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# APPLICATION OF MULTIPLE COMPARISON PROCEDURES ON AN INDIVIDUAL'S INNOVATIVE BEHAVIOR

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## ABSTRACT

In this paper, we have discussed the widely used multiple comparison procedures (MCPs) and compared them on the basis of management data for testing individual or employee innovation and work life imbalance of individuals along with their limitations and advantages. This study, for the first time in Pakistan is a distinctive attempt to look at an individual's innovative behavior in the universities situated in the three provinces, Punjab, Sindh and Khyber Pakhtunkhwa using ANOVA and MCPs. Furthermore, with stratified sampling technique, the total target population was 80 M. Phil and Ph.D. scholars, out of which only 59 questionnaires were returned. Lastly, counter arguments are further discussed in the research.

## KEYWORDS

Climate for innovation, work life imbalance, employee innovation, multiple comparisons.

## 1. INTRODUCTION

Multiple comparison procedures (MCPs), after obtaining significant Anova and F-test are widely used in the agricultural and industrial experiments, pharmaceutical research, clinical research, education, $K(K-1)/2$ physiology, data mining, market research, health sciences, project management, marketing and many other disciplines. But these procedures (Anova and MCP) have not been applied or rarely used in management data analysis by researchers in recent years as researchers in this area are still working on it (Toroudia 2016).

Multiple comparison procedures have been under debate since the 1950s. The procedures are discussed for pairwise comparison of hypotheses using data from the survey data. If the significant ANOVA result rejects the null hypothesis $H_0$ this signifies that the means are not similar. Multiple comparison procedures are then used to conclude which means differ and which do not differ, meaning at least two groups should differ. A one-way ANOVA involving K group means as there are pair-wise comparisons.

## 2. MCP AND ANOVA

We describe a brief account of MCPs procedures and describe extensions and its limitations which may prove useful in management sciences research. MCPs is prevalent because it is computationally straightforward and intuitive. We describe recent extensions and generalizations which are better suited to observational management research but many researchers may not have full concepts of MCPs procedures and their limitations.

The tests most frequently used for comparison of treatments (means) comprise of Fisher's LSD, Fisher's Protected LSD, Fisher's Unprotected LSD, Student's t, Duncan's Multiple Range, Bonferroni's Scheffé, Dunnett's Tukey's, Waller-Duncan's, Sidak's, tests, Student-Newman-Keul's (SNK) tests and other non-parametric tests.

In hypothesis testing, the "alpha level" popularly known as "Type I error", is the chance of accepting a hypothesis when it is not true. A significant F in an analysis of variance means rejecting the null hypothesis at level α, which depicts that there may exist at least one pair or a contrast which would be accepted. Generally, in management sciences, the alpha level is considered as 0.05 which shows that a researcher commits a Type I error at 5% level.

A second approach is to recognize that the probability of a building at least one false positive (or Type I error) in two completely independent statistical tests is $1-(1-\alpha)^2 = 1-0.952 = 0.0975$ and $C = k(k-1)/2$.

If more than two independent comparisons are made, then the robustness of Student t-test provides probability that at least one of these group means will be significant by chance according to $\alpha_0 = 1-(1-\alpha_t)^c$, where $\alpha_0$ is set at a predetermined level, and then derive the value of $\alpha_t$. The general equation is $\alpha_t = 1-(1-\alpha_O)^{1/c}$. For example, suppose the ANOVA factor has four levels ( $k = 4$ ) and we set the experiment wise error to .05 ( $\alpha_0 = .05$ ), then $c = k(k-1)/2 = 6$ and we have $\alpha_t = 1-(1-.05)1/6 = 0.0034$.

## 3. SOME SELECTED MCPs

In this paper, we discuss the following widely used MCPs and compare them on the basis of management data recently collected by authors along with their limitations and advantages.

1. Fisher's LSD
2. Scheffé's Method
3. Bonferroni Method
4. Modified Bonferroni Method
5. Tukey's Studentized Range Procedure
6. Student-Newman-Keul's Method
7. Multiple Comparison with the Best (MCB)
8. Multiple Comparison with the overall Mean (MCM)

The above tests are illustrated below:

**3.1 Fisher's LSD**

It is an ordinary t-test among all pairs of means, if the F-test in the ANOVA rejects the $H_0$ hypothesis. The t-tests are executed at $\alpha$ level and may reject more pairs of means, when the F-test rejects. It tests all possible pairs of means. Since it tests all pairs, it may reduce the level of significance. To avoid this problem, some modifications have been proposed. The Fisher's protected test is used by replacing pooled variance MSE by weighted $MS_w$ from ANOVA.

$$t = \frac{\bar{X}_i - \bar{X}_j}{\sqrt{\frac{MS_{error}}{n_i} + \frac{MS_{error}}{n_j}}}$$

If $n_i = n_j = n$ then the denominator of t is $\sqrt{\left(2MSE_{Error}/n\right)}$. As the number observations are large enough to make the means fulfills normality conditions.

Results are given in Table 2.

**3.2 Scheffé's Method**

If the F-test rejects the null hypothesis at level $\alpha$, then it may show that at least one pair of means or one contrast is rejected using the Scheffé procedure at level $\alpha$. Scheffé's method applies to all possible estimates -or contrasts among the factor level means,andnot just pairwise differences which are considered by Tukey's method. The Scheffé method provides $\alpha$ level protection againstrejecting the null hypothesis when it is true, regardless of how many contrasts of the means are tested. Let $\mu_1,...,\mu_r$ be the means of some variable in $r$ disjoint populations. An arbitrary contrast is defined by $C = \sum_{i=1}^{r} c_i \mu_i$, subject to $\sum c_i = 0$. The standard error of $\hat{C}$ is $s_{\hat{C}}^2 = \hat{\sigma}_e^2 \sum_{i=1}^{N} c_i^2 / n_i$ and the confidence interval is $\hat{C} \pm s_{\hat{C}} \sqrt{(r-1) F_{(\alpha; r-1,; N-r)}}$. , where $\hat{C}$ is the estimator of $C$. The method provides robust confidense interval.

**3.3 Bonferroni Method**

Suppose $c$, the number of comparisons, are tested at $\alpha$ level. The Bonferroni method proposed to use α/c instead of $\alpha$ for testing each of the $c$ comparisons.

Fishers's LSD method controls the $\alpha$-level error rate for each pairwise comparison so it does not control the family error rate where asthe Bonferroni method controls the family error rate, by performing the pairwise comparison tests using α/c level of significance. In addition, it can be easily presented that the p-value of each pairwise comparison calculated by Bonferroni method is $c$ times the p-value calculated by Fisher's LSD method. The adjusted $\alpha$ value is $\alpha/6$, for each of 6 comparisons as shown in Table 2.

### 3.4 Modified Bonferroni Method

The method is developed by Holm (1979) and is also called the Holm procedure. Holm (1979) acquainted with variant of the Bonferroni adjustment which is often applied by researchers. To conduct this procedure, researchers initially organize the p-values from lowest to highest, as shown below

| Position in Sequence | p-values | Adjusted $\alpha$ |
|---|---|---|
| 1 | 0.001 | 0.0083 |
| 2 | 0.013 | 0.0100 |
| 3 | 0.057 | 0.0130 |
| 4 | 0.084 | 0.0170 |
| 5 | 0.157 | 0.0250 |
| 6 | 0.677 | 0.0500 |

For this procedure, the alpha, which is adjusted, is different for each p value for 6 positions. Precisely, the $\alpha$ (alpha) at each position equals $\alpha$ divided by (the number of tests – position in the sequence + 1).

### 3.5 Tukey's Studentized Range

Simultaneously, Tukey's test, applies to all set of pairwise comparisons in the analysis. The Tukey procedure, $q$, when $n_i$ are equal say to $n$ is $q = \dfrac{(\bar{y}_{\max} - \bar{y}_{\min})}{s\sqrt{2/n}}$.

The Bonferroni procedure is a good one for making pairwise comparisons and the Tukey studentized range method is slightly better than the Bonferroni procedure. When compared with the q table value, it is significant at 0.05 level.

### 3.6 Student-Newman-Keul (SNK) method:

The SNK method is a non-parametric method and a stepwise multiple comparison process, useful in MCPs where it identifies sample means, significantly different from each other. The Newman–Keuls method and Tukey's range test use studentized range statistics. Different fromTukey's range test, the Newman–Keuls method adoptsdifferent critical values for different pairs of mean comparisons. Therefore, the procedure is more expected to expose significant differences between group means and to result in type I errors by falsely rejecting a null hypothesis when it isinfact true. In other words, the Neuman-Keuls procedure is more stringent but less conservative than Tukey's range test.

### 3.7 Multiple Comparison with the Best (MCB)

The MCB makes comparisons between each sample mean and the "best" of all the other means, where we postulate that the "best" means are either the largest or the smallest. We use

MCB (Multiple Comparison with the Best) $= \mu_i - Max(\mu_i),\ i = I, 2, ...$

$\hat{\mu} = \hat{\mu}_1 - Max\ \hat{\mu}_1$

The standard error of $\hat{\mu}$ is $\sqrt{\left(S_{\hat{\mu}}^2/2\right)}$, t-test is applied to get the result.

### 3.8 Multiple Comparison with the overall Mean (MCM)

The MCM test is; MCM (Multiple comparison with the overall mean) $= \mu - \bar{\mu}$**, or** MCM $= \mu - \bar{\bar{\mu}}$**,** where $\bar{\mu}$ is unweight mean and $\bar{\bar{\mu}}$ is the weighted mean. We illustrate MCPs by considering a study on student's innovation in universities.

To begin with, without people, innovation will not occur (Kuratko et al. 2014). Innovation and diversity from doctoral students convert ideas into successful products and services (Bernstein et al. 2014). Research institutions and universities play a primary goal in novel innovation. These institutions generally contribute through their innovative ideas to the cultural as well as social lives of people, build research institutions and contribute to economic capital and national building (Elliott 2013; Bano & Taylor 2015 and Collini 2012) but research demonstrated the loopholes that the higher education sector and research institutions lacked to create a proper climate for innovation (Leonard et al. 2006).

We study the individual's innovative behavior in the universities, in the three respective provinces of Pakistan, i.e. Khyber Pakhtunkhwa, Sindh and Punjab, excluding Balochistan, as there was no scholar from the province at this level.

In this study, we try to probe the effects of the two independent variables i.e. climate for innovation and work life imbalance predicting employee or individual innovation. Our research questions of the study shall pertain to:

i) What is the influence of climate for innovation on employee innovation?
ii) What is the influence of wok life imbalance on employee innovation?

Innovation has been described as the development of a novel system, method process, an idea or a new product (Schumpeter 1934; Damanpour 1991; Galunic and Rodan 1998; Binyamin & Carmeli 2010; Fernandez & Moldogaziev 2013; Yidong & Xinxin 2013; Carmeli et al. 2013; Holman et al. 2012 and Anderson et al., 2014).

Innovative climate is also an essential contextual predictor for innovative behavior where the organization extends support and encouragement to its workforce to explore innovative ideas (Ren & Zhang 2015; Martins & Terblanche 2003; Alas et al. 2011; Nusair 2013; Yuan & Woodman 2010 and Thompson, 2005).

Yet very few studies have worked on investigating the impact of climate for innovation on individual or employee innovation (Sethibe & Steyn, 2016).

Another pivotal antecedent which is deliberated in the current study is the work life imbalance with individual innovation. Work life imbalance is defined as a job-related stressor where there is a deterioration of resources in energy and time, emotions or feelings of commitment towards family and work life (Premuzic, 2013; Porter, 2001). While many antecedents of innovative performance have been studied, the impact of work life imbalance on innovative behavior has rarely been examined (Zhou and Shalley, 2003).

In some countries, individuals get to work long hours, increased workload, job insecurity, high levels of job stress that result in work life imbalance (Fisher 2002; Kodz et al. 2002; Flowers & Robinson 2002; Aziz & Zickar 2006 and Aziz et al. 2013).

## 4. EMPLOYEE INNOVATION

Employee innovation is a crucial component for any organization to maintain a distinguishing competitive edge in the marketplace. Furthermore, it is boosted in a knowledge-based economy, where intangible assets play an even more primal role in organizations to maintain a distinguishing competitive edge in the market. Innovation had been described as an idea, a concept, a new knowledge creation (Schumpeter 1934; Damanpour 1991; Galunic and Rodan 1998; Martins & Terblanche 2003; Binyamin & Carmeli 2010; Carmeli et al. 2013; Parker & Collins 2010; De Jong & Hartog 2010; Fernandez & Moldogaziev 2013; Yidong & Xinxin 2013; Holman et al. 2012; Anderson, Potocnik & Zhou 2014; Ren & Zhang, 2015). It breeds leadership factors like loyalty, professional respect, freedom empowered to the employees (Alas et al. 2011; Nusair 2013; Yuan & Woodman 2010 and Thompson 2005). Another research reckoned six factors including trust, openness, independence, positive challenges and support for novel and original ideas (Tidd & Bessant, 2009 and Griffiths, 2005) that sometimes result in work life imbalances (Aziz et al. 2013; Aziz & Zickar 2006 and Danna & Griffin 1999).

Understanding the process that generated individual innovation is an area of critical importance even today. However, there is a lack of research that focuses on understanding this process of individual or employee innovation (Wallace et al., 2016). Hence, this research serves to address this gap in the literature. To do so, we highlight the important role of climate for innovation and work life imbalance as contextual variables which influences the individual –level innovation process**.**

## 5. THEORETICAL FRAMEWORK

The employee innovation, the dependent variable, comprises of two independent variables viz. (i) Climate for innovation and (ii) Work life imbalance. The theoretical framework predicts the hypothesized relationships of the two independent variables with one dependent variable. The independent variables are climate for innovation and work life balance and the dependent variable is employee innovation.

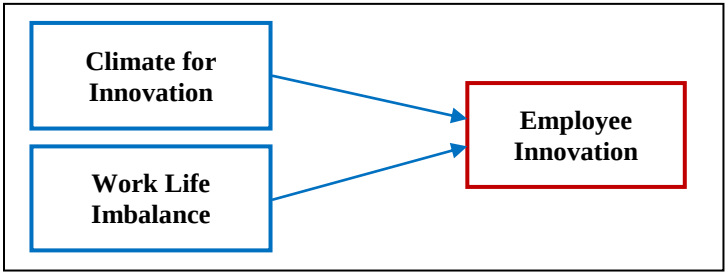


**Figure 1: Theoretical Framework**

For brevity we denote EI to be Employee innovation; CI to be Climate for innovation and WLI to denote Work life imbalance.

## 6. STUDY HYPOTHESES

This research proposes the following list of null hypotheses.

$H_{(01)}$ : All else being equal, organizations with higher climate for innovation have no impact on employee innovation.

$H_{(02)}$ : All else being equal, organizations having work-life imbalances have no impact on employee innovation.

## 7. METHODOLOGY

A pilot survey was led in a university in Lahore, Pakistan to find out as to how research scholars kindle creativity in research environments. From the response it was reckoned that there was no ambiguity in understanding the items or terminologies or survey instrument.

All the universities were approached for a list of doctoral students. A list of students from the universities was considered as frame. Since the background of all senior students is similar, a sample of 80 students was picked for the survey. The questionnaires were mailed and a response of 59 students was received after a few contacts. Eventually, data had been collected through stratified sampling technique. Post stratification was made after the completion of survey work. The primary data was gathered through self-administered questionnaire. The response rate seemed reasonable and assumed quite high which was 73.75%.

### 7.1 Measures and Scale Items

**Employee Innovation (EI)**

Is the creative performance in terms of original and novel ideas. Furthermore, we wanted to investigate over the innovative behavior of the M.Phil. or Ph.D. scholars in their respective universities, so we developed the items as per our research requirement. Sample items include, 'How many research papers have you published so far?', 'How many conferences have you attended so far?' The Cronbach Alpha of 0.839 showed the reliability of these developed items, indeed an attainment in capturing the consistence in the degree of innovative behavior of the research scholars.

**Work Life Imbalances (WLB)**

We also created the items for work life imbalances to measure the imbalance created in the scholars' lives due to their work load and creative behaviour which drive these individuals away from their homes and family duties and obligations. Sample items include 'on average, how many hours/day do you dedicate to research?' The Cronbach Alpha appeared to be 0.550.

**Climate for Innovation (CI)**

Items for climate for innovation were also developed to measure the degree of innovative or creativity which these scholars display due to the favourable changes in the Climate for innovation. Sample items include 'Does your institution allow flexible working hours?' The internal consistency of these items was measured through Cronbach Alpha (0.703).

## 8. RESULTS

The data had been analyzed in terms of respondent's demographics, descriptive statistics, using ANOVA technique and multiple comparisons to test the statistical differences in the innovative behavior of the MPhil and PhD scholars, for the first time in Pakistan.

## 9. DEMOGRAPHICS

Demographic characteristics of the MPhil and PhD scholars are exhibited below. There were 59 respondents, of which 39% comprise of females and 61% comprise of males; 64% are married and 36% are single, whereas 34% belong to the universities of private sector and 66% of the respondents belong to the universities of public sector. From all over Pakistan, 19 from Punjab, 9 are from Khyber Pakhtunkhwa, 32 are from Sindh, and none from Baluchistan. Also, 61% comprise of MPhil degrees and 39% have PhD degrees.

Of these 59 respondents, 52.5% are of professorial ranks, of which about 3.4 % are Associate Professors, 5.6% belong to Assistant Professorship, 13.6% are full Professors and about 47.5% are Lecturers.

**Table 1**
**Mean Scores by Designation and Questions**

| S# | Employee Innovation | L | $P_1$ | $P_2$ | $P_3$ |
|---|---|---|---|---|---|
| 1. | Research Papers | 2 | 21 | 29 | 36 |
| 2. | Teaching Years | 4.93 | 8.90 | 27.50 | 34.88 |
| 3. | Conferences Attended | 0 | 2 | 12 | 18 |
| 4. | Research Meetings | 1 | 14 | 21 | 31 |
| 5. | Research Projects | 0 | 2 | 4 | 5 |
| 6. | Courses Taught | 12 | 22 | 34 | 39 |
| 7. | Research Supervisions | 0 | 2 | 9 | 24 |
| L-Lecturer ; $P_1$-Assistant Professor ; $P_2$ -Associate Professor; $P_3$-Professor | | | | | |

**Table 2**
**Significance of Comparisons by Designations and Employee Innovation**

| S# | Employee Innovation | L vs $P_1$ | L vs $P_2$ | L vs $P_3$ | $P_1$ vs $P_2$ | $P_1$ vs $P_3$ | $P_2$ vs $P_3$ |
|---|---|---|---|---|---|---|---|
| 1. | Research Papers Published | 0.013 | 0.057 | 0.001 | 0.157 | 0.084 | 0.677 |
| 2. | Teaching Years | 0.013 | 0.057 | 0.001 | 0.368 | 0.114 | 1.000 |
| 3. | Conferences Attended | 0.004 | 0.027 | 0.000 | 0.306 | 0.128 | 0.880 |
| 4. | Research Meetings Attended | 0.006 | 0.102 | 0.008 | 0.601 | 0.509 | 0.886 |
| 5. | Participated in Research Projects | 0.038 | 0.000 | 0.000 | 0.002 | 0.004 | 0.139 |
| 6. | Courses Taught | 0.127 | 0.160 | 0.079 | 0.424 | 0.519 | 0.682 |
| 7. | Research Supervisions | 0.000 | 0.821 | 0.000 | 0.141 | 0.009 | 0.007 |
| L-Lecturers ; $P_1$-Assistant Professor ; $P_2$ -Associate Professor; $P_3$-Professor | | | | | | | |

**Table 3**
**Correlation Coefficients and their Significance at 5% Level**

| Correlations | | | | | |
|---|---|---|---|---|---|
| | | **Average of Innovation Scale** | **Work Life Balance Average** | **Climate for Innovation Average** | **Work Family Conflict Average** |
| **Average of Innovation Scale** | Pearson Correlation | 1 | .064 | .187 | -.044 |
| | Sig. (2-tailed) | | .646 | .185 | .750 |
| | N | 54 | 54 | 52 | 54 |
| **Work Life Balance Average** | Pearson Correlation | .064 | 1 | .185 | -.184 |
| | Sig. (2-tailed) | .646 | | .172 | .167 |
| | N | 54 | 58 | 56 | 58 |
| **Climate for Innovation Average** | Pearson Correlation | .187 | .185 | 1 | -.153 |
| | Sig. (2-tailed) | .185 | .172 | | .259 |
| | N | 52 | 56 | 56 | 56 |
| **Work Family Conflict Average** | Pearson Correlation | -.044 | -.184 | -.153 | 1 |
| | Sig. (2-tailed) | .750 | .167 | .259 | |
| | N | 54 | 58 | 56 | 58 |

## 10. COMPARISONS OF MCPs

In this section, multiple comparisons, using the least significance difference (LSD) are done among the four designations to compare the employee innovative behavior at the universities or research institutions for the first time in Pakistan. LSD taps the smallest but significant difference among the group means (Sekaran & Bougie, 2013). The multiple comparisons or LSD labels the differences in individual innovation between the lecturer and other designations in our research study.

The differences of creative display of employee innovation is tagged through the total of research papers published by a research scholar, number of conferences and academic meetings attended by the respondents, the diversity of different courses an individual teaches, also the number of students in supervision and the number of projects he/she has participated in and the teaching experience of the research scholar.

Lecturer's innovation is substantially distinguishable in terms of conferences, research papers, seminars, research projects, different courses, workshops, number of students being supervised and teaching experience from the other three designations.

We will protrude with the significant difference in the teaching experience of the Lecturer and Full professor, which is significant at 0.001. This is because the lecturers are fresh in their respective teaching field whereas the professors have a massive experience in teaching with remarkable hard work and handling all kinds of students with knowledge and skills. The performance of the Professors does not build overnight; it takes years of hard work and lots of portion of fun and love to draw such a successful career. The comparisons further imparted from the table above, that there is no significant difference among assistant professors, associate professors and full professors in terms of the teaching experience.

In terms of research papers/publications, lecturer's performance is also low-pitched in comparison with the other three designations. A Full professor strikes out more innovation in terms of his research papers being published as against the lecturer's research publications. LSD also depicted that there is no significant differences in the innovation of research papers published between an associate professor and an assistant professor.

Furthermore, from the table above, there was a significant difference in the attendance of conferences, regarding the comparison of lecturer with the other three designations. It was seen that a lecturer goes to fewer conferences than the other three positions. Conferences extend the innovative horizons, branching out creative, novel and useful ideas for research papers by assistant, associate and full professors.

There was no substantial difference among associate professor, assistant professor and a full Professor regarding the conferences. Further support as an evidence is conferred that Hemlin and Olsson (2011) detected that research meetings and supervisor/expert advice stimulated leaders' innovation by more than 50%.

The results also noted that Lecturer is inactive in the participation of research / innovation projects. There was a noteworthy difference in the participation of research projects between a full professor and an assistant Professor but apparently no noteworthy difference in the participation of research projects between a full professor and an associate professor, unveiling the fact that the participation in the research projects, between a full professor and an associate is almost as equal as a part of their level of innovation. This is in line with another study which pointed that lesser time expended in research projects kick in to lesser research (Hum, 2015).

Furthermore, Research supervisions by an assistant, an associate and a full professor is greater in number than a lecturer, signifying a further increase in the level of employee innovation. There is magnanimity in the research supervision of a full professor as they come up with supervising students with new research topics, lending him or her edge over the other three designations.

In another very recent study, a visualization method, journey plot, tried to explore experiences of four supervisors with their respective students over a four year period, marking their high and low points, from the time they first turn out to be their supervisor to the time of their thesis completion, showing the improvement in their supervision skills and incepting the research skills in their students (Turner, 2015).

## 11. DISCUSSION

Present study is a kickoff endeavor in determining the innovative behavior of the employees among the research scholars in the respective three provinces of Pakistan. After analyzing the data, the results confirm and support the phenomena or the reality we were interested in.

Previous research supports our phenomena of interest. Traditional and nontraditional instructional materials (Zehyoue, 1996) teach students efficiently. Teacher characteristics and their teaching techniques determine the innovativeness of a research institution.

Climate for innovation builds a suitable career ladder (Padmaja, 2014; Sethibe &Steyn, 2016) for individual innovation. It further encourages expression of ideas and learning (Charbonnier-Voirin et al., 2010). The researchers adopted the research practices like collaboration and communication with the statistics colleagues, nourishing the soft skills and scientific environment (Pyhalto, Stubb & Lonka 2009).

One Ph.D. pointed out that research workshop I and II had been pioneered as two research subjects in their university, which increase the research skills of students and scholars. Developments of concept papers and data analysis subject are of primal importance in their universities. To help the professors, research assignments had been assigned to every professor, who could assist them in their lectures and research outputs, which in turn nourishes the research skills of the assistants (Fatima and Rehman 2012; Tabassum and Rahman 2012).

Availability of the research resources is extremely pertinent as well. Access to research sites and research library also produce research work rapidly (Hunter and Cusherbery 2011). Teachers place their research lecturers at web portal for students and discuss research topics at online forums.

Investment in Capital and research resources will definitely benefits every scholar. For Load shedding, the economic crises in Pakistan, generators have been installed which do not hinder the research work and lectures in the universities.

To stimulate educational innovation, vast sums of subsidies are important to carry out workshops or conferences / with added research institutions as it opens different avenues for a researcher (Giles & Hargreaves, 2006). Many researchers are encouraged to opt for post Doc at a university out of Pakistan to enhance their teaching and research skills and research pointers could be established over a cup of tea with friends, colleagues and teachers.

The doctoral students are being trained in research activity, reading interpretation of theoretical perspective and engage in concept threshold crossings and the process of research writing in their own authoritative voice. The concept of threshold crossings helps the doctoral students or authors to learn leaps or break through in their learning and research process with the help of their supervisors and communities, enabling them to contribute valuably to the literature review and be successful doctoral authors (Wisker, 2015). Doctoral students can further explore research learning opportunities with the multiple supervisors which in turn can enhance the value of supervision when students interact with multiple supervisors and can benefit from authentic scientific argumentation (Kobayashi, Grout and Rump, 2015). This joint doctoral supervision would eventually uncover doctoral students to think like a scientist, which is a pooled responsibility of several supervisors (Guerin & Green 2013).

Furthermore, doctoral students can learn to write their research drafts through the examiner expectations of theory (Coherence, Accuracy, Alignment, Consistency Grasp completeness and Treatment in discussions and findings and dimensions of contribution) (Holbrook, Bourke and Fairbairn 2015).

Alternative hypothesis $H_2$ predicted that higher the asymmetry between the work of a researcher's and personal life, the greater the innovative behavior. These are consistent

with another study which stressed the fact that a research scholar can only expend very restricted time and energy with his family while overloaded with his/her research work, i.e. the greater an individual is a workaholic the higher the work life imbalance (Aziz et al. 2010 and Robinson et al. 2001 ).

Research scholars have the work enjoyment drive with the sole purpose of their personal development and positive work engagement without any extrinsic rewards (Aziz et al. 2013) leading to sleep deprivation (Aziz and Zickar, 2006). Also, work life imbalance occurred when teachers face long working hours with disproportionate working days (Madipelli et al., 2013) deteriorating their resources to fulfill their family roles (Hecht and Allen, 2009 and Snir and Harper, 2009).

## 12. LIMITATIONS AND FUTURE DIRECTIONS

This research study has a handful of limitations. First, the results of the existing study are beached on cross-sectional data. Therefore, future research may benefit from longitudinal data (Eby et al. 2005 and Kelly et al. 2008) which can survey the impact of the climate for innovation and work life imbalances on the employee innovation in all the public and private universities of prevailing in Pakistan including the province, Baluchistan.

Secondly, we could not make a contrast between international research scholars and national scholars and their significant difference in their varying number of research projects and their participation in the number of workshops, research or academic meetings, conferences and research publications which help them paint their research display.

## 13. CONCLUSION

In recent years doctoral education and research is on increase because of HEC, Pakistan directives. Lecturers are still working hard to come up to the levels of teachers of professorial ranks. The number of Ph.Ds. in Baluchistan is still rare. Sindh, being a province of smaller population than Punjab, the number of PhDs are much higher than Punjab. Research seems to be restricted because of imbalance behavior environment in Pakistan.

## REFERENCES

1. Alas, R., Ubius, U. and Vanhala, S. (2011). Connections between organisational culture, leadership and the innovation climate in Estonian enterprises. E-Learning Bachelor's, International Prestige. *E-Leader*, 1-15.
2. Anderson, N., Potocnik, K. and Zhou, J. (2014). Innovation and creativity in organizations a state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, 40(5), 1297-1333.
3. Aziz, S. and Zickar, M.J. (2006). A cluster analysis investigation of workaholism as a syndrome. *Journal of Occupational Health Psychology*, 11(1), 52-62.
4. Aziz, S., Adkins, C.T., Walker, A.G. and Wuensch, K.L. (2010). Workaholism and work-life imbalance: Does cultural origin influence the relationship? *International Journal of Psychology*, 45(1), 72-79.

5. Aziz, S., Uhrich, B., Wuensch, K.L. and Swords, B. (2013). The workaholism analysis questionnaire: emphasizing work-life imbalance and addiction in the measurement of workaholism. *Institute of Behavioral and Applied Management*, 14(2), 71-86.
6. Bano, S. and Taylor, J. (2015). Universities and the knowledge-based economy: Perceptions from a developing country. *Higher Education Research & Development*, 32(2), 242-255.
7. Bernstein, B.L., Evans, B., Fyffe, J., Halai, N., Hall, F.L., Jensen, H.S., Marsh, H. and Ortega, S. (2014). The continuing evolution of the research doctorate. In *Globalization and Its Impacts on the Quality of PhD Education* (pp. 5-30). Sense Publishers.
8. Binyamin, G. and Carmeli, A. (2010). Does structuring of human resource management processes enhance employee creativity? The mediating role of psychological availability. *Human Resource Management*, 49(6), 999-1024.
9. Charbonnier-Voirin, A., EL Akremi, A. and Vandenberghe, C. (2010). A multilevel model of transformational leadership and adaptive performance and the moderating role of climate for innovation. *Group and Organization Management*, 35(6), 699-726.
10. Carmeli, A., Gelbard, R. and Reiter Palmon, R. (2013). Leadership, Creative Problem Solving Capacity and Creative Performance: The Importance of Knowledge Sharing. *Human Resource Management*, 52(1), 95-121.
11. Collini, F. (2012). *What are universities for?* London: Penguin.
12. Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, 34(3), 555-590.
13. Danna, K. and Griffin, R.W. (1999). Health and well-being in the workplace: A review and synthesis of the literature. *Journal of Management*, 25(3), 357-384.
14. Day, R.W. and Quinn, G.P. (1989). Comparisons of treatments after an analysis of variance in ecology. *Ecological Monographs*, 59(4), 433-463.
15. De Jong, J. and Den Hartog, D. (2010) Measuring Innovative Work Behavior. *Creativity and Innovation Management*, 19(1), 23-36.
16. Eby, L.T., Casper, W.J., Lockwood, A., Bordeaux, C. and Brinley, A. (2005). Work and family research in IO/OB: Content analysis and review of the literature (1980-2002). *Journal of Vocational Behavior*, 66(1), 124-197.
17. Elliott, G. (2013). Character and impact of social innovation in higher education. *International Journal of Continuing Education and Lifelong Learning*, 5(2), 71-84.
18. Fatima, G. and Rehman, W. (2012). Impact of Role (Ambiguity and Conflict) on Teaching Assistants' Satisfaction and Intention to Leave: Pakistani HEIs. *International Journal of Business and Management*, 7(16), 56-61.
19. Fernandez, S. and Moldogaziev, T. (2013). Employee empowerment, employee attitudes, and performance: testing a causal model. *Public Administration Review*, 73(3), 490-506.
20. Fisher, G.G. (2002). *Work/personal Life Balance: A Construct Development Study* (Doctoral Dissertation, ProQuest Information & Learning).
21. Flowers, C.P. and Robinson, B. (2002). A structural and discriminant analysis of the Work Addiction Risk Test. *Educational and Psychological Measurement*, 62(3), 517-526.

22. Galunic, D.C. and Rodan, S. (1998). Resource recombinations in the firm: Knowledge structures and the potential for Schumpeterian innovation. *Strategic Management Journal*, 19(12), 1193-1201.
23. Giles, C. and Hargreaves, A. (2006). The sustainability of innovative schools as learning organizations and professional learning communities during standardized reform. *Educational Administration Quarterly*, 42(1), 124-156.
24. Griffiths, M.D. (2005). Workaholism is still a useful construct. *Addiction Research and Theory*, 13(2), 97-100.
25. Guerin, C. and Green, I. (2015). They're the bosses: Feedback in team supervision. *Journal of Further and Higher Education*, 39(3), 320-335.
26. Hecht, T.D. and Allen, N.J. (2009). A longitudinal examination of the work-nonwork boundary strength construct. *Journal of Organizational Behavior*, 30(7), 839-62.
27. Hemlin, S. and Olsson, L. (2011). Creativity-Stimulating Leadership: A Critical Incident Study of Leaders' Influence on Creativity in Research Groups. *Creativity and Innovation Management*, 20(1), 49-58.
28. Holbrook, A., Bourke, S. and Fairbairn, H. (2015). Examiner reference to theory in PhD theses. *Innovations in Education and Teaching International*, 52(1), 75-85.
29. Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics*, 6(2), 65-70.
30. Hunter, S.T. and Cushenbery, L. (2011). Leading for innovation: Direct and indirect influences. *Advances in Developing Human Resources*, 13(3), 248-265.
31. Holman, D., Totterdell, P., Axtell, C., Stride, C., Port, R., Svensson, R. and Zibarras, L. (2012). Job design and the employee innovation process: The mediating role of learning strategies. *Journal of Business and Psychology*, 27(2), 177-191.
32. Hum, G. (2015). Workplace learning during the science doctorate: what influences research learning experiences and outcomes? *Innovations in Education and Teaching International*, 52(1), 29-40.
33. Kelly, E.L., Kossek, E.E., Hammer, L.B., Durham, M., Bray, J., Chermack, K., Murphy, L.A. and Kaskubar, D. (2008). 7 Getting There from Here: Research on the Effects of Work–Family Initiatives on Work–Family Conflict and Business Outcomes. *The Academy of Management Annals*, 2(1), 305-349.
34. Kobayashi, S., Grout, B.W. and Rump, C.O. (2015). Opportunities to learn scientific thinking in joint doctoral supervision. *Innovations in Education and Teaching International*, 52(1), 41-51.
35. Kodz, J., Harper, H. and Dench, S. (2002). *Work-life balance: Beyond the rhetoric*. Brighton: Institute for Employment Studies.
36. Kubota, K., Shimazu, A., Kawakami, N., Takahashi, M., Nakata, A. and Schaufeli, W.B. (2010). Association between workaholism and sleep problems among hospital nurses. *Industrial Health*, 48(6), 864-871.
37. Kuratko, D.F., Hornsby, J.S. and Covin, J.G. (2014). Diagnosing a firm's internal environment for corporate entrepreneurship. *Business Horizons*, 57(1), 37-47.
38. Leonard, D., Metcalfe, J. and Evans, J. (2006). *Review of literature on the impact of working context and support on the postgraduate research student learning experience*. London: Higher Education Academy.

39. Madipelli, S., Sarma, V.S. and Chinnappaiah, Y. (2013). Factors Causing Work Life Imbalance among Working Women-A Study on School Teachers. *Indian Journal of Industrial Relations*, 48(4), 621-633.
40. Martins, E.C. and Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management*, 6(1), 64-74.
41. Nusair, T.T. (2013). The role of climate for innovation in job performance: Empirical evidence from commercial banks in Jordan. *International Journal of Business and Social Science*, 4(3), 208-217.
42. Nybakk, E. and Jenssen, J.I. (2012). Innovation strategy, working climate, and financial performance in traditional manufacturing firms: An empirical analysis. *International Journal of Innovation Management*, 16(2), 1250008-1-1250008-26.
43. Padmaja, B. (2014). Organizational climate as a predictor of job satisfaction of employee: A case study with special reference to electricity employees. *International Journal of Organizational Behaviour and Management Perspectives*, 3(4), 1350-1356.
44. Parker, S.K. and Collins, C.G. (2010). Taking Stock: Integrating and Differentiating Multiple Proactive Behaviors. *Journal of Management*, 36(3), 633-62.
45. Pisanu, F. and Menapace, P. (2014). Creativity & Innovation: Four Key Issues from a Literature Review. *Creative Education*, 5(3 special issue), 145-154.
46. Porter, G. (2001). Workaholic tendencies and the high potential for stress among co-workers. *International Journal of Stress Management*, 8(2), 147-164.
47. Premuzic, T.C. (2013). Embrace Work-Life Imbalance. *Finweek*, 40-41.
48. Pyhalto, K., Stubb, J. and Lonka, K. (2009). Developing scholarly communities as learning environments for doctoral students. *International Journal for Academic Development*, 14(3), 221-232.
49. Ren, F. and Zhang, J. (2015). Job Stressors, Organizational Innovation Climate, and Employees' Innovative Behavior. *Creativity Research Journal*, 27(1), 16-23.
50. Robinson, B.E., Flowers, C. and Carroll, J. (2001). Work stress and marriage: A theoretical model examining the relationships between workaholism and marital cohesion. *International Journal of Stress Management*, 8(2), 165-175.
51. Saville, D.J. (1990). Multiple comparison procedures: The practical solution. *Am. Stat*., 44, 174-180.
52. Schumpeter, J.A. (1934). *Theory of Economic Development*, Harvard University Press.
53. Sekaran, U. and Bougie, R. (2013). *Research method for business: A skill-building approach* (6th Ed.), John Wiley and Sons, New York, NY.
54. Sethibe, T. and Steyn, R. (2016). Organizational Climate, Innovation and Performance: A Systematic Review. *Journal of Entrepreneurship and Innovation in Emerging Economies*, 2(2), 161-174.
55. Snir, R. and Harpaz, I. (2009). Workaholism from a cross-cultural perspective. *Cross-Cultural Research*, 43(4), 303-308.
56. Tabassum, A. and Rahman, T. (2012). Gaining the insight of workaholism, its nature and its outcome: A literature review. *International Journal of Research Studies in Psychology*, 2(2), 81-92.

57. Thompson, J.A. (2005). Proactive personality and job performance: a social capital perspective. *Journal of Applied Psychology*, 90(5), 1011-1017.
58. Tidd, J. and Bessant, J. (2009). *Managing Innovation: Integrating Technological, Market and Organizational Change*, 4th Ed. Chichester: Wiley.
59. Toroudi, H., Madani, M. and Sarlak, F. (2016). Analytic network process (ANP) approach for product mix planning in railway industry. *Management Science Letters*, 6(8), 535-540.
60. Turner, G. (2015). Learning to supervise: four journeys. *Innovations in Education and Teaching International*, 52(1), 86-98.
61. Wallace, J.C., Butts, M.M., Johnson, P.D., Stevens, F.G. and Smith, M.B. (2016). A multilevel model of employee innovation understanding the effects of regulatory focus, thriving, and employee involvement climate. *Journal of Management*, 42(4), 982-1004.
62. Wisker, G. (2015). Developing doctoral authors: engaging with theoretical perspectives through the literature review. *Innovations in Education and Teaching International*, 52(1), 64-74.
63. Yidong, T. and Xinxin, L. (2013). How ethical leadership influence employees' innovative work behavior: A perspective of intrinsic motivation. *Journal of Business Ethics*, 116(2), 441-455.
64. Yuan, F. and Woodman, R.W. (2010). Innovative behavior in the workplace: The role of performance and image outcome expectations. *Academy of Management Journal*, 53(2), 323-342.
65. Zehyoue, A. Jr. (1996). *The chemist in the college chemistry classroom: A case study of excellence*. Unpublished Ph.D. Thesis, Louisiana State University.
66. Zhou, J. and Shalley, C.E. (2003). Research on employee creativity: A critical review and directions for future research. *Research in Personnel and Human Resources Management*, 22, 165-217.