that communication and trust affect other human-related factor and trust towards system concept (TTS).(Thompson, 2018) elaborates on stress as a human factor. (Morris et al., 2010) also cites stress as a human factor.(Kadefors, 2004) study factors that influence development of trust and co-operation in client-contractor relationships in construction projects.(Strahorn et al., 2017) conclude Human Variables-Relationship, trust , project management, relationship interaction and trust, initial intent of stakeholder, (Tejpal et al., 2013) bring out a complex multi-dimensional construct of supply chain partner's relationship and (Tejpal et al., 2013) factor analysis.(Singh, 2022) illustrate that trust is important while extending trade credit in supply chains and the impact of block chain in this context.

(Alias et al., 2014) work on human factors consider human-related factors like client's experience, nature of client, size of client's organization, client's emphasis on low construction cost/ high quality of construction/ quick construction, and client's ability to brief including to make decision; to define roles; contribution to design; Other important variables like contribution and support from senior management, skilled designers, skilled project manager ,troubleshooting, project team motivation, commitment of all project participants ,strong/detailed plan effort in design and construction ,adequate communication channels and effective feedback are also mentioned in the work. (Dul & Neumann, 2007) analyse ergonomics in strategy and risk as human factors.

(Francis et al., 2008)conclude project management and reputation of PM as a critical success factor.(Zadeh et al., 2017) work highlights cooperation and (Hsieh et al., 2020) work on goodwill, (Flyvbjerg et al., 2009) on deception, (Flyvbjerg, 2006) on inaccuracy and forecast risk in project management, optimism bias and strategic misinterpretation while (Poster, 2013) brings out the variable as emotions and (Zwikael & Smyrk, 2015) control and trust.

From the above we choose the following variables to study for human factors which present a gap in research and search major databases to funnel down on widely researched variables. Sixteen variables and constructs are chosen which top 16 in searches are.

### **Selection of Variables**

The following table is the search results with the variable name and project strategy as keyword in the various databases. The top 16 variables are chosen.

**Table 1:** Number of search results in databases

SL. No	Variable	References	Google Scholar	ERIC	ProQuest	JSTOR	Science Direct	Emerald Insights	PMI	SAGE	Total excluding Google Search
1.	Errors due to humans or Human Error	(N. Durmic, 2020) (Bussier Chong 2022)	3,800,000	4	1123134	83092	190072	29000	359	57255	1482916
2.	Effective Communication	(PrakashPrabhakar, 2009), Alias et al., 2014) Korsakiene et al., 2020) Pinto & Selvin ,1988	421000	0	216823	7159	16025	4000	23	9299	253392
3.	Stress	(Morris et al., 2010)	11900		5386	187	678	74	1	137	6463
4.	Engagement of Project Manager	(Washington,2013) (RD Saade 2015)	86200	3	91667	2032	4117	3000	846	1802	103467
5.	Flexibility of Project Manager	(PrakashPrabhakar, 2009)	103000	2	97291	2188	8809	3000	535	1587	113412
6.	Decisive Client	(Alias et al., 2014)	128000	1	200122	21816	4242	2000	70	8209	236460
7.	Trust Between Client and contractor	(Korsakiene et al., 2020) (Kadefors, 2004)(Zwikael & Smyrk, 2015)	3,520,000	9	2680308	164477	124963	56000	1439	95411	3122607
8.	Experience of client	Alias et al., 2014)	1290000	62	1097535	40068	63994	31000	1204	49001	1282864
9.	Support of senior management	(Alias et al., 2014) Dong et al. (2004),Pinto & Selvin 1988	514000	6693	24401	4926	12156	5000	333	6671	60180
10.	Contract Handling by Project Manager	Moshood et al., 2020) Thomson 1992	1660000	33	2019701	82098	96922	40000	1468	69292	2309514
11.	Effective Feedback of project Team	Sunindijo,2015	129000	0	191079	7295	4358	1000	15256	44118	263106
12.	Anchor Bias	(Flyvbjerg,2006)	162000	8	173800	3616	5568	4000	2097	2288	191377
13.	Reputation of Project Manager	(Francis et al., 2008)	51,600		82959	1605	2550	1000	399	789	89302
14.	Charisma of Project Manager	(Blaskovics,2016)	99400	0	121940	10419	1874	1000	66	8148	143447
15.	Risk Personality	(Costigan, R., Iter, S., & Berman, n.d.)	770000	8	722559	6839	14828	11000	910	6189	762333
16.	Self Awareness	(Love et al., 2009)	10,400		3412	122	240	237	84	131	4226
17.	Leadership	Zakaria,2015, Anantamula,2010 Murphy, D., Baker, N. and Fisher, D. (1974).	140000	841	69800	1940	6684	4000	776	2883	86924
18.	Persuasiveness	(PrakashPrabhakar, 2009)-	12,700		23962	387	467	221	52	185	25274
19.	Organized Project Team	Alias et al., 2014)	1160000	60	982436	69338	73995	39000	1139	96580	1262548
20.	Technical Expertise Project manager	(Alias et al., 2014)	20500	1	28662	459	879	432	155	238	30826
21.	Assertive Project manager	(PrakashPrabhakar, 2009)-	8600		16387	170	310	140	54	126	17187
22.	Aggressiveness of Project manager	(PrakashPrabhakar, 2009)-	31,300		72314	983	1289	518	263	516	75883
23.	Adaptability of Project Manager	(PrakashPrabhakar, 2009)-	25,600	1	29615	305	1834	800	186	291	33032

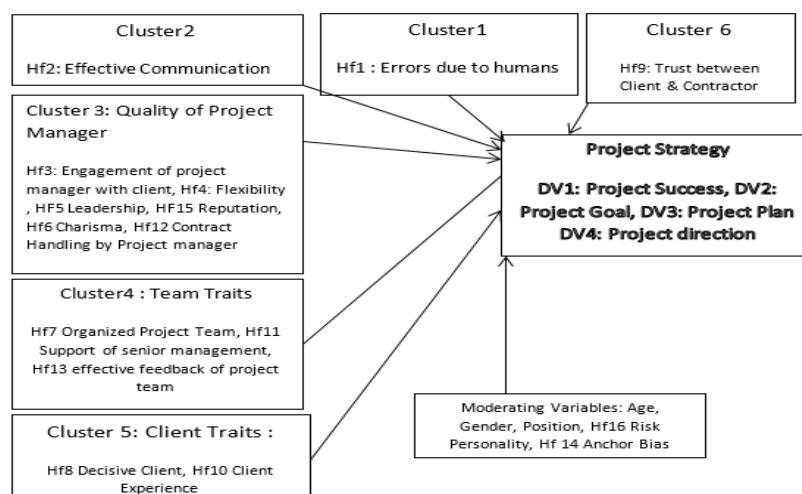
Of the 16 variables chosen, from the search results, we study these from (Artto et al., 2008) framework of Independence and number of stakeholders to determine project strategy.

**Table 2: Discussion on selected variables**

SL. No	Variable	References	Discussion
1	Errors due to humans or Human Error	(N. Durmic, 2020) (Bussier Chong 2022)	The articles discuss the errors due to human from a risk mitigation perspective and human factors are majorly perceived as safety related. We weigh this against other variables.
2	Effective Communication	(Prakash Prabhakar, 2009), Alias et al., 2014) Korsakiene et al., 2020) Pinto & Selvin ,1988	Effective communication is a crucial human factors and Pinto and selvin's work elucidates the tactical and strategic nature of critical success factors and how communication plays an important role. This variable will take a wider definition.
3	Engagement of Project Manager	(Washington,2013) (RD Saade 2015)	Client relationship is studied in these articles and trust is given a construct and models are discussed.
4	Flexibility of Project Manager	(Prakash Prabhakar, 2009)	The Article discusses this variable as a critical success factor amongst others. Pinto's work Arttos work on project strategy will have important implications when this variable is studied.
5	Decisive Client	(Alias et al., 2014)	This variable is put in human factor variable responsible for project success. With the project strategy definition we study, we will see this has an impact.
6	Trust Between Client and contractor	(Korsakiene et al., 2020) (Kadefors, 2004) (Zwikael & Smyrk, 2015)	The articles study the various models of trust and how this is critical to project success.
7	Experience of client	Alias et al., 2014)	This variable is put in human factor variable responsible for project success. With the project strategy definition we study, we will see this has an impact.
8	Support of senior management	(Alias et al., 2014) Dong et al. (2004),Pinto & Selvin 1988	Artto's independence of project manager strategy is closely related to this variable which has been informed as a critical success factor. Pinto's tactical and strategic nature is also crucial.
9	Contract Handling by Project Manager	Moshood et al., 2020,(Thevendran & Mawdesley, 2004) Thomson 1992	The articles have discussed this in various forms. Thomson's book deals extensively. Thevendran discusses the human risk factors and reasons for risk attitude.
10	Effective Feedback of project Team	Sunindijo,2015	This article deals with project manager skills and mentions effective feedback as a crucial skill. We take this as a variable and it shall be critical to a system dynamics model preparation.
11	Anchor Bias	(Flyvbjerg,2006)	This variable is selected as Flyvbjerg shows how this influences our decision making. In project strategy elaborated by Artto, this will play an interesting role.
12	Reputation of Project Manager	(Francis et al., 2008)	This variable is one of qualities of project manager and widely researched majorly for CEO's in business. In Artto's framework of project strategy this will play a crucial role.
13	Charisma of Project Manager	(Blaskovics,2016)	Charisma has been widely studied in leadership and in this article brings out this variable as a critical factor of project success.
14	Risk Personality	(Costigan, R., Liter, S., & Berman, n.d.)	This variable is carefully chosen along with trust, risk taking ability and Arttos framework. The article studies a multidimensional study of trust.
15	Leadership	Zakaria,2015, Anantamula,2010 Murphy, D., Baker, N. and Fisher, D. (1974).	Widely studied and crucial to projects, this will be critical in analysing Arttos framework. These articles study this aspect on project success.
16	Organized Project Team	Alias et al., 2014)	This variable is put in human factor variable responsible for project success. With the project strategy definition we study, we will see this has an impact.

## Methodology and Hypothesis

In this study, after a comprehensive literature survey we have identified 16 variables and relationship between variables is shown in the following diagram. The variables have been divided into 6 human factor clusters.



A questionnaire survey is used to collect data from 129 participants. The participants are chosen from project based and manufacturers who supply to project based companies which execute large scale projects like NTPC, EIL, L&T, BHEL, MBE etc. The factors like age, gender, position, risk personality and anchor bias are considered as moderating variables and have not been researched in this study.

Measurements in this study are from 1- Strongly Disagree to 5- Strongly Agree, Ranking 1- Highest and 5- Least and Likert Scale of 1- Least Important to 5- Most Important.

### **Measures**

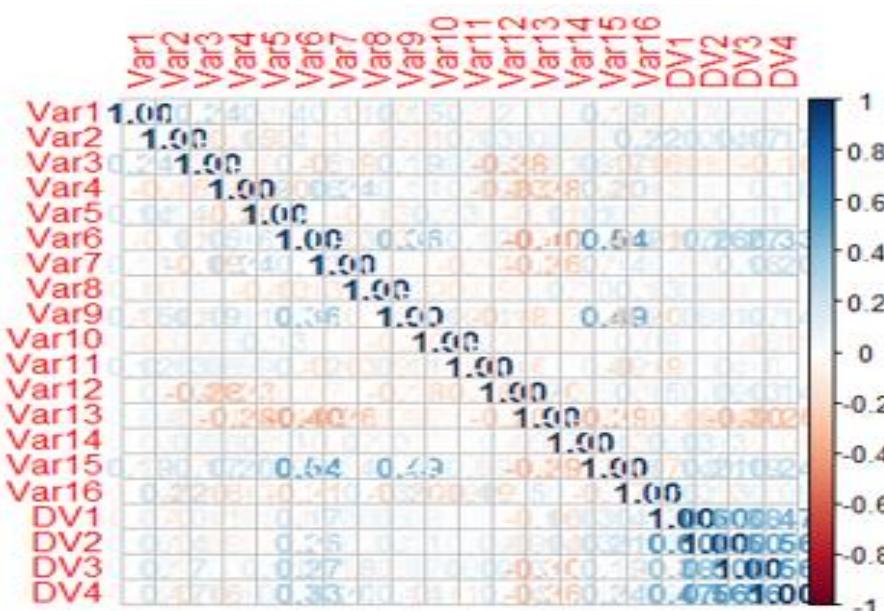
The dependent variable is *project strategy* which is a combination of factors of project success, project goal, and project plan and project direction. Independent Variables are the 16 variables mentioned above in 6 human factor clusters. The structures were studied for validity using Cronbach Alpha. Prior studies indicate that Cronbach Alpha ( $\alpha=0.70$ ) is adequate to test the construct. To do this we first check the validity of the constructs using factor analysis with principal component analysis with promax rotation. The principal component analysis helps in reduction in number of variables to be studied. R programming is used to conduct the analysis. Based on the factors identified we formulate the hypothesis.

The questionnaire (Appendix) has 30 questions for the dependent and independent variables. The data is cleaned and normalized to scale of 0-1 for all variables. For the ranked questions, weightage is given for highest 5 and least 1 and converted to the 0-1 scale.

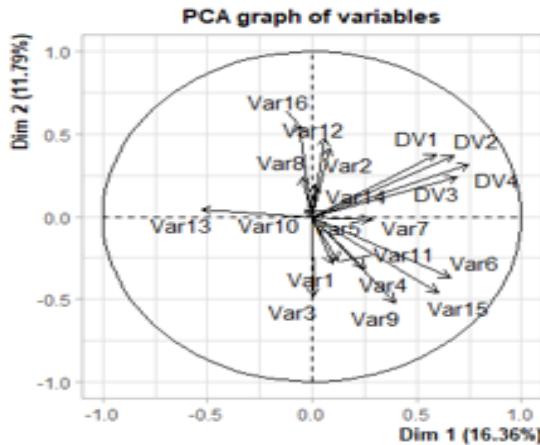
## **Data Analysis**

Data is tested for correlation using corrplot in R. Eigen values of the covariance matrix is calculated. The Kaiser-Meyer-Olkin (KMO) test is conducted to check sample adequacy. After the KMO Bartlett test is conducted to check the level of significance. After the test, a Scree plot is executed to see the number of factors. After this the factor analysis is done and finally a regression model to test the hypothesis.

After the correlation plot on 16 IV and 4 DV, we get low correlation in data.



**Figure 2: Correlation Plot**



**Figure 3: Principal Component Analysis**

A PCA analysis yields without the dependent variables. We thus see that 42% of the variation is only explained by the PC1 & PC2. If we go upto PC3, 52% and till PC7 80% of the variation is explained. In the figure we see, Var 15, Var 6, Var 4, Var 7 , Var 9, Var 11, Var 13, Var 3 and Var 16 as prominent.

From the KMO test we find that

Kaiser-Meyer-Olkin factor adequacy														
Call: KMO(r = cor(X1))														
Overall MSA = 0.49														
MSA for each item =														
Var1	Var2	Var3	Var4	Var5	Var6	Var7	Var8	Var9	Var10	Var11	Var12	Var13		
0.41	0.49	0.36	0.45	0.26	0.67	0.45	0.39	0.75	0.46	0.47	0.32	0.41		
					Var14	Var15	Var16							
					0.42	0.67	0.63							

We find that only Var 6 & Var 15 - Charisma of Project Manager & Reputation of Project Manager is near 0.7 i.e 0.67 ( Average) Var 9- Trust between client and contractor is above 0.7 i.e 0.75 (Average) and Var 16 – Risk Personality is 0.63 i.e Mediocre.

Var 2, Var 4, Var 10 and Var 11 are just below acceptable & need further data for sufficiency. Others are below 0.5 and hence unacceptable. We therefore select these 4 variables belonging to cluster 2 and cluster 6 (refer fig on conceptual model). The results indicate that further data needs to be collected for structural equation modeling. The PCA shows that 7-11 variables impact the results.

Bartletts test for these 4 show the following:

\$chisq [1] 42.27841 \$p.value [1] 1.620087e-07 \$df [1] 6

Indicating significance as acceptable

## Hypothesis

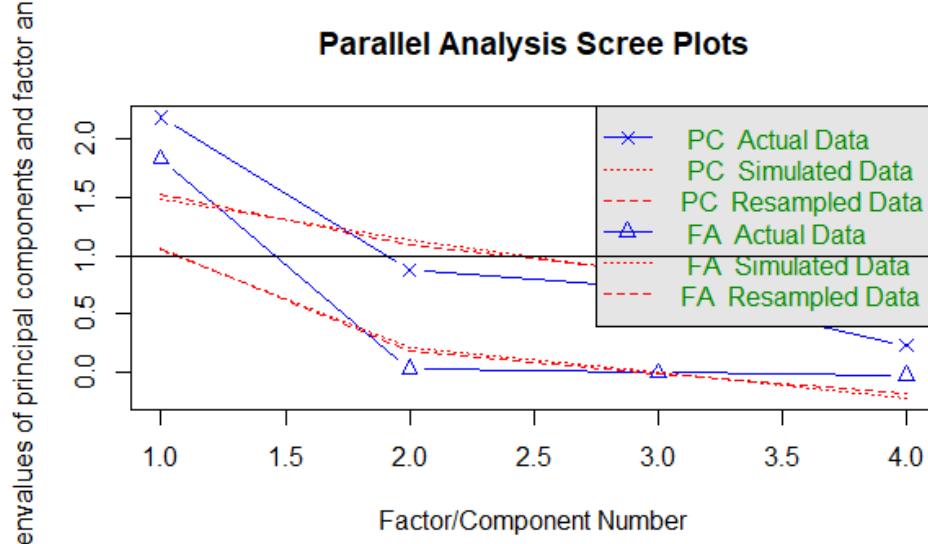
**H1:** Charisma of Project Manager has no influence on project strategy

**H2:** Reputation of Project Manager has no influence on project strategy

**H3:** Trust between client and contractor has no influence on project strategy

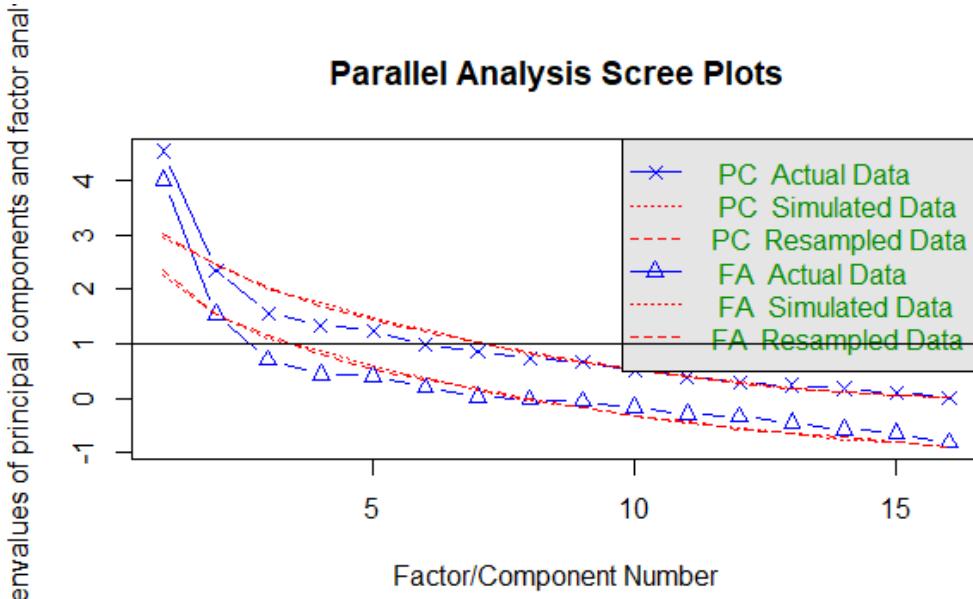
## Results

A Scree plot shows the following, number of factors as 1.



**Figure 4:** Scree plot

The number for factors for unreduced matrix shows 3 factors.



**Figure 5:** Scree Plot for unreduced matrix

With the reduced matrix from PCA we conduct factor analysis:

Call:

factanal(x = X, factors = Nfacs, rotation = "promax")

Uniquenesses:

Var6 Var9 Var15 Var16

0.26 0.37 0.07 0.70

Loadings:

[1] 0.86 0.80 0.97 -0.55

Factor1

SS loadings 2.60

Proportion Var 0.65

Test of the hypothesis that 1 factor is sufficient.

The chi square statistic is 1.57 on 2 degrees of freedom.

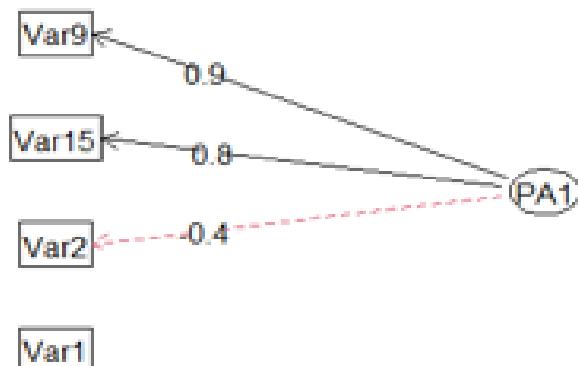
The p-value is 0.456

We get the factor loadings as:

Var1 Var2 Var9 Var15

0.3 -0.4 0.9 0.8

## Factor Analysis



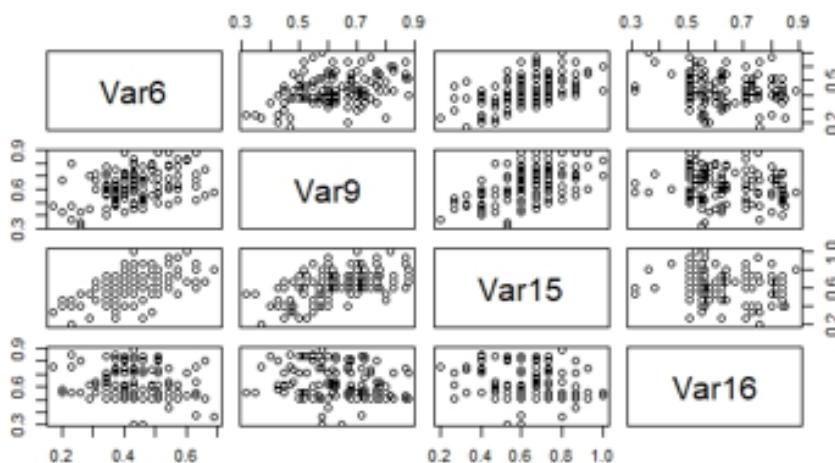
We check the Cronbach Alpha for the factor and find:

raw\_alpha

0.8756496

This confirms reliability > 0.7.

We now use the pairs function to get a visualization as follows. We see there is a moderate correlation between (Var15) reputation of project manager and (Var6) charisma of project manager. (Var 9)- Trust between client and contractor also has a moderate correlation.



**Figure 6: Pair Plot**

We now conduct a multivariate regression with these 4 variables and the 4 DV:  
Results for multiple regression

**Table 3: Multiple Multivariate Regression results**

Response Variable	Level of Significance	Coefficients			
		Estimate	Std. Error	t value	Pr(> t )
DV1- Goal	p-value: < 2.2e-16	(Intercept)	-1.892e-15	1.997e-16	9.473e+00 2.71e-16 ***
		pcdata\$DV1	1.000e+00	2.330e-16	4.292e+15 < 2e-16 ***
DV2- Ploy	p-value: < 2.2e-16	pcdata\$DV2	-3.673e-16	2.635e-16	-1.394e+00 0.166
		pcdata\$DV3	2.725e-16	2.110e-16	1.291e+00 0.199
		pcdata\$DV4	-2.478e-16	2.397e-16	-1.034e+00 0.303
		(Intercept)	-4.135e-16	6.602e-17	-6.264e+00 5.86e-09 ***
		pcdata\$DV1	-6.144e-16	7.705e-17	-7.975e+00 9.31e-13 ***
		pcdata\$DV2	1.000e+00	8.715e-17	1.148e+16 < 2e-16 ***
		pcdata\$DV3	-6.978e-17	6.977e-17	-1.000e+00 0.319
		pcdata\$DV4	9.563e-17	7.925e-17	1.207e+00 0.230
		(Intercept)	4.256e-16	8.605e-17	4.947e+00 2.44e-06 ***
		pcdata\$DV1	1.561e-16	1.004e-16	1.555e+00 0.122551
DV3- Plan	p-value: < 2.2e-16	pcdata\$DV2	4.396e-16	1.136e-16	3.870e+00 0.000176 ***
		pcdata\$DV3	1.000e+00	9.093e-17	1.100e+16 < 2e-16 ***
		pcdata\$DV4	-6.524e-17	1.033e-16	-6.320e-01 0.528756
		(Intercept)	1.612e-16	5.792e-17	2.783e+00 0.006244 **
		pcdata\$DV1	1.602e-16	6.759e-17	2.370e+00 0.019361 *
		pcdata\$DV2	1.579e-16	7.645e-17	2.065e+00 0.041034 *
		pcdata\$DV3	2.197e-16	6.121e-17	3.589e+00 0.000479 ***
DV4- Direction	p-value: < 2.2e-16	pcdata\$DV4	1.000e+00	6.952e-17	1.438e+16 < 2e-16 ***
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1					

Thus we find that the p-value is significant enough to reject the null hypothesis. Hence we can say that Charisma, Reputation of Project Manager and Trust between client and contractor have impact on project strategy.

### **Limitation of Research**

The KMO test showed lack of sample adequacy for many variables. Further the PCA indicated that around 7-11 variables may be critical to explain the impact on project strategy. Further data may be gathered to test the sample adequacy and conduct the research on the missed variables. Risk personality was seen as a significant variable from the PCA analysis, however, this was identified as a moderator variable and hence no hypothesis testing was done for this variable. The research deployed an exploratory data analysis and validity and reliability was checked but no confirmatory data analysis was conducted. The data collected did not categorize respondents and though the moderating variables were mentioned in the conceptual model, it was beyond the scope to elaborate on each of them and their impact. Factor analysis for the dependent variable project strategy for goal, plan, ploy and direction may be carried out and reliability and validity may be checked.

### **Future Research**

Further research may be done on the other variables and a structural equation modeling with confirmatory data analysis can be conducted. Based on degree of autonomy and risk personality category wise analysis may be done. This will illuminate on the project strategy definition given by Karlos Artto. This is part of a larger doctorate level research where the different human factor clusters will be studied with an analytical hierarchical process model for the impact of the factors on project strategy. The research also aims to develop a system dynamics model to test the behavior over time and impact of feedback on project strategy.

### **Conclusion**

The paper presents a perspective on usage of the word strategy and a comprehensive literature illustrates how the word has evolved from military origins to business and other domains like education etc. to encompass a larger meaning. Rumelt's definition of *kernel* of strategy is elaborated and how research has embraced it and extended to *project strategy*. The article thereafter presents a literature review on human factors which play a crucial role in project strategy. By a survey in energy related project sector, subsequently model testing and data analysis we validate our research hypothesis. From the principal component analysis we identify 3 major factors influencing project strategy:

1. Project manager's Charisma
2. Project manager's Reputation
3. Trust between client and contractor

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## Appendix

### **Questionnaire**

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#### **1 How much impact does effective communication have on for project strategy?**

- 1a Strongly Disagree
- 1b Disagree
- 1c Neutral
- 1d Agree
- 1e Strongly Agree

2 You are a project manager and need to take a decision to pay a contractor 100% advance to start a job. The impact of everyday delay is 0.5% of contract value. Any higher approval will take 7 days. What will you do

- 2a a. Take Head Office Approval
  - 2b b. Pay part advance and ask the contractor to start, take head office approval in parallel
  - 2c c. Pay the contractor and get the job done
  - 2d d. Rush to head office personally to get the approval immediately
  - 2e e. Don't need any such approval, will pay
- 3 How would rank risks leading to project cost overrun ?
- 3a a. Errors due to human
  - 3b b. Inadequate systems and processes
  - 3c c. Inadequate insurance coverage in projects
  - 3d d. Inadequate scope clarity
  - 3e e. Weak Project Manager

4 Are you aware of blockchain technology based smart contracts and its use in project management

Yes

No

5 When the project has been partially done, the project manager asks his lead on the time the long lead items will take to be delivered at site. Does this estimate on time impact project strategy decisions of schedule crashing?

6 Rank the following as per importance for project success :

- 6 a. Engagement of Project Manager with client
- 6 b. Flexibility of project manager
- 6 c. Effective feedback in projects
- 6 d. Contract Management
- 6 e. Leadership of Project manager

7 Which one would you prefer as your project condition:

- 7 a. Trust between client and contractor
- 7 b. Organized Project Team
- 7 c. Contract adherence by parties
- 7 d. Charismatic Project Manager
- 7 e. Good return on investment

8 How will you rank the following for Customer Satisfaction in Projects?

- 8 a. Engagement of project manager with client
- 8 b. Organized Project Team
- 8 c. Timely updates to client





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- 24                    a.     With extended trade credit terms  
24                    b.     Late payments  
24                    c.     Trust the project manager to get his payment done  
24                    d.     With extra risks in the contract  
24                    e.     Will not work.  
25a                  What will be your choice if the project manager is of high reputation?  
24                    a.     With extended trade credit terms  
24                    b.     Late payments  
24                    c.     Trust the project manager to get his payment done  
24                    d.     With extra risks in the contract  
24                    e.     Will not work.  
25                    How do human factors impact they way be execute projects?  
26                    How do human factors impact project success?  
27                    How do human factors impact project plans?  
28                    How do human factors impact the identifying project priorities and direction of  
                      project movement?
-