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Required Project Designers' Attributes as Perceived by Male and Female Engineers

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ABSTRACT

Project designer (PD) personality defines the way PDs cooperate with the project team, make decisions, and influence the project performance. The current research focused on identifying attributes associated with successful PDs as considered by male and female project engineers. In this context, a five-year questionnaire survey collected 423 responses from Greek engineers. The survey recorded data regarding the respondents and the scores assigned to the required PDs attributes. The methodological approach included an SPSS database, followed by descriptive statistics analysis, independent sample t-test, and correlation analysis. It became obvious that gender influences the assessment and selection of desired PD personality characteristics. Female engineers tend to assign the highest Likert scale-based scores, whereas male respondents tend to assign lower scores. The most highly ranked abilities included "responsibility," "reliability," and "obedience to rules." The findings facilitate the implementation of multi-criteria decision-making tools for efficient project teams.

KEYWORDS

Attributes, Gender, Personality Characteristics, Project Designers, Technical Projects, Views

INTRODUCTION

Every technical project relies on a robust project design and on the efficient collaboration among the project designers themselves and among designers and constructors. On the one hand, design is widely considered to be the central or distinguishing activity of engineering (Dym et al., 2005). Bubshait (Bubshait et al., 1999) suggests that design organizations play a major role in the construction industry. Carr (Carr, 2000) emphasizes how critical to successful projects is the creation of high performing design teams. In addition, Cheung et al. (Cheung et al., 2001) point that the construction projects design is a collective effort, bringing together specialists from different organizations. It should be emphasized that construction planning is the process to make the design a physical reality; therefore, it is the implementation of a design envisioned by architects and engineers. In both design and construction, numerous operational tasks must be performed (Hendrickson, 1998). Most of the project implementation issues, problems and even conflicts arise between the design requirements and the construction process, as both project stakeholders plan and predict the project path but from their point of view. The link among project designers and project managers is also an essential connection affecting project success. Thus, it is very interesting to examine the personality characteristics and required skills of the project designers who organize the whole project before its initiation. Therefore,

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the focus of the current research is the identification of the most competent project designers' attributes with emphasis on the variations by male and female project engineers.

The current paper has a number of sections that include literature review and then follows the methodological approach. The main tool of the research is a structured questionnaire survey. Details are presented regarding the research survey and the consecutive analyses that took place. Then follows the research results and findings. Finally, conclusions and future research are presented.

LITERATURE REVIEW

Project Designers are preparing the projects' smooth implementation. International literature has made a considerable contribution towards project designers' tasks and skills. Guertin (Guertin, 1996) suggests that it is necessary to put emphasis on the anthropometric design parameter in the workplace, in order to present different approaches in job design analysis, to apply all these concepts into an existent project evaluation, and to meet the company needs.

Moreover, Lofthouse (Lofthouse, 2004) provides empirical evidence to support that there is a specific and valuable role for core industrial designers working at the operational end of ecodesign. Her study led to the conclusion that industrial designers have a very similar role to play in ecodesign as they do in regular design. This means that core industrial designers are concerned with generating ideas and developing design concepts. Furthermore, they add to the scope of projects, while at the same time developing concepts that are fit for purpose, pleasurable and easy to use. Finally, they design product concepts by using manufacturing and material knowledge.

Furthermore, Han et al. (Han et al., 2019), propose an effective, innovative partner selection method on the basis of collaboration network deconstruction optimization, using collaboration and knowledge networks. They have found that highly skilled employees are generally able to work effectively alone or collaborate with others.

Considering the relationship among designers and users Darses and Wollf (Darses & Wollf, 2006), propose that during a design process: i) the users' needs were inferred by the designers on the basis of their own mental representations of the new device use and ii) the future device users are mostly viewed by the designers as one of the subsystems of the global device. Accordingly, meeting types diversification should be promoted by the project leader, so that designers extend their points of view to the operators.

The design of the user experience is the subject of the following paper. Collmann et al. (Collmann et al., 2009), claim that user experience practitioners who have a good understanding of and experience with agile projects: i) they are better able to design the user experience in an agile context, ii) they are willing to be more flexible and change their work practices to fit with the agile approach, and iii) they have a positive attitude towards it.

Focusing on the design process Manavazhi (Manavazhi, 2004), noted that a key for success in the design projects management is the ability to predict the extent to which a particular design project is likely to be afflicted by rework. This goal can be achieved through the dichotomous characterization of designer effort expended in design projects and the development of mathematical theory based on the application of the binomial distribution.

The relationship and communication among design and client is the focus of the research conducted by Weedman (Weedman, 2008). It was found that there were fewer problems caused by differences in disciplinary cultures than by the difference between design worlds and client worlds. One main difficulty lies within the meanings in the original official project description, the need to use tools before they were finished, the role of failure in design, and the learning curve for technologies that were not only new to the scientists but often incomplete and therefore lacking documentation. The single biggest problem was a lack of full understanding on both sides of the consequences for clients of collaboration on a design science research project.

The design process in engineering and industrial sector and their uniqueness is emphasized by Oakes et al. (Oakes et al., 2006). They claimed that there is no single integrated model of a design process, which is applicable to both engineering and industrial design disciplines. Through their study they proposed a model addressing this shortcoming. A number of benefits obtained from using a new process design model include the equal use by both engineering and industrial designers, enhanced integration of design and manufacturing, better-designed product, more efficient design process.

Howard and Melles (Howard & Melles, 2011), recognized the theme of design, culture and interaction through its focus on the designer role within a complex design project. This expanding role of the designer takes into consideration creating meaningful interactions between participants in order to design an outcome appropriate to the culture and context of the environment. Through the preliminary findings presented in their paper from one case study of an organization they demonstrate the changing role of the designer. A designer can have more than one roles, this of design leader teacher, facilitator and director and the roles should be interrelated and interdependent in leading a complex design project to a successful outcome. This fundamentally changes the demands on a designer and the skills required to navigate successfully through a co-design process.

City planning and designers' communication is the research topic by Saad-Sulonen and Cabrera (Saad-Sulonen & Cabrera, 2008) that presented a software tool for sharing, obtaining and gathering location-based information. This is a good example of collaboration between a design team and city planners involved in public participation.

In addition, Minder and Heidemann-Lassen (Minder & Heidemann Lassen, 2018), tried to answer how and why does facilitation through the designer influences innovation project. They explore the contribution that designers bring into multidisciplinary settings.

Sariola and Martinsuo (Sariola & Martinsuo, 2016), have focused on the designers' perspective to designer-supplier relationships in project networks. The findings have revealed: i) the designer's experience of the supplier's activeness, ii) the supplier's technical capability, and iii) the designer-supplier cooperation beyond projects' boundaries, have a positive link in strengthening the relationship between the supplier and designer. Nevertheless, the supplier's technical capability is the main factor. The above factors explained more of trust than commitment, which indicates that there are other practices and mechanisms driving the commitment between designers and suppliers. Limitations of the current research included the limited questionnaire survey (group of 89 respondents).

Vezzoli (Vezzoli, 2002), discussed the role of design research to the production of new educational forms, methods and tools. There exists a need to redefine the design activity itself, to produce new educational forms, methods and tools in order to create a new generation of professionals who will facilitate the transition towards a sustainable society. The need for a general redefinition of education has resulted from new technological opportunities and changed social, economic and cultural conditions.

Kärnä and Junnonen (Kärnä & Junnonen, 2017), examined the designers' performance as evaluated by the main participants: the client, the project consultant/manager and the main contractor, and identified the main success factors of designer performance. The data (892 evaluations) consists of surveys on the project level, based on a multi-dimensional standard evaluation and analyzed by ANOVA, making assessments based upon the different economic sizes of the projects. The assessment of the success rate of a project was party-specific, clearly affected by the size of the project. Contractors were satisfied with the designers' performance in small projects, whereas the client and the project consultant/manager rated the designers' performance most successful in large projects. The main problems in the designers' performance were related to the design content: flawlessness, comprehensiveness, compatibility and consistency of designs. Improvement could be found in internal communication and collaboration within the design teams. There is a need to develop project-specific practices in managing multidisciplinary design teams. In large projects, designers should focus more on solving problems and design requirements occurring at the construction site. In small projects, designers should focus more on customer-oriented methods to serve client needs better. This study

provides a holistic approach of the designers' performance. A more project-specific approach is suggested to identify the main parameters for measuring project success. The final measure for the success of the project and the central indicator of quality is the satisfaction of the client, but also the satisfaction of key project participants indicates a successful project.

Bremdala et al. (Bremdal & Haddadi, 2017), addressed how designers contribute to value creation in design-build (DB) projects. It sets out to answer the following research questions: How do designers contribute to value creation in design-build projects? What contextual constraints in design-build projects prevent designers in maximizing their value creation? How could designers maximize their value creation in design build projects? Findings come from three separate case studies of Norwegian DB projects and conclude into two main aspects: i) architects contribute to value creation by conceptualizing the building's level of esthetics, functionality and adaptability, ii) main contractors may restrain the communication between clients and the designers, while pursuing profit. To prevent such constraints after the DB-contract is signed, forwarding of designers in addition to co-localization, where the client also is present, is suggested. Implementing attributes as a design manager and BIM in DB projects, are also suggested to curtail the addressed constraints.

The following paper (Hong & Choi, 2019), focused on reflective thinking. The latter is considered as a critical element in the process of solving ill-defined design problems. The purpose of this study is to investigate the relationship between students' patterns of reflective thinking and their performance in solving design problems. Through a self-assessed questionnaire, 44 students' reflection patterns were collected in three areas: timing of reflection, objects of reflection, and levels of reflection. The results revealed a general pattern of student designers' reflection behaviors. Certain patterns of student designers' reflection are found to be more instrumental in creating successful design. Most student designers exercise their reflection toward the end of the design process, when it may be too late to make any positive impact. It is suggested starting to reflect at the early stage. Developing students' cognitive abilities for solving a design problem is essential. There is no significant difference in terms of the depth of reflection between the high- and low-performing participants.

Minder and Heidemann - Lassen (Minder & Heidemann Lassen, 2018), proposed that designers increasingly facilitate multidisciplinary innovation projects, but there exist little knowledge about how they do it. This paper explores the contribution of designers that bring into multidisciplinary settings. It aims at answering the research question of 'how and why does facilitation through the designer influences innovation projects?' It is based on empirical data from three case studies. A key element is that facilitating through designers involves input on the process level and on creative input level.

Tools facilitating the tasks of PDs are being developed. In this context, Lazic (Lazić, 2010) proposed a simulated defect removal cost savings model. The research enabled software designers to achieve a higher quality for their design and a better insight into quality predictions for their design choices.

One other aspect of research interest is the way designers make their choices. Zannier et al. (Zannier et al., 2007) through a qualitative multi-case study produced a model of design decision making. The research goal was to identify how software designers make design decisions. The study concludes that the structure of the design problem determines the aspects of rational and naturalistic decision making used. Consequently, the more structured the design decision, the less a designer considers options. Huff and Cooper (Huff & Cooper, 1987) focused on potential sex bias associated with educational software. The methodological approach involved 43 educators with programming experience in the design of software for either boys, girls, or students. The study found variations in the program classification. More specifically, programs for girls were categorized as "learning tools," whereas programs for both boys and students were most like "games." The research concluded that it was not the computer, or the software itself that produces the gender bias in software, but "the expectations and stereotypes of the designers of the software".

Finally, Hope and Amdahl (Hope & Amdahl, 2019), examined the possibilities and limits of involving end-users in applied knowledge-producing settings. The main question addressed in this

paper include: "could a design method provide a setting that actually facilitates communication between user representatives and the software engineers designing the system?" The agile method 'The Dynamic Systems Development Method' (DSDM) is supposed to enhance user participation, improve the collaboration between software designers and users and develop other aspects of computer system design projects management. DSDM does, in principle, offer user representatives new tools to influence design. In the following section the methodology applied in the current study will be presented and analyzed in detail.

METHODOLOGICAL APPROACH

The research methodology has in its core a structured questionnaire survey. The latter assessed the Greek PDs' attributes and identified the relative importance of the various abilities and personality characteristics. The survey lasted for five years and was addressed to engineers from Greece (Aretoulis, 2018), (Aretoulis et al., 2014), (Aretoulis et al., 2015). The current research was simultaneously ran with a corresponding one concerning project managers. One of the last samples of questionnaires was collected and added in the last quarter of 2017. The pool of respondents is quite broad. It includes engineers from selected significant technical enterprises throughout Greece and Public Authorities. The questionnaires were completed through interviews, emails and google forms.

The survey's participants, provided scores for the PDs' attributes and characteristics. The number of engineers that participated are equal to 423. The attributes presented in the research survey were all positive in nature. Research used Correlation Analysis and Independent Sample T Test to identify and highlight the way gender influences the perception of the desired attributes of a PD. The methodology is briefly outlined below:

- Creation of structured questionnaire (considering international literature and interviews)
- Initial pilot survey
- Main questionnaire survey
- Questionnaire dissemination through email, interviews and google forms (Final sample consisted of 423 participants)
- Responses' processing
- Proper codification of data
- Design and creation of an SPSS database
- Descriptive statistics of survey participants' profile
- Descriptive statistics of Project Designers' attributes
- Ranking of PD's attributes
- Correlation analysis among gender and PDs' attributes
- Independent Sample T- test analysis based on the gender of participants
- Discussion of results
- Conclusions and Further Research

Questionnaire Structure and Survey Participants' Profiles

The questionnaire has been used in its current form for relevant research in the past (Aretoulis, 2018), (Aretoulis et al., 2014), (Aretoulis et al., 2015). The questionnaire consisted of two main parts, which included:

- Profile of the survey's participants
- Required attributes (personality characteristics and abilities) of PDs

More specifically, the first part of the questionnaire is devoted to the participants, which have to respond to 13 personal questions, ranging from age to academic and professional background, namely, (Aretoulis, 2018), (Aretoulis et al., 2014), (Aretoulis et al., 2015):

- Main experience
- Discipline
- Age
- Gender
- Years of experience in projects
- Year of license award
- Academic Degrees
- Institution of bachelor degree award
- Most years of experience in certain project types

The second part focuses on PD's attributes. Characteristics regarding abilities and personality traits and facets sum up to 40 elements. Survey participants were asked to assign scores to each PDs' characteristic. This attribute assessment was based on the perceived degree of correlation among attributes and project success, with emphasis on team performance. The majority of the answers are collected through check boxes and use of a Likert scale, ranging from 1 to 5. One point represents the lowest value and five points represent the highest value, meaning the most desirable attribute for optimum team collaboration and maximum team performance.

The results of the research (valid percent) are based on a sample of 423 Greek Project Engineers. Respondents identify their roles as (valid percentages): "Designer Engineers" 59.6%, "Construction Engineers" 13.3%, "Project Managers" 20.9% and finally "Contractors" 5.1%.

Regarding their discipline the 69% are Civil Engineers and another 7.4% Land Surveyors, 5.7% Architects, 4.8% Mechanical Engineers, 3.1% Electrical Engineers, 2,4% Chemical Engineers and 7.6% Other Engineers. The survey participants are 57% males, whereas 43% are females. Their ages vary from 24 to 61, with the 43.4% being among the ages of 27 and 38.

Descriptive Statistics of The PDs' Attributes

Descriptive statistics are calculated with the application of IBM SPSS v.25. The recorded responses concerning the questionnaire survey participants' profile were properly processed and parameterized into categorical data. Then, an SPSS database was constructed. The scores per each attribute, trait, skill and ability were included in the database. These were recorded in their original format, as the Likert scale, and is regarded as categorical data.

The produced SPSS database consists of 423 cases (participants) and 60 variables in total. The incorporated variables represent the participants' profile (13 variables) and at the same time the attributes of the PD (40 variables). The descriptive statistics analysis' results concerning the cognitive abilities and personality characteristics of PDs are depicted in descending order in the following Table 1:

The most important attribute identified is "Responsibility". This is anticipated as the professional environment is quite volatile. It is important to deliver on time and reliable designs. The amount of available jobs is limited, both for public and private projects, the discounts provided for public projects on behalf of designers are extremely extensive, the profit margin is limited.

The next attribute is "Reliability". This is also logical as the antagonistic business environment, accompanied by continuous changes require reliable engineers. This attribute is similar to the previous one, and emphasizes the amount of significance assigned to such skills by engineers.

It is emphasized that reliability and responsibility are also connected to following the rules and legislations. Therefore, the third and fourth most important factors include correspondingly "Obedience to Rules" and "Diligent". PD is also expected to be a team player especially in large projects. Thus, it

Table 1. Descriptive statistics analysis' results concerning the cognitive abilities and personality characteristics of PDs

Attribute	Minimum	Maximum	Mean
Responsibility	2,00	5,00	4,5526
Reliability	1,00	5,00	4,4892
Obedience to Rules	1,00	5,00	4,4139
Diligent	1,00	5,00	4,3876
Collaborative / Team Spirit	1,00	5,00	4,3643
Combinatorial Thinking	2,00	5,00	4,3556
Justified Opinion	1,00	5,00	4,3469
Capability of Identifying Critical Project Activities	1,00	5,00	4,3310
Hardworking	1,00	5,00	4,3165
Accuracy	2,00	5,00	4,3126
Promptness on Solution Provision	1,00	5,00	4,2297
Integration of Projects Physical Development Schedule	1,00	5,00	4,1575
Capability of Predicting	2,00	5,00	4,1487
Methodicalness	2,00	5,00	4,0262
Clarity of Design Solutions	1,00	5,00	3,9713
Creativity	1,00	5,00	3,9667
Perception of the Projects Social Consequences	1,00	5,00	3,9593
Analytical Thinking	1,00	5,00	3,9262
Scheduling Capability	1,00	5,00	3,9212
Cleverness	1,00	5,00	3,9141
Decisiveness	1,00	5,00	3,7201
Patience	1,00	5,00	3,7057
Communication Skills	1,00	5,00	3,6962
Typicality	1,00	5,00	3,6452
Imagination	1,00	5,00	3,5274
Originality	1,00	5,00	3,4571
Understanding	1,00	5,00	3,4255
Conflict Management	1,00	5,00	3,3914
Politeness	1,00	5,00	3,3565
Instructiveness	1,00	5,00	3,3524
Increased Esthetic	1,00	5,00	3,3222
Public Relations	1,00	5,00	3,1077
Proper Acquaintances	1,00	5,00	2,9881
Capability of Dominating	1,00	5,00	2,9257

is important to be able to provide a context for smooth collaboration and high performance. That is the reason why the attribute "Collaborative / Team Spirit" occupies the fifth place of the most significant

characteristics. In general, due to the conditions of the economy the margin for errors is essentially nonexistent. This is the reason why the above attributes were identified as the most significant.

On the other hand, "Public Relations", "Proper Acquaintances" and "Capability of Dominating" are at the bottom of the list regarding their significance for the project designer, according to the survey participants. Engineers consider them as professionals, being able to provide useful plans and calculations to be used, by the project team, in an effort to implement the project.

"Public Acquaintances" are not considered essential for technical projects and therefore, this attribute is assigned very low scores regarding the required characteristics of the project designers. The latter is not necessarily needed for a technical project. It should be noted that the conceptual content, or meaning of each term, is different in each language.

Independent Sample T-Test Among Gender and Project Designers Attributes

An independent-samples t-test was conducted to compare required personality characteristics' scores for project designers assigned by female and male survey-participating engineers. The results are presented in detail in the following section. Firstly, mean and standard deviation among male and female participants per Project Designers' attributes are presented in the following Table 2. Then follows, Table 3 that includes data relevant to: "Attribute", "t value", "Degrees of Freedom", and the value of "p" (2-tailed significance). Levene's test for equality of variances has taken place, in order to choose the appropriate data to interpet, based on the validity of the assumption of equal variances (Table 3). The data reveals that there was a statistically significant difference in the scores among male and female engineers:

There existed PDs' attributes where the independent sample t-test did not identify statistically significant differences. The reason may rely on the fact that survey participants tend to agree on the significance or lack of it regarding these specific attributes. It is very interesting to mention that female engineers assigned greater scores to all considered attributes. It could be mentioned that female engineers are more demanding regarding the professional and personality profile of designers.

It is also worth mentioning that among the attributes identified in the independent sample t-test, the least mean score differences were associated with: Originality, Imagination, Proper Acquaintances, Capability of Predicting, Accuracy, Capability of Identifying Critical Project Activities, Analytical Thinking, Cleverness. The greatest differences among the mean scores include: Understanding, Conflict Management, and Hardworking.

Correlation Analysis Among Gender and PDs Attributes

IBM SPSS 25 software was employed for the statistical analysis. Chi–square test was used to examine the association of participants' profile and their assessment of skills, personal characteristics and knowledge for the PDs. The analysis revealed a number of interesting correlations. The findings will be presented in the following Table 4. The first column presents the attributes and the next columns highlight the 2-tailed asympotic significance, adjusted residual and the Likert - score that each group tends to assign to each attribute. They all rate what attributes they consider essential for a competent PD.

5. CONCLUSION AND FURTHER RESEARCH

Project Designers' attributes indeed influence the project team performance and as a consequence the project performance. Therefore, a project designer is a significant stakeholder in any project implementation. The decisions a PD is making during project planning are great in number and broad in scope regarding the construction worksite activities. These decisions critically influence the construction performance of the project.

The current paper initially identified through international literature designers' activities, roles, duties, skills and attributes. A comparison with the general findings as highlighted through international literature reveals that there is general direct or indirect agreement in the required

Table 2. Mean and SD among Male and Female Participants per PDs' Attributes

Attribute	Gender	Mean	Std. Deviation
Capability of Predicting	Male	4,1308	0,85108
	Female	4,1742	0,87528
Imagination	Male	3,5105	1,04866
	Female	3,5449	1,04189
Creativity	Male	3,8661	0,98244
	Female	4,1006	0,86826
Communication Skills	Male	3,6245	1,07668
	Female	3,7989	0,95623
Conflict Management	Male	3,2510	1,09417
	Female	3,5843	1,05025
Collaborative Team Spirit	Male	4,3013	2,77769
	Female	4,4581	0,71279
Combinatorial Thinking	Male	4,2469	0,76267
	Female	4,5056	0,69092
Promptness on Solution Provision	Male	4,1429	0,94387
	Female	4,3652	0,85458
Clarity of Design Solutions	Male	3,8992	0,90377
	Female	4,0787	0,84003
Increased Esthetic	Male	3,2469	1,02988
	Female	3,4438	1,00265
Instructiveness	Male	3,3013	1,03775
	Female	3,4302	0,92977
Analytical Thinking	Male	3,8912	0,87728
	Female	3,9721	0,92061
Scheduling Capability	Male	3,8201	1,01100
	Female	4,0618	0,94576
Capability of Identifying Critical Project Activities	Male	4,3054	0,89982
	Female	4,3799	0,84855
Diligent	Male	4,3235	0,77429
	Female	4,4775	0,68234
Responsibility	Male	4,5000	0,64794
	Female	4,6236	0,57135
Obedience to Rules	Male	4,2941	0,89398
	Female	4,5787	0,69461
Accuracy	Male	4,2941	0,76696
	Female	4,3520	0,70642
Cleverness	Male	3,8782	0,87020
	Female	3,9721	0,78918
Typicality	Male	3,5607	0,90021
	Female	3,7654	0,86162
Methodicalness	Male	3,9289	0,85453
	Female	4,1620	0,72010
Originality	Male	3,4477	0,96818
	Female	3,4749	0,99051
Proper Acquaintances	Male	2,9707	1,23465
	Female	3,0112	1,08398
Public Relations	Male	3,0630	1,25965
	Female	3,1685	1,02771
Perception of The Projects Social Consequences	Male	3,8319	0,91236
	Female	4,1292	0,78124

continued on following page

Table 2.. Continued

Attribute	Gender	Mean	Std. Deviation
Decisiveness	Male	3,5983	0,93359
	Female	3,8870	0,93462
Patience	Male	3,6134	1,09166
	Female	3,8315	0,99417
Politeness	Male	3,2385	1,07962
	Female	3,5311	1,00589
Understanding	Male	3,3008	0,99710
	Female	3,6011	0,90410
Capability of Dominating	Male	2,8655	1,11321
	Female	3,0169	1,07911
Integration 0f Projects Physical Development Schedule	Male	4,0377	0,90438
	Female	4,3202	0,80516
Justified Opinion	Male	4,2731	0,80412
	Female	4,4494	0,78849
Reliability	Male	4,3933	0,76430
	Female	4,6250	0,60119
Hardworking	Male	4,1597	0,87133
	Female	4,5198	0,62241

attributes. The research agendas regarding the PDs include but are not limited to: characteristics, skills, personality traits, performance, success factors, assignment of the right PD to the right 'job', are only a few of the research agendas focusing on PDs.

This study examined the view of the PD attributes based on the gender of the survey participant. The main findings identified statistically significant differences among male and female engineers regarding the required characteristics. In order for the research to be realized a questionnaire was used. This structured questionnaire survey succeeded in collecting 423 responses from engineers working in Greece. The analysis revealed that female engineers provided in general greater scores than male engineers. This could indicate increased and more demanding expectations considering the required attributes. Correspondingly, male engineers provided lower scores. It could be mentioned that they are more conservative selecting attributes and assessing them. This finding could not be attributed to a specific parameter or event. An effort to justify or explain their different attitude could rely on the attitude toward the external business environment, or the assessment of the professional environment.

It is also worth mentioning that there was a significant amount of correlations that appeared in the sample, a lot greater than the previous research initiatives. As the sample size increases so does the number of observed correlations. Summarizing the descriptive statistics findings it could be concluded that the most significant abilities include:

- Responsibility
- Reliability
- Obedience to Rules
- Diligent
- Collaborative / Team Spirit
- Combinatorial Thinking
- Justified Opinion
- Capability of Identifying Critical Project Activities
- Hardworking
- Accuracy

Table 3. Independent Sample t-test results among Male and Female Participants per PDs' Attributes

ATTRIBUTE	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Creativity	2,595	0,108	-2,536	416	0,012
Conflict Management	0,238	0,626	-3,129	415	0,002
Combinatorial Thinking	1,004	0,317	-3,566	415	0,000
Promptness on Solution Provision	0,999	0,318	-2,474	414	0,014
Clarity of Design Solutions	3,181	0,075	-2,065	414	0,040
Increased Esthetic	0,015	0,903	-1,954	415	0,051
Scheduling Capability	1,135	0,287	-2,482	415	0,013
Diligent	2,845	0,092	-2,110	414	0,035
Responsibility	6,620	0,010	-2,024	414	0,044
Obedience to Rules	14,013	0,000	-3,653	413,383	0,000
Typicality	3,387	0,066	-2,343	416	0,020
Methodicalness	3,900	0,049	-3,022	410,204	0,003
Perception of The Projects Social Consequences	5,288	0,022	-3,572	406,432	0,000
Decisiveness	0,806	0,370	-3,117	414	0,002
Patience	3,951	0,048	-2,122	398,278	0,034
Politeness	0,150	0,699	-2,813	414	0,005
Understanding	2,055	0,152	-3,157	412	0,002
Integration of Projects Physical Development Schedule	0,004	0,950	-3,305	415	0,001
Justified Opinion	0,008	0,929	-2,231	414	0,026
Reliability	16,782	0,000	-3,455	411,183	0,001
Hardworking	8,211	0,004	-4,910	412,376	0,000

Regarding identified correlations, female participants assign 5 points to almost all the attributes. "Public Relations" and "Understanding" are the only attributes that received 3 and 4 points on behalf of the female participants. These two personality characteristics seem not to align with the strict professional profile of the PD and are not considered so essential for their efficiency, the professional activities, role or team performance.

Considering the identified correlations, and focusing on male participants this time, it is becoming apparent that they did not assign 5 points on the Likert scale, to neither of the considered attributes. In essence male engineers didn't assign 5 points to neither of the correlated attributes.

Their highest score is four, and this is assigned to only two attributes, namely: "Collaborative – Team Spirit" and "Combinatorial Thinking". These are all very practical and essential attributes, useful

Table 4. Asymptotic Significance (AS), Adjusted Residual (AR) and responses of identified correlations regarding "PDs Attributes"

ATTRIBUTE	MALE ENGINEERS			FEMALE ENGINEERS		
	Asymp. Sig. (2-sided)	Adjusted Residual	Likert Value Assigned	Asymp. Sig. (2-sided)	Adjusted Residual	Likert Value Assigned
Conflict Management	.032	-	-	.032	2.5	5
Collaborative – Team Spirit	.002	2.1	4	.041	4	5
Combinatorial Thinking	.002	2.6	4	.002	3.7	5
Obedience to Rules	.01	2.4	3	.01	3.2	5
Methodicalness	.007	2.8	3	.007	-	-
Public Relations	.002	2.4	1	.002	3.6	3
Perception of the Projects Social Consequences	.005	3.1	3	.005	2.1	5
Decisiveness	.013	2.2	3	.013	3.1	5
Understanding	.022	1.9	1	.022	2.4	4
Integration of Project's Physical Development and Schedule	.02	-	-	.02	3	5
Reliability	.009	3.1	3	.009	2.8	5
Hardworking	.0002	3.5	3	.0002	3.5	5

for the project design stage. Both attributes are ranked in the fifth and sixth place correspondingly. In general, male engineers seem to be less "demanding", regarding the assignment of scores, in comparison to female engineers.

In an effort to "translate" the research findings, it is considered important to mention that these results originate from engineers living and working in Greece. Furthermore, since these attributes may have slightly different meaning and semantic content, the specific location where the research is taking place is very important and influences the research results and findings. The meaning and understanding of each attribute may vary from place to place and among cultures. Even the significance and the ranking of each attribute may vary among different countries. Moreover, the special conditions of the study area should be taken into consideration. Therefore, an effort to explain or interpret the findings should also consider the conditions that Greek engineers face today within their professional activities and the surrounding economic and working environment. Most of the research has taken place during the financial crisis that occurred in Greece. Taking this under consideration in the process of discussing and interpreting the study results one should consider a number of parameters that influence the views of the survey participants. These parameters include the following:

- Limited job offer and opportunities
- Extremely antagonistic professional environment
- Margins for errors are almost non-existent
- Profit margins for enterprises are very limited
- Risks and unforeseen events are high
- Cash liquidity is limited
- Large enterprises are the main pillars left in the field of design
- Legislation concerning taxation and insurance policies
- Political environment and government policies

Each engineer relies on his experience and accumulated knowledge to make sure that he or she continues to have and maintain a professional competitive advantage, always comparing his / her knowledge and experience with other engineers. At the same time salaries are not adequate and do not correspond to the working hours. Furthermore, working days stretch beyond the typical schedule. Furthermore, there still exists insecurity regarding project designers' future professional activities and prospects.

All the above issues influence the engineers' personality and at the same time their professional attitude. This leads to developing specific viewpoints regarding the required PDs' abilities and personality. Therefore, in this demanding professional environment, there is a requirement for designers with specific characteristics and attributes that include but are not limited to the following: Responsibility, Reliability, Obedience to Rules, Diligent, Collaborative / Team Spirit.

At the same time it is critical to note that each country exhibits varying economic and political conditions. As a consequence, the understanding and assessment of the required attributes may change from country to country. One final thought that should be considered is the fact that survey participants may project their own personality when they assign scores to the PD. It is always possible that people assign scores to attributes, based on what they personally want and not based on the job's description requirements. In this case, there exist a matter of objectivity in the assessment, and potential assignment of scores to attributes.

Considering the contribution of the current research, it could be argued that it resides on five main areas:

- The identification and understanding of the preferences among different genders of engineers.
- Findings that facilitate decisions on the synthesis and management of the design project teams based on attributes' compatibility.
- Enhancement of cooperation and optimization of project team performance.
- Enhancement of cooperation and optimization among project designers and project stakeholders
- Findings that facilitate the organization of multi-criteria decision making tools for project team creation

In a future research it would be interesting to identify the required attributes of different stakeholders cooperating in the implementation of projects throughout the project lifecycle. Furthermore, the type of project and the special characteristics could be also considered when creating a project team for optimum performance. In addition, it is proposed that other characteristics should be considered that may influence the performance. These could include experience, age, professional and educational background, specific roles and professional positions undertaken by the survey participant. The current study could be repeated and record data during different periods of time, associated with different economical, legislative and political conditions. Finally, the use of psychometric tests in order to objectively assess the personality characteristics of the survey participants and correlate them with their scores would provide insightful findings.

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