Original Article

Personality Based Job Analysis of Air Traffic Controller

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Abstract

The selection procedure of air traffic controller is very critical because specific to this job, the consequences of human errors may be very devastating. The present study identifies the personal characteristics and work styles needed to execute successfully the air traffic controller job. Personality Based Job Analysis was conducted on eighty seven controllers (N = 87), consisting of Flight Lieutenants (23%), Squadron Leaders (42.5%) and Wing Commanders (34.5%) representing different seniority and ranks. The participants were interviewed and assessed on Performance Improvement Characteristics and Work Style Rating Scale. The results revealed high ratings for the personality characteristics like Adjustment, Prudence and Ambition. In Work Style Attributes Cooperation, Self-Control, Stress Tolerance, Adaptability, Dependability, Attention to Detail and Integrity were rated high. The results of the study also showed no significant effect of seniority on perception of personality and work style attributes rating. Understanding the personality characteristics and work attributes of workers in the organization have applications at selection as well in designing training of air traffic controllers.

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Introduction

With the changing pattern of time we are witnessing a paradigm shift at our workplaces. Today our workplaces have become turbulent and unpredictable. Increasing competition from competitors, new market arrivals, innovation and development in product services andtechnologies, the globalization and workforce diversities have imposed a challenge for the survival of organisations. With these new transformations organisations are now realizing the fact that the way to gain competitive advantage is through the nurturance and development of their human capital. The nature and characteristics of work have altered because of the radical changes at the organizational level. Paradoxically the nature of work has become more complex. Work is more challenging; besides mere knowledge, it requires higher and variety of skill. One important constrain which the organisations have been facing is to match the right person with the right kind of job. In order to maintain the person and job fit organisations are now making positive overtures for job analysis. Although comprehensive, this approach ignored the very significant personality characteristics. To curb this, a personality based job analysis came into existence which focused on personal attributes needed to perform the job successfully. It also identifieda particular job characteristic required for a particular job.

A job analysis is a systematic procedure for gathering, documenting, and analysing information about the content, context, and requirements of the job. It demonstrates that there is a clear relationship between the tasks performed on the job and the competencies/ Knowledge Skills and Other Attributes (KSA) required to perform the tasks. Decenzo and Robbins stated that "*Job analysis indicates what activities and accountabilities the job entails*" [1]. Job analysis is a pattern of tasks,

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duties and responsibilities that can be done by a person. To identify the best person for the job, one should fully understand the nature of the job. Job analysis provides a means of developing such an understanding.

Conventionally, there are two types of job analysis –job oriented analysis and person oriented analysis. In job oriented analysis, various tasks which makes a job are analysed which include a detailed description of both manual & mental activities, task & element durations, task frequency, task allocation, task complexity, environmental conditions, necessary clothing & equipment, and any other unique factor involved in or required for one or more people to perform a given task. Person oriented job analysis focuses on the knowledge, skills, abilities and other personal attributes needed to perform the job.

For organizational effectiveness, conducting a task analysis is not enough.A much more comprehensive approach is needed for "the person-job fit". As it has been said "One cannot hire a hand; its owner always comes with it" [2]. When an employee joins an Organisation he comes with values, attitudes, needs, expectations and personality dispositions. Personality based job analysis identifies which particular job characteristics are important for a particular job. However personality characteristics in general received much less attention.

Review of Literature

The earliest work done on this area was by using a Position Analysis Questionnaire [3], which analysed jobs in terms of human attributes, basic skills and abilities needed on the job. Another important form which was used as a measure for assessing Personality Based Job Analysis (PBJA) was developed by Raymark, Schmit and Guion [4].The Personality Based Position Requirement Form (PPRF) consisted of 112 items on 12 position requirements or sub-dimensions (e.g., general leadership, friendly disposition, general trustworthiness, emotional stability, and desire to generate ideas) framed by the Big-Five personality constructs. Arneson used a checklist known as Worker Characteristic Inventory (WCI) to identify personality characteristics used for performing a job. WCI identifies the personality scales with the highest criterion-related validity [5]. Another important method designed to evaluate personality-based job requirements was Performance Improvement Characteristics (PIC) [6]. PIC reflected the personality dimensions that were most important for job performance. The PIC consisted of 48 items that formed seven scales. These seven scales were adjustment, ambition, sociability, and interpersonal sensitivity, and prudence, inquisitive and learning approach. More recently Sumer &Demirutku used PBJA to identify personality traits required for Turkish armed forces officer job performance [7]. Finally, it resulted in five personality dimensions as being relevant for the job of an officer Conscientiousness/Self-Discipline, Military Factor, Self-Confidence, Agreeableness-Extraversion, and Leadership. In another study Cucina, Vasilopoulo, Sehgalhypothesised that personality-based job analysis (PBJA) ratings are correlated with subject matter expert (SME) personality scale scores (through a self-serving bias) [8].

Air Traffic Controllers -Since personality factors are important determinants of job performance, its role cannot be ignored in the field of aviation, specifically in air traffic control. Air traffic system being a technology dominated field. The psychological component of human element is unique and distinct from one another. Air traffic controllers are the professionals who ensure safety of flight. It is a vast network of people and equipment that ensures the safe operation of military,

commercial and private aircraft. ATC controllers coordinate the movement of air traffic, to make certain a safe separation of aircrafts.

ATC controller is entrusted with an enormous responsibilityasmostof their decisions made within fraction of seconds; affect the safety of pilots, crews, and passengers. It is a well-known fact that in carrying out the job of an ATC controller, an operator has to utilize some intricate cognitive skills. These cognitive skills are employed for completing tasks like situation monitoring, resolving aircraft conflicts, managing air traffic sequences, assessing weather impact, managing sector/position resources, separation, efficient air traffic flow, attention & situational awareness, communicating clearly, accurately, and concisely facilitating information flow, performing multiple tasks, and managing sector workload. Although it is lucidly evident that these tasks are cognitive in nature, they have to be coordinated and communicated within the team. Therefore, air traffic controller, have to be team oriented. This aspect is largely influenced by individual differences like attitudes, motives, values etc. Hence suggesting, that non-cognitive components are equally important for flight safety.

Previous researches in this area have shown the role of personality as an important determinant in the job performance of air traffic controllers. Using 16 Personality FactorInventory (16PF), efficient air traffic controllers were found to be low on anxiety, dominance and empathy [9]. Using the Five –Factor Personality Inventory it was found that air traffic controller trainees expressed more positive emotions and were more conscientious in their performance [10]. In another study, it was found that students who were higher on anxiety and anger scores were more likely to fail as air traffic controllers [11]. Air traffic controller students were found to be higher in extroversion, openness to experience and conscientiousness & low in neuroticism as compared to general population [10].

Relevance of the present study

As sited and discussed above it can be seen that the component of personality was ignored in traditional job analysis methods. Meta-analyses have shown that personality can predict job performance [12]. It is an inevitable fact that choosing a wrong person for a job can have apparently devastating consequences. In air traffic controllers the consequences of error may be instant and cataclysmic. The method by which an Organisation selects the operator for the complex air traffic controllers system is important [13]. Important considerations that must take into account for air traffic controller task are, the range of human abilities, skills and knowledge as well as the other important personal dispositions such as motivation, personality and contextual criterion such as enthusiastic persistence, volunteering for extra-role assignments, and helping others. For this, a comprehensive approach of Personality Based Job Analysis is needed.

In India, at the entry level of aviators in selection centers the candidates undergo many personality tests. The personality of the aviators is assessed at global level, focusing mainly on leadership skills and thereby ignoring job specific personality traits. Therefore, a need is felt to identify the personality characteristics and work style attributes needed to perform the air traffic controller job successfully.

Methodology

87 controllers from 6 different IAF stations voluntarily participated in this study .Out of these, 74 were from air traffic controller cadre and 13 were from fighter controller cadre. The controllers were from different level of hierarchy. Flight Lieutenants (23%) represented the junior level,

Squadron Leader (42.5%) represented the middle level and Wing Commander (34.5%) represented the senior level officer. Their mean age was 35.7 ± 6.1 years, and mean service was 11 years. The educational level of the controllers ranged from graduate (N= 36) to post graduate (N=51).

Job Analytic Interviews

To collect job analytic information, open ended questions were asked in the interview. The interview was conducted by the author along with one psychologist and senior air traffic controller. The interview questions focused on the routine and non routine responsibilities of the controllers; materials, tools, equipment, work aids used and also about people working in coordination. The major part of the interview included questions dealing with personality and work attributes needed to be successful on the air traffic controller job. The interview also focused on attributes that discriminated the successful from unsuccessful air traffic controller, profile of "ideal" air traffic controller, potential reasons for intentions to join and leave as air traffic controller. The interview with the instructors included additional questions concerning the criteria used in the assessment of training performance in the Air Force Academy.

Demographic Information Questionnaire

Demographic characteristics of the participants were assessed using an 11-item questionnaire. Information concerning name, gender, age, rank, tenure in the air force station, total service, educational level, unit, branch, kind of service entry and awards received were collected using this questionnaire.

Procedure

Job analytic interviews of the currently employed air traffic controllers were conducted individually in selected IAF stations. The interviewers asked the participants to fill out the job analytic survey questionnaire. Following the completion of questionnaire by the participants, interviews were conducted.Responses on the job analysis sheet were noted verbatim. Each interview lasted for 30 minutes.

Measures

The following measures were used: - Performance Improvement Characteristics [6] and Work Style Rating Scale of O*Net(US Department of Labor/Employment and Training Administration).

Performance Improvement Characteristics (P I C) [6] - The PIC is a 48 item scale, measures adjustment, ambition, sociability, interpersonal sensitivity, prudence, inquisitive and learning approach. The PIC identifies the personal characteristics needed for a job, and the degree to which performance on the job is enhanced by them [6]. Subject Matter Experts (SME) rate jobs on scales ranging from 0-3 (ie, Does Not -Substantially Improves Performance). Scale scores are then figured out by: (a) summing the item responses within each scale, (b) averaging the scores for each scale across raters (SMEs). The PIC has proven to be a reliable job analysis tool. Results reported in the manual [6] indicate that PIC scales' internal consistency reliability estimates range between 0.76 (Adjustment) and 0.87 (Interpersonal Sensitivity); average internal consistency is 0.83. The average test-retest reliability is 0.71.Previous research indicated that the PIC differentiated among jobs, and scores on PIC scales correlated with the HPI scales that predicted job performance [14]. The results of these studies support the validity of the PIC results for job analyses across different jobs and organisations [15].

Work Style Rating Scale- Work Style Rating Scale of Occupational Information Network (O*NET)[16] measures occupational requirements

Table 1: Mean, SD and Intercorelations of Personality Factors of Air traffic controllers

Variables	M	SD	1	2	3	4	5	6
Adjustment	18.14	3.93	1.00					
Ambition	14.48	2.76	0.13	1.00				
Sociability	7.88	5.38	0.16	0.53**	1.00			
Likeability	9.09	4.68	0.22*	0.46**	0.75**	1.00		
Prudence	18.54	4.06	0.36**	0.63**	0.51**	0.51**	1.00	
Intellectance	12.54	4.63	0.08	0.59**	0.69**	0.55**	0.56**	1.00
Success	12.51	2.34	-0.01	0.39**	0.33**	0.29**	0.50**	0.57**

**p <.01, *p<.05

& worker attributes. This scale of the O*Net, centers on personality requirements associated with jobs [17]. This scale measured constructs that wereneitherdirectly observable nor identifiable via 'strong inference' [3]. The Work Styles scale was designed to measure seven first-level constructs along with 17 second level constructs. First level constructs with corresponding second-level constructs were- (a) achievement orientation (achievement/effort, persistence, and initiative); (b) social influence (energy, leadership orientation); (c) interpersonal orientation (cooperation, concern for others, social orientation); (d) adjustment (self-control, stress tolerance, adaptability/flexibility); (e) conscientiousness (dependability, attention to detail, integrity); (f) independence (independence); and (g) practical intelligence (innovation, analytical thinking) [17]. Each of the preceding was rated on an absolute level scale, as well as a relative importance scale.Reliabilities for levelratings range from 0.16 to 0.84, with a median of 0.66. Reliabilities for importance ratings range from 0.26 to 0.84 with a median of 0.64.

Results

The survey data obtained on a sample of 87 controllers were analysed descriptively and data obtained on different ranks of officers were analysed using One Way Analysis of Variance (ANOVA).

Table-1 shows mean, SD and inter correlation of the personality variables such as adjustment, ambition, sociability, likeability, prudence, and intellectance and school success. Among the other variables adjustment (18.14 ± 3.9), prudence (18.54 ± 4.06), and ambition (14.48 ± 2.76) had higher mean values. It also shows the zero order correlation cases amongst personality variables like adjustment, ambition, sociability, likeability, prudence, and intellectance and school success. The table also shows the positive correlation among Ambition, Sociability, Likeability, Prudence, and Intellectance and School success.

Table-2 shows a one-way between subjects ANOVA among air traffic controller on personality variables. A one-way between subjects ANOVA was conducted to compare the effect of seniority on perception of personality variables like ambition, sociability, likeability, prudence, and intellectance and school success. The results revealed no significant effect of seniority on personality variables at the p<.05.

Table 2: ANOVA of Personality Variables among Different Level of Air traffic controllers

Variables	GROUPS	SS	df	MS	F	Sig.
Adjustment	Between Groups	1.130	2	0.56	0.036	0.96
	Within Groups	1331.92	84	15.85		
	Total	1333.05	86			
Ambition	Between Groups	30.101	2	15.05	2.014	0.14
	Within Groups	627.62	84	7.472		
	Total	657.72	86			
Sociability	Between Groups	3.416	2	1.70	0.058	0.94
	Within Groups	2493.43	84	29.68		
	Total	2496.85	86			
Likeability	Between Groups	2.311	2	1.15	0.05	0.95
	Within Groups	888.94	84	22.48		
	Total	1891.26	86			
Prudence	Between Groups	8.11	2	4.05	0.24	0.78
	Within Groups	1413.49	84	16.82		
	Total	1421.60	86			
Intellectance	Between Groups	3.06	2	1.53	0.07	0.93
	Within Groups	1844.54	84	21.95		
	Total	1847.60	86			
Success	Between Groups	1.55	2	0.77	0.13	0.87
	Within Groups	470.16	84	5.59		
	Total	471.72	86			

Table-3 shows mean and SD of Work Style Attributes. Among the other variables the controllers have rated high on cooperation (4.13 ± 0.76), self-control (4.3 ± 0.76), stress tolerance (4.58 ± 0.60), adaptability (4.14 ± 0.85), dependability (4.28 ± 0.77), attention to detail (4.25 ± 0.70), and integrity (4.32 ± 0.89).

Table-4 shows a one-way ANOVA among air traffic controller on Work Style Attributes. A one-way between subjects ANOVA was conducted to compare the effect of seniority on perception of work style attributes like cooperation, self-control, stress tolerance, adaptability/flexibility, dependability, attention to detail and integrity. The results revealed no significant effect of seniority on Work Style Attributes at the $p<.05$.

Table 3: Mean and SD of Work Style Attributes of Air traffic controllers (N = 87)

Variables	Mean	S D
Achievement	3.89	0.73
Persistence	3.83	0.84
Initiative	3.90	0.84
Leadership	3.88	0.89
Cooperation	4.13	0.76
Concern other	3.58	0.81
Social orientation	3.52	0.96
Self-control	4.36	0.76
stress tolerance	4.58	0.60
Adaptability	4.14	0.85
Dependability	4.28	0.77
Attention detail	4.25	0.70
Integrity	4.32	0.89
Independence	3.21	1.23
Innovation	3.13	1.02
Analytic thinking	3.93	0.78

Table 4: ANOVA of Work Style Attributes among Different Level of Air traffic controller

Variables	GROUPS	SS	df	MS	F	Sig.
Cooperation	Between Groups	.786	2	0.39	.66	.516
	Within Groups	49.55	84	0.59		
	Total	50.34	86			
Self-control	Between Groups	1.88	2	.941	1.63	0.20
	Within Groups	48.34	84	.576		
	Total	50.23	86			
Stress Tolerance	Between Groups	.084	2	.042	.11	0.89
	Within Groups	31.01	84	.369		
	Total	31.10	86			
Adaptability	Between Groups	.130	2	.065	.08	0.91
	Within Groups	62.92	84	.749		
	Total	63.05	86			
Dependability	Between Groups	3.29	2	1.646	2.84	0.06
	Within Groups	48.52	84	.578		
	Total	51.81	86			
Attention detail	Between Groups	.412	2	.206	.41	0.66
	Within Groups	42.02	84	.500		
	Total	42.43	86			
Integrity	Between Groups	.175	2	.087	.10	0.89
	Within Groups	68.81	84	.819		
	Total	68.98	86			

Discussion

The present study was conducted to identify the personality characteristics and work style attributes needed to perform the air traffic controller job successfully. The job analysis survey revealed highest mean score for three personality characteristics. The air traffic controllers perceived adjustment, prudence, and ambition as important personal attributes for successful job performance. Adjustment constitutes personal attributes such as resilient, upbeat, remaining calm under pressure. Luuk and Alujo reviewed the personality characteristics of air traffic controllers and concluded that air traffic controller appeared to be intelligent and emotionally stable [18]. Similarly Karson& O'Dell in their study on air traffic students reported that they showed less anxiety, higher self-discipline, and higher emotional stability and were more self-reliant and assertive than normative samples [9]. Castaneda, Campbell and Pulos concluded in their study that emotionally stable individuals were well suited to undertake the stressors of military aviation training [19]. Within the framework of air traffic controllers their work scenario was straining and stressful. It is required for the air traffic controller to be emotionally stable, optimistic, and well-adjusted with others in order to thrive well under stressful conditions.

Prudence comprises the personality attributes of being planned, controlled, paying attention to details etc. Air traffic controller trainees were found to be higher in extroversion and conscientiousness [10].One possible reason is nature of job. It is discussed that the air traffic controllers provide safe, orderly, and speedy flow of air traffic both in the air and on the ground and also coordinate the movement of air traffic to make certain that planes stay a safe distance apart. This work requires

careful planning, meticulously scanning each and every environmental details, paying attention to the smallest cues. It is because of these characteristics that the air traffic controllers are high on this factor.

Ambition (Surgency) consists of facets as being competitive, self-confident, taking initiative etc. Air traffic controllers perform an exigent job; the nature of their job requires quick and confident decisions as they are responsible for thousands of lives.

As concluded in researches that besides cognitive skills, job performance was also reliant on personality traits [18]. Literature review provides support for the fact that controller who is careful, specific, confident and emotionally stable, performed well [10].

The effect of seniority on perception of job specific personality characteristics was assessed. The results revealed no significant effect of different level of air traffic controllers on adjustment, ambition, sociability, likeability, prudence, and intellectance and school success. Irrespective of their hierarchy and job experiences all the officers perceived similar personality characteristics. This was because the present sample constituted mainly officers from air traffic controller cadre and they carried out the same kind of jobs.

Further in this study, the mean ratings of work style attribute indicated that controllers rated high on work style attributes such as cooperation, self-control, stress tolerance, adaptability, dependability, attention to detail and integrity.

As an air traffic controller, the nature of work requires teamwork, cooperation and being pleasant with others, the requirement for team work increases with the level of task interdependence [20]. Working in teams requires a person to be mild with others, soft and amicable in their conversations, and maintaining a harmonious relationship with others at work. It is because of this reason that the controllers have rated on this particular work style attribute as an important factor of job performance.

Self-control as a work oriented attribute requires a person to be calm and composed, keeping emotions in control, controlling anger and avoiding violent and aggressive behavior even in difficult situations. In the milieu of aviation, difficult situation is the situation of heavy workload with increased task demands from the environment. Rodgers and Nye confirmed in their study that too heavy workload may lead to a loss of situation awareness [21].

Stress Tolerance requires an individual to accept criticism and deal calmly and effectively with high stress situations. The tasks of an air traffic controller involve information processing, accurate and speedy decision making, monitoring, scanning and integrating the information. [22]. What makes their job stressful is when they have to perform all this in a complex scenario. During this situation the controller is not able to attend the whole information but can only attend to a part of the environmental stimuli. To handle this stress it is required that the operator ‘s state of mind should be at ease. Hofstrand& Murphy concluded that organizational climate factors such as controllers relationship with supervisors, and other crew members also play an important role in determining controller‘s state of mind [23].

Adaptability, in work setting comprises of being open to change and to considerable variety in the work place. Within air traffic scenario, the work is challenging and requires different varieties of skills and abilities. The controllers have to be open to accept new challenges like (handling new automated equipment and machines), discarding their obsoleteness by updating themselves through different training program etc.

Attention to details is another important work style attribute. Attention to details means being careful about details and thorough in completing tasks. Air traffic controller's environment is filled with abundance of information in physical, symbolic and auditory form [23]. What makes their task challenging is that out of these excessive details and cues, the operators have to pay attention to the necessary but apparently insignificant cues, in the environment.

Dependability and integrity are value oriented work style attributes. Dependability implies that the job requires being reliable, responsible, dependable and fulfilling obligations whereas integrity entails being honest and ethical. The Air traffic controllers also serve as officers in Indian Air force. At the time of selection the candidates have to undergo many tests (numerical aptitude test, psychological test, group test, medical examination etc). During psychological assessment of the candidate, various attributes are assessed, to gauge his/her potential as a future officer. The tests aim at selecting individuals with Officer Like Qualities. It is because of this reason that they are high on these attributes.

The effect of seniority on perception of work style attributes revealed no significant effect of seniority on work style attributes. One possible explanation is the uniformity of the job. The nature and characteristics of the job were same for everyone. This could be further elaborated by the fact that irrespective of seniority, every controller is given to handle the same type of work scenario in terms of complexity in handling traffic situation, technicalities of the flights etc. Not only this, every controller has to undergo same type of "on the job" training sessions. It is because of these components there was no difference in the perception of work attributes.

Limitations of the Study

The small sample size of this study makes the generalization of the results intricate. Additionally, because of practical limitations, the sample did not include the higher cadre as they might have perceived the nature of job differently. Finally, majority of the participants in this study were male participants so gender differences could not be accounted for in this study.

Conclusion

The study basically fell into two broad categories. In terms of important personality characteristics, three factors emerged - Adjustment, Ambition and Prudence. These factors are convergent with the dimensions of big five theory where they are known as Emotional Stability, Surgency and Conscientiousness. The study also highlights the importance of work style attributes, which are also convergent with the big five dimension of Emotional Stability and Conscientiousness. One important connotation of this study is that, as it has highlighted the role of personality characteristics and work style attributes, these factors could be considered during the selection of the candidate at the selection phase and the training phase in the Air Force Academy.

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