

## **WORKFORCE DIVERSITY & ITS IMPACT ON PRODUCTIVITY**

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### **ABSTRACT**

*Due to globalized scenario, employing diversified workforce is a necessity for every organization but to manage such diversified workforce is also a big challenge for management. The rapid growth in the Banking industry has posed several challenges such as workforce diversity which is a natural phenomenon that has both negative and positive impacts on employee performance depending on how well it is managed. The study covered the bank's branches in Agra specifically, whose zonal offices lie in Agra. The study tackled areas of workforce diversity, effects of diversity on employee performance and how workforce diversity can be managed so as to maximize the positive outcomes and minimize the negative outcomes. The respondents were the managers and employees of the Bank. To make the study more focused, the researchers have selected certain variables of diversified workforce. The study reveals that there is a positive correlation between age and productivity of organization. The employees whose age is above 50 are very much effective in client handling. But if we talk about the bank's work which is related with physical activeness, youngsters are much more contributing towards the bank's productivity. If we talk about the qualification of employees and productivity then we find that, the qualification of the bank employees and their performance are associated significantly with each other. Next diversity factor is the experience of various employees, the results shows that the working experience of the bank employees and their performance are associated significantly with each other. Another variable is interpersonal relationship. Research shows that if the employees are satisfied at their workplace and are having cordial and harmonious relations with other employees, they can contribute positively towards the productivity of an organization. Recent studies have also shown a strong correlation between good diversity practices and profits.*

**Keywords: Workforce Diversity, Age, Experience, Productivity, Interpersonal Relationship**

### **INTRODUCTION**

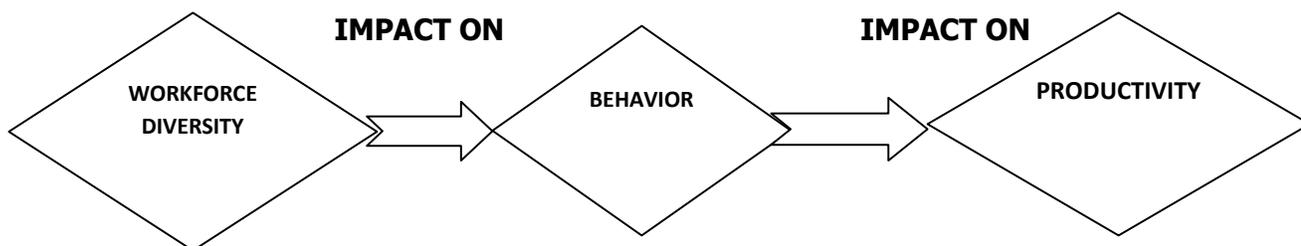
The world has now recognized India as one of the prime economic driver in the global scenario. Various companies are coming India to explore this opportunity. In order to survive in this type of cut throat competitive world the organizations have to hire an effective an efficient workforce that can handle such competitive environment. Employing diversified workforce is a very essence for each and every organization. In the current scenario the organizations that employ quality and competitive workforce regardless of their age, attitude, language, gender, religion, region can only compete at the marketplace. Human resource is an important asset for any

organization. Capital and physical resources, by themselves, cannot improve efficiency or contribute to an increased rate of return on investment.

It is through the combined and concerted efforts of people that monetary or material resources are harnessed to achieve organizational goals. But these attitudes, efforts and skills have to be sharpened from time to time to optimize the effectiveness of human resources and to enable them to meet greater challenges. Without employees the organization cannot move an inch. Therefore the management of this resource is also an important issue. Human resource management is concerned with managing 'human aspect' of the organization in such a way that organizational objectives are achieved along with employee development and satisfaction. When the organizations employ human resource having different age, gender, perception, attitude, caste, religion, region then it will be very difficult for the management as well as for the employees to manage and adjust with that environment. To manage diversified workforce is a big challenge for any organization.

Diversity to us means all aspects in which people differ from one another. This includes both the visible and relatively easily demonstrable personal characteristics such as gender, age and ethnicity, as well as the less visible personal characteristics, such as competencies, needs and wants, work styles and character traits. Each employee has his or her own, unique combination of such characteristics. Another definition describes diversity as creating high performing organizations through valuing and using all the talents of employees of different groups. Regardless of how diversity is defined, it is an issue that is sweeping the nation. If the corporate society does not address the issue by learning how to manage diversity, they will fail. "It is very helpful to suggest that diversity is not so much an end in itself as it is a condition of our society and the condition of the World in which we live." Frank Wong Vice President for Academic Affairs University of Redlan.

Each and every individual is different from each other because of their different religion, educational background to which they belong, age and also the perception that forms there personality. When different types of people in terms of thinking, perception, generation come together to work at the same place then definitely a situation may come where all these different types of people may not agree at the same point. At that point of time it is going to affect the interpersonal relationship among people. The researcher has taken some aspects which are a part of diversity among workforce they are age, experience, professional qualification and interpersonal relationship among employees. On the basis of above statement, researcher has prepared the following model.



**Fig.1 Impact of Diversified Workforce on Productivity**

Any organization's main motive is to earn profit, for that management wants productive employees in their organization. For every organization, employees are considered as an asset

or resources, because they come with skills, knowledge, talent which is scarce in nature. Therefore organizations want to employ such manpower which is productive in nature and every organization wants optimum utilization of available resources. That is why the researcher wants to identify impact of workforce diversity on productivity. The researcher has chosen certain parameters of work force diversity like age, nowadays the government banks are creating new vacancies for young generation by introducing certain schemes like voluntary retirement scheme etc. Privatization is increasing at a fast speed therefore number of private banks is also increasing at a fast speed. Even youngsters are coming into private and public sector banks. Next parameters are employees' work experience and professional qualification. Today, the organizations are giving equal opportunities to fresher as well so that the management can infuse new blood with new ideas in their organization. Organizations specifically the banking sector is also hiring those people who are just graduate and fresher.

Gone were the days when the workplace was meant for males only, nowadays females are working in different sectors. Today, hiring diversified workforce is the very essence for every organization to compete in this cut throat competitive world regardless of their language, educational background, experience and geographical region which creates diversity at workplace and can affect their interpersonal relationship which is ultimately going to affect the productivity of an organization.

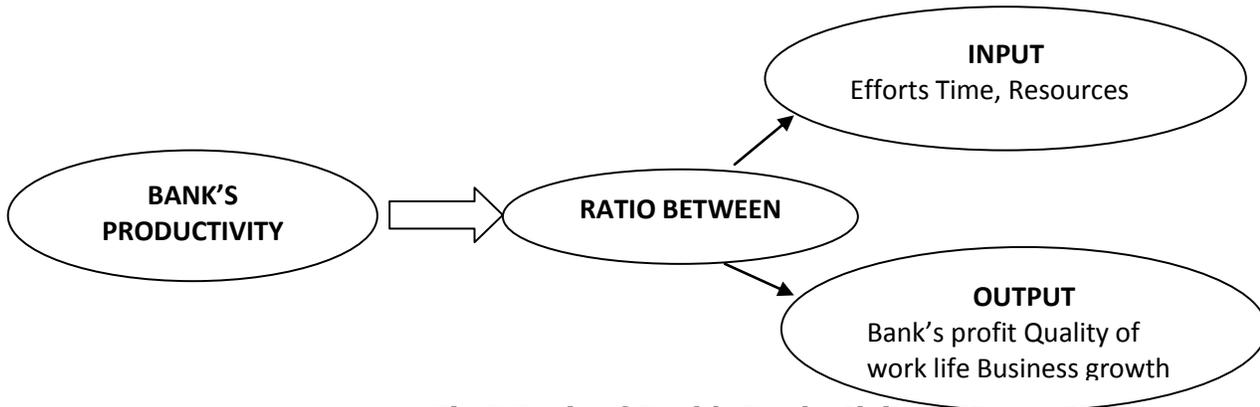
Cordial interpersonal relationship among the employees is one of the major ingredients for smooth functioning of an organization. Organization is a network of people who work together to achieve some common objective and if this network has some loopholes then it would be very difficult for any organization to achieve those objectives effectively.

Productivity shows whether the activity of an organization is efficient and effective. Though the terms like productivity, efficiency and effectiveness are used together and practicing sometimes alternate their meanings, however we must not identify productivity with efficiency and/or effectiveness. Productivity requires both efficiency and effectiveness, because a certain activity will not be productive if it is only efficient, but not effective, or effective, but not efficient. Productivity in economic position is defined as the relation between output and input. Input element in an organization consists of resources used in the product creation process, such as labour, materials, energy. Output consists of a given product, service and the amount of both. Service sector input elements such as materials, machines and energy are not as important as in manufacturing. The main element in service sector is labour because service sector is more personnel-intensive comparing to manufacturing. Output in manufacturing is measured by quantity units and boosted by increasing the amounts of production, its realization. Service sector output usually has no high values by the quantity aspect, therefore it is mostly increased by the attempt to provide higher quality services to the customer, seeking for better customer satisfaction.

## **SERVICE PRODUCTIVITY**

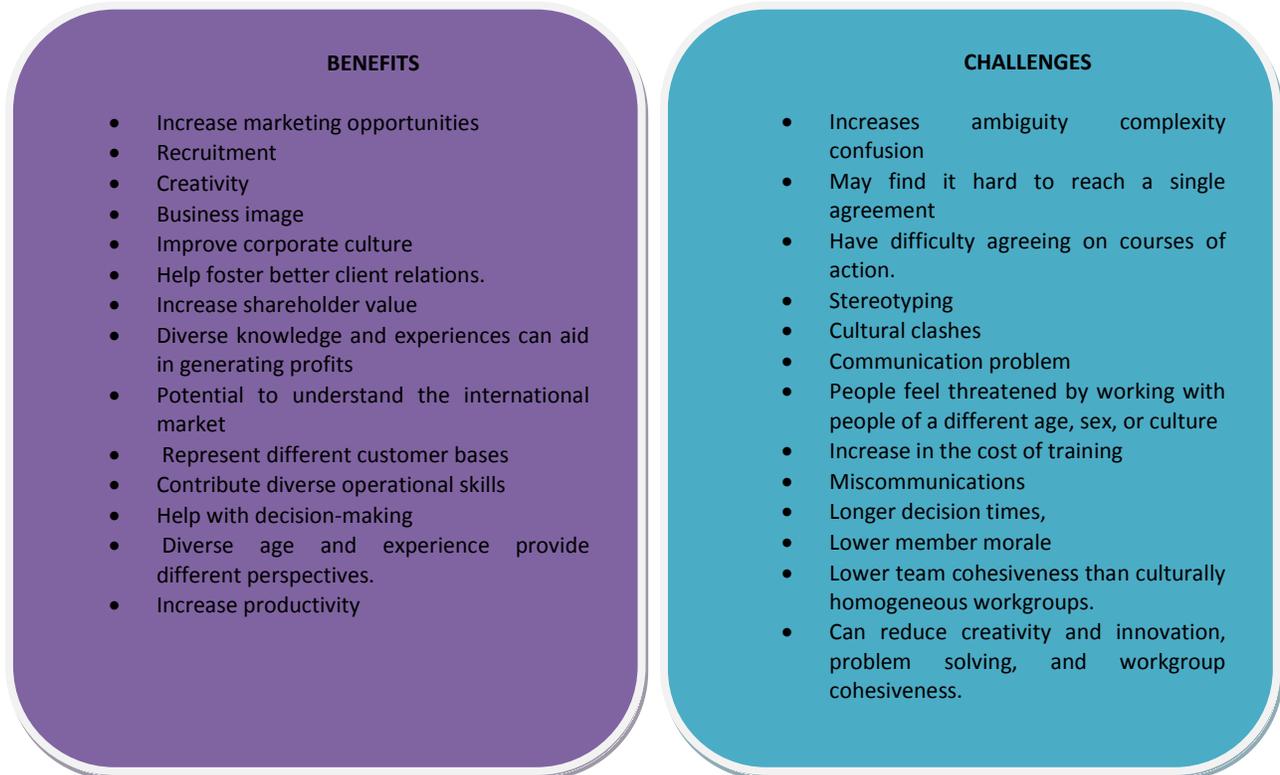
The amount of output per unit of input (labor, equipment, and capital), a measure of the efficiency of a person, machine, factory, system, etc., in converting inputs into useful outputs is known as productivity. There are many different ways of measuring productivity. For example, in a factory productivity might be measured based on the number of hours it takes to produce a good, while in the service sector productivity might be measured based on the revenue

generated by an employee divided by his/her salary. The researcher will measure the productivity on certain parameters. Since banks are service providers one cannot measure its productivity on the basis of number of hours spent by an employee or on the basis of production but we can set standards on the basis of banks' profit, business growth and quality of work. On the basis of above statement, researcher has prepared the following model.



**Fig.2 Basis of Bank's Productivity**

Majorly the bank's growth depends upon two things of banks, they are the deposits accepted from public and advances given by the bank. This is one of the instruments to measure the profitability of a bank because the main business of any bank is based upon deposits and advances made by bank.



**Fig.1.3: Benefits & challenges of Workforce Diversity**

## **Workforce Diversity in Banking Sector**

The rapid growth in the Banking industry has posed several challenges such as workforce diversity which is a natural phenomenon that has both negative and positive impacts on employee performance depending on how well it is managed. This has affected the commercial banks, Non-Banking Financial Institutions, and even the Micro-Finance sector.

The unprecedented growth of the Indian economy over the last few years portends well for the banking sector. That said, Indian banks need to address two key issues to maintain growth and profitability in the coming decade—financial inclusion and streamlining human resource management. Reinventing HR processes and acquiring and retaining quality talent is critical to addressing the imbalance that is being created by growth in the banking industry and rapid retirements in banks. New hires at the entry level, however, will require a wide-ranging knowledge, skills and the right attitude to make them 'job ready'.

### **REVIEW OF LITERATURE**

This study tries to assess the impact of diversity on productivity of the organization. The various findings of past researches were of great help for the researcher to sort out the different factors to be used in the study. This review also helped in finding out the differences between the past researches and the current research on the same topic. Let us look at glance on the earlier researches.

**Saumya Goyal (Aug 2009)** depicted four models to understand the dimension of diversity they are diversity wheel in this model the author has classified the model into two dimensions first is primary which includes age, gender, mental/ physical abilities, race, ethnic heritage, sexual orientation and the secondary dimension includes geographic location, work experience, income, religion, first language, organizational role and level, communication style, family status, work style, education, military experience. Next model is four layers of diversity in this the author adds on two more layers with the diversity wheel they are personality at the core and external dimension includes work field, division, seniority, work location, union affiliation, management status, organizational dimensions. Third model is diversity iceberg in this the author adds one more dimension in diversity wheel which is tertiary dimensions like beliefs, assumptions, perceptions, attitude, values, group norms. And the last model is kaleidoscope perspective of the individual in this the author has described various attributes like age, region, gender, qualification, caste, family status.

**Milliken and Martins (1996)** opines that diversity appears to be a double-edged sword, increasing the opportunity for creativity as well as the likelihood that group members will be dissatisfied and fail to identify with the group. **McGath, Berdahl & Arrow (1995)** conceptualized workplace diversity by developing a five cluster classification. This often cited categorization is as follows: demographic characteristics such as age, ethnicity, gender, sexual orientation, physical status, religion and education; task-related knowledge, skills and capacities; values, views and attitudes; personal, cognitive and attitudinal styles; Status in the organization such as one's hierarchical position, professional domain, departmental affiliation and seniority. **Sharbari Saha, Dewpha Mukherjee Patra (2008)** focused over the

requirements due to globalized market and benefits of workforce diversity further they said that if the organization is not employing the diversified workforce then that organization is not competitive enough and the sales managers can make their diversified workforce effective and competent by providing them training. **Asmita Jha (2009)** reviewed that the most important asset of any organization is diversified workforce because the diversified workforce is good at problem solving as they provide different and creative ideas and gives competitive advantage to the organization. Further the author focused over making the workforce happier by proper understanding of the expectations and needs of each individual. **Emiko Magoshi A, Eunmi Chang (2008)** discussed that diversity management is an important issue in current scenario due to increasing globalization. In order to make these diversified employees as competitive resources the organizations have to manage them effectively. Further the authors have concluded by saying that if the organizations will focus over managing the diversified employees then the employees will become more committed. **Josh Greenberg (2004)** defined the workforce diversity as a variety of differences between people in an organization. The diversified workforce in an organization affects interactions among the employees because diversity not only involves how people perceive themselves but how they perceive others. The author further says that the organizations employing diversified workforce faces lot of challenges like communication problem, resistance to change among employees, implementation of diversity in the workplace policy, successful management of diversity in the workplace etc but the organizations also enjoys certain benefits like larger pool of ideas and experiences, variety of solutions to problem in service, sourcing and allocation of resources. **Janice R.W. Joplin and Catherine S. Daus (1997)** emphasizes that various companies are focusing over capitalizing the skills of a diverse workforce but they have to face many challenges like diverse opinion, lack of empathy, differences in perception, lack of participation. Further the author has concluded that these challenges can be faced by effective leadership style instead of implementing traditional methods.

**Jeffery Sanchez-Burks and Michal E. Mor Barak (2005)** have discussed one's perceptions, values, and behavior in such situations reflect deep-seated beliefs about the nature of interpersonal work relationships. He further emphasized that to understand and manage these differences requires understanding the nature of cultural diversity and how it influences relational and communication styles. **Ashok Chanda (Dec 2006)** says that workforce diversity is a hot and burning issue in every organization of current scenario. Every human resource manager has to take care in managing this diversity and finally he concluded that there is a lack of awareness towards diversity management approach, the manager don't have sufficient knowledge and competency to manage diversified workforce. **K Mallikarjunan (2007)** in this the author is saying that each and every individual is different, everybody is having their own perception, attitude and thoughts and to manage such type of different individuals require a specific skill because of the complexities involved in this process. **Radha Mohan Chebolu (2007)** in this article the author says that the culturally diversified workforce is really competent but to manage such a talent is not an easy task it requires such a leader that have an organizational vision and an attitude that are line in culture. **Arpita Saha (2007)** stated that due to the increased globalization the world is shrinking day by day. Hence the organizations have to recruit cross cultural employees but it is very difficult for the employees to adapt and adjust with a new environment and culture. At this point of time a manager can play a very important role like a leader by providing the employees with training, interactive sessions so that they come to know about the rituals, dressings, mannerisms, food habits of different

people. **Hall and Parker (1993)** stated that good workforce diversity practices in the area of human resources are believed to enhance employee and organizational performance. Diversity brings the value of different employee perspectives and varied types of contribution especially when organizational members increasingly reflect the diverse custom base of the organization. This provides a way in which organizations can understand, and therefore meet, their customer needs. Following the same line of argument, **Allen and Montgomery (2001)** say that for an organization to succeed, its strategies must consist of managing change, establishment of appropriate diversity management policies and procedures and target diversity related competencies. **Hayles and Mendez (1997)** this study shows a strong correlation between good diversity practices and profits as diversity allows increased creativity, a wider range of perspectives, better problem definition, more alternatives and better solutions. Managing workforce diversity refers to a comprehensive managerial process for developing an environment that works for all employees. **Fernandez (1993)** argues that good workforce diversity practices in the area of human resources are believed to enhance employee and organizational performance. This is because managing diversity involves leveraging and using the cultural differences in people's skills, ideas and creativity to contribute to a common goal, and doing it in a way that gives the organization a competitive edge.

## **RESEARCH METHODOLOGY**

The researcher did this research among the banking sectors in Agra, whether the differences like age, qualification, employees' work experience and interpersonal relationship among the employees are going to affect the productivity of the organization.

The researcher will find out the advantages and disadvantages faced by the organization and problems faced by employees due to these differences.

Removal of challenges and problems faced by organization and employees: The another main motive of this research is to suggest counseling & mentoring techniques that can help removing the problems like absenteeism, employee turnover due to diversified workforce from organizations.

## **RESEARCH OBJECTIVES**

- To find out the impact of age on productivity.
- To find out the impact of employee work experience on productivity.
- To determine the impact of professional qualification on productivity.
- To find out the impact of interpersonal relationship among the employees on productivity.
- To determine the impact of workforce diversity on productivity of organization.

## **NEED OF THE STUDY**

Managing diversity in the workplace should be the concern of every organization. In order to survive, a company needs to be able to manage and utilize its diverse workplace effectively. Failure to manage diversity in terms of race, gender, level of education, profession, ethnic affiliation, religious affiliation often leads to differences in promotions, pay, training, turnover, mutual acceptance, job satisfaction and other forms of inequality (Tilly, 1998; Reskin, 2003).

Due to the rapid expansion of the bank nationally and even internationally, there has been an increase in the diversity of the employees and managers within the bank. These employees and managers have varied worldviews, perceptions, culture and these can only be successfully tapped to the advantage of the bank, if there is an effective workforce diversity management strategy in place. Various researchers studying diversity in the workplace have consistently found that organizations that emphasize collectivism in the work environment see more benefits of workplace diversity than organizations that emphasize individualism (Dwyer, et al., 2003). Jayne and Dipboye (2004) in their research also found out that some diversity management strategies such as emphasis on teamwork fosters better relationships within a department and can promote identity within the department or organization that moves beyond surface level differences. This study aims at filling up knowledge gaps identified in previous studies by establishing the effects of workforce diversity management on employee performance in the banking industry in Agra.

The findings of the study are of great significance in offering guidelines to address the current challenges in Human Resource Management and Development and ultimately enhance employee performance in organizations. The research is helping the managers by expanding the literature in the management of workforce diversity to improve employee performance for competitive advantage of their various organizations. It also enables practicing Human Resource Managers in the Bank to remain relevant amidst the contemporary challenges by putting in place programmes for managing workforce diversity and employing strategies for management of workforce diversity in their organizations to get better employee performance. To the researchers, it poses a challenge to be proactive in the search for solutions to the contemporary HRM challenges and also enrich the limited body of knowledge on workforce diversity. This study also provides benefit to the Bank by improving the benefits from unity in diversity, be it in terms of knowledge, cultural, gender, racial among others. This includes improvement of employee performance and consequently, the overall performance of the organization. The research shall benefit the employees in terms of improved interpersonal relationships, mutual understanding, and mutual acceptance of each other regardless of the various differences.

### **SCOPE OF THE STUDY**

The study covered the bank's branches in Agra specifically, whose zonal offices lie in Agra and not other branches or other commercial Banks. The study tackled areas of workforce diversity, effects of diversity on employee performance and how workforce diversity can be managed so as to maximize the positive outcomes and minimize the negative outcomes. The respondents were the managers and employees of the Bank. There was some resistance from some of the respondents to participate in the research and also some respondents failed to bring back the questionnaires for the researcher in good time. Some sampled members, especially managers, had no time for attending to all the items in the Questionnaire to their tight schedule or high work-load. All these were taken into consideration and alternative measures taken.

### **STATEMENT OF THE PROBLEM**

So keeping all these things in mind this study of finding out whether the differences are going to affect the productivity of the organization. The study will be conducted among the banking sector of Agra. The main consent of our research is to find out the impact of workforce diversity

on the productivity of the organization. According to the previous researches being done in this area, the problem still exists. To find out the actual causes to this problem the researchers have conducted a survey in the banks whose zonal office lie in Agra and also the branches govern by that zonal office and collected the data through various projective techniques. Finally the researcher have suggested various methods and counseling techniques for managing the problems faced by the employees due to diversified workforce.

## **RESEARCH DESIGN**

Multi stage stratified random sampling technique is used for selecting the respondents in the present study. Agra region will be selected purposely in the first stage as it is convenient to the researcher. Agra region consist of 8 regional offices, all the offices were included in the present study in the second stage. All the regional office consist of 10-20 branches in Agra city, out of these branches five branches of each bank were selected randomly in the third stage and each selected branch will consist of 12-15 employees. Out of these employees of the selected branch of each bank, 50% were selected randomly in the 4<sup>th</sup> stage. Thus about 250 employees will be the unit of information in the presentation. (See Annexure I, Selection of sample)

## **DATA COLLECTION**

1. **Primary Data Source**-> Questionnaire & Interviews. The researcher has prepared questionnaire for employees.
2. **Secondary Data Source**-> HR Journals, Magazines, Books, Past Database provided by the institutions & Internet.

- **Techniques to be used**-> Projective techniques, Depth interviews, Group interviews; Mass observation, Attitude Scales and further appropriate effective tools were used.

## **SAMPLING DESIGN**

My research is qualitative in nature rather than rigorously quantitative in nature as it will be based on human behavior. The research was Exploratory in nature as it is focused on exploring human behavior, whether the factors like age, experience, professional qualification and interpersonal relationship among the employees are going to affect the productivity of the organization. The researcher has selected the region of Agra, U.P. The researcher has selected 8 public sector banks whose zonal offices are located in Agra and the branches govern by their zonal offices. The list of those banks is as follows:-

- Canara Bank
- Punjab National Bank
- Allahabad Bank
- State Bank of India
- Bank of India
- Syndicate Bank
- Central Bank
- Union Bank

The sampling method used in the study was Stratified Random Sampling. I have selected a number of employees from each bank.

## HYPOTHESIS TESTING

- Ho1: There is no significant relationship between age of employees and productivity of an organization.
- Ho2: There is no association between qualification and productivity of employees
- Ho3: There is no significant relationship between experience of employees and productivity of the organization.
- Ho4: There is no significant relationship between interpersonal relationship among the employees and productivity of an organization.
- Ho5: There is no association between workforce diversity and productivity of the organization

### OBJECTIVE 1: To find out the impact of age on productivity

**Ho1:** There is no significant relationship between age of employees and productivity of an organization.

**Table 1: Coefficients(a)**

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	54.199	1.247		43.459	.000
	Age	2.923	.477	.362	6.122	.000

a Dependent Variable: productivity

Present the regression equation is:

$$\text{Productivity} = 54.199 + 2.923 (\text{Age})$$

The Coefficients table gives us the values for the regression line. Basically in the (Constant) row the column B provides us with our intercept - this is where  $X = 0$ . In the Age standard marks row the B column provides the gradient of the regression line which is the regression coefficient (B). This means that for every one standard mark increase in age score the model predicts an increase of 2.923 standard marks in productivity score. Notice how there is also a standardized version of this second B-value which is labelled as Beta ( $\beta$ ). Now we can say productivity is 2.923 times dependent on age and add to the value ie constant 54.199. Therefore we can say if age is increasing than productivity is also increased.

**Ho:** There Is No Significant Difference between the Variance of Two Factors Age and Productivity

### Univariate Analysis of Variance (ANOVA)

**Table 2: Tests of Between-Subjects Effects**

Dependent Variable: Productivity

	<b>Sum of Squares</b>	<b>Df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Between Groups	3418.558	3	1139.519	13.585	.000
Within Groups	20633.958	246	83.878		
Total	24052.516	249			

If F sig. value in the ANOVA Table is less than .05, we reject our null hypothesis (at 95% confidence level) that the category of age has significant impact on productivity. From the output table for the one way ANOVA, we see that the probability value of F is .000. Therefore, we reject our null hypothesis and we can say that the different age group employees have different efficiency of productivity.

### OBJECTIVE 2: To determine the impact of professional qualification on productivity

**Ho2.** There is no association between qualification and productivity of employees:

**Table 3: Chi-Square Tests**

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	138.993(a)	72	.000
Likelihood Ratio	128.611	72	.000
Linear-by-Linear Association	1.439	1	.230
McNemar-Bowker Test	.	.	.(b)
N of Valid Cases	250		

a 94 cells (84.7%) have expected count less than 5. The minimum expected count is .02.

b Computed only for a PxP table, where P must be greater than 1.

**Table 4: Symmetric Measures**

		Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Nominal by	Contingency	.598			.000
Nominal	Coefficient				
Interval by	Pearson's R	-.076	.057	-1.201	.231(c)
Interval					
Ordinal by	Spearman	-.116	.057	-1.842	.067(c)
Ordinal	Correlation				
N of Valid Cases		250			

a Not assuming the null hypothesis.

b Using the asymptotic standard error assuming the null hypothesis.

c Based on normal approximation.

In this case the Chi square calculated value 138.99 is greater than the tabulated value of chi square, so we reject our null hypothesis at 5% level of significance (95% confidence interval). The Chi square test revealed the significant association between the qualification of employees and their productivity. From the chi square test output table we see that a significant level of .000.(Person's) has been achieved. This means the chi square test is showing a significant association between the above two variables. Thus we conducted that, The Qualification of the Bank Employees and Their Performance are associated significantly with each other.

The contingency coefficient gives us the measures of strength of the output. If the values close to 0, there is no strong correlation between the two variables. However, if the value ranges between 0.5 and 1, there exists a strong correlation. From the above table, we can therefore conclude that there exists a strong correlation between the independent variable (Qualification) and the dependent variable (productivity) because the contingency coefficient between the variables is 0.598.

**OBJECTIVE 3: To find out the impact of employee work experience on productivity**

**Ho3:** There is no significant relationship between experience of employees and productivity of the organization.

**Table 5: Coefficients(a)**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta	B	Std. Error

1	(Constant)	55.442	1.175		47.191	.000
	Duration of service	2.591	.478	.326	5.424	.000

a Dependent Variable: productivity

Present the regression equation is:

$$\text{Productivity} = 55.442 + 2.591 (\text{Work Experience})$$

The Coefficients table gives us the values for the regression line. Basically in the (Constant) row the column B provides us with our intercept - this is where  $X = 0$ . In the Age standard marks row the B column provides the gradient of the regression line which is the regression coefficient (B). This means that for every one standard mark increase in work experience score the model predicts an increase of 2.591 standard marks in productivity score. Notice how there is also a standardized version of this second B-value which is labeled as Beta ( $\beta$ ). Now we can say productivity is 2.591 times dependent on work experience and add to the value i.e. constant 55.442. Therefore we can conclude that if work experience increases then productivity also increases.

**Ho:** There Is No Significant Difference between the Variance of Employees' Experience and Productivity

### Univariate Analysis of Variance (ANOVA)

Dependent Variable: productivity

**Table 6: Tests of Between-Subjects Effects**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2705.929	3	901.976	10.394	.000
Within Groups	21346.587	246	86.775		
Total	24052.516	249			

From the output table for the one way ANOVA, we see that the probability value of F is .000. Therefore, we reject our null hypothesis and concluded that there is a significant difference among the variance of experience group and factors of productivity. So we can say the productivity of fresher employee and experienced employees are different.

### OBJECTIVE 4: To find out the impact of interpersonal relationship among the employees on productivity

**Ho4:** There is no association between interpersonal relationship and productivity.

**Table 7: Coefficients(a)**

Model	Unstandardized Coefficients	Standardized Coefficients	T	Sig.
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		B	Std. Error	Beta	B	Std. Error
1	(Constant)	17.586	4.211		4.176	.000
	interperson	1.401	.135	.550	10.378	.000

a Dependent Variable: productivity

Present the regression equation is:

$$\text{Productivity} = 17.586 + 1.401 (\text{Interpersonal relationship})$$

Which is the regression coefficient (B) this means that for every one standard mark increase in interpersonal relationship score the model predicts an increase of 1.401 standard marks in productivity score. Notice how there is also a standardized version of this second B-value which is labeled as Beta ( $\beta$ ). Now we can say productivity is 1.401 times dependent on interpersonal relationship and add to the value i.e. constant 17.586. So we can say if interpersonal relationship among the employees are cordial than productivity also improves.

**OBJECTIVE 5: To determine the impact of workforce diversity on productivity of organization.**

**Ho5:** There is no association between workforce diversity and productivity of the organization

**Table 8: Coefficients(a)**

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	9.914	4.665		2.125	.035
	Diversity	2.571	.234	.573	11.009	.000

a Dependent Variable: productivity

Present the regression equation is:

$$\text{Productivity} = 9.914 + 2.571 (\text{Workforce Diversity})$$

Which is the regression coefficient (B) this means that for every one standard mark increase in Workforce Diversity score the model predicts an increase of 2.571 standard marks in productivity score. Notice how there is also a standardized version of this second B-value which is labeled as Beta ( $\beta$ ). Now we can say productivity is 2.571 times dependent on Workforce Diversity and add to the value i.e. constant 9.914. Thus we can say that if diversified workforce increases than productivity also increases.

**Ho: There Is No Significant Difference between the Variance of Diversified Workforce and Productivity**

**Univariate Analysis of Variance (ANOVA)**

**Table 9: Tests of Between-Subjects Effects**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	14521.918	4	3630.479	93.328	.000
Within Groups	9530.598	245	38.900		
Total	24052.516	249			

Dependent Variable: productivity

From the output table for the one way ANOVA, we see that the probability value of F is .000. Therefore, we reject our null hypothesis and concluded that there is significant difference among the variance of diversified workforce and factors of productivity. We can say there is impact of work force diversity on productivity.

### **CONCLUSION**

The findings were summarized in order of the research questions of the study finally followed by the hypotheses. The study focused on only four diversity dimensions- age, experience, professional qualification and interpersonal relationship among the employees which may have limited the robustness of this research. As companies are becoming more and more diverse it's becoming more and more crucial for companies to understand and manage it.

The results show that the age of the bank employees and their performance are associated significantly with each other. If we talk about the banking sector of Agra, the productivity of employees is increasing slightly with the increase in age which is a bit different result from usual studies but if we go into the depth, the employees whose age is above 50 are considered as experienced and are very much effective in client handling. But if we talk about the bank's work which is related with physical activeness, youngsters are much more contributing towards the bank's productivity.

The qualification of the bank employees and their performance are associated significantly with each other. From the frequency distribution we can see that majority of the bank employees are post graduate which clearly indicates that nowadays banks are hiring qualified persons for the sake of organization's productivity.

There exists a strong correlation between the independent variable (Work experience) and the dependent variable (productivity). Thus we concluded that, the working experience of the bank employees and their performance are associated significantly with each other. The experienced employees very well know how to work effectively and efficiently, how to handle the clients, work pressure and peer pressure and that is why are much more productive.

Another variable is interpersonal relationship. Effective workplace relations are critical to our productivity and ultimately our job performance. We have relationships with our coworkers, supervisors, managers or employees. Regardless of the position, successful relationships at work will make us more effective. We are all responsible for different parts of the process, but we all need our business to succeed. Frustration often occurs in our job. Conflicts with coworkers, supervisors, managers and employees add stress to our lives every day. Our relations at work contribute directly to our job satisfaction. It is important to focus on the interpersonal process at work to be as effective as possible. Although many variables affect our

workplace, we are accountable to create a productive environment. We spend a large portion of our lives at our places of work. If put forth the effort to use our interpersonal skills, effective communication, prevent conflict and resolve conflict, we will be more productive at work. We will also reduce the amount of stress created in the workplace resulting in greater job satisfaction. We will always have stress at work. Not everyone will commit to building successful relationships at work. Some will actually try to create conflict. One thing is certain. If you make the effort it will bring value to your relationships at work. So there is a significant difference between interpersonal relationship and productivity.

There is a strong correlation between the independent variable (Workforce diversity) and the dependent variable (productivity). Thus we concluded that, Bank employees Workforce diversity and Their Performance are associated significantly with each other. This shows that the organizations are channelizing the various positive aspects of employees which are due to hiring diversified workforce. Various researches also say that due to the increased globalization the world is shrinking day by day. Hence the organizations have to recruit cross cultural employees but it is very difficult for the employees to adapt and adjust with a new environment and culture. At this point of time a manager can play a very important role like a leader by providing the employees with training, interactive sessions so that they come to know about the rituals, dressings, mannerisms, food habits of different people. Recent studies have also shown a strong correlation between good diversity practices and profits.

## **MANAGERIAL IMPLICATIONS**

It is really a big matter of concern for all HR professionals as one side we say that we should include new trends in HR policies and on the other hand, the latest trend like workforce diversity is treated as a problem. However, this problem can be solved by adopting various policies like encouraging the use of common language in the organization among the employees, by conducting various motivational and mentorship programs, by keeping the channels of communication open among the employees and employers, by encouraging employee participation. Further one should accept the fact it is not the matter of culture in fact it is the matter of quality. Therefore, quality has to be maintained and not thrown out.

As per the research, sourcing people from a diverse background is an essential part of a successful employment strategy. Workers who vary in age, gender, ability, sexual orientation, socioeconomic background or culture, ethnicity and language make a positive contribution to an organization's workforce; they are an asset to company culture and bottom line. And a diverse workforce brings innovation and creative solutions to an organization "outside the box" An effective corporate diversity program is a powerful way to gain competitive advantage and stand apart from your competitors.

After considering all the findings in the research it becomes a compulsion for the researchers to suggest, the ways to handle the shortcomings found during the survey.

- The very first variable is age. Research shows that the organizations must hire employees of different age because if younger generation works with full enthusiasm and activeness then the senior employees are also contributing towards effective client handling.
- As far as the qualification is concerned, organizations must hire the qualified employees so that they can help in increasing productivity.

- Next variable is experience of employees, research shows that the experienced employees positively contribute towards the productivity of organization. Because they better understand the organization and can very well handle the work and peer pressure.
- Organization is a network of people and generally an employee spends his/her maximum duration at workplace. At workplace we have to interact with human beings who are in the form of superiors, coworkers or juniors. And it is a fact that each and every individual is different from one another in terms of perception, attitude, thoughts, likes and dislikes. Therefore frustration or conflicts may occur and that is why interpersonal relationship among employees plays an important role in the smooth functioning of organization. Research shows that if the employees are satisfied at their workplace and are having cordial and harmonious relations with other employees, they can contribute positively towards the productivity of an organization.

If we talk about the diversified workforce, results show that employing diversified workforce in an organization helps in increasing the productivity because nowadays organizations treat their employees as assets as they bring skills, knowledge, abilities, vision along with them. People have a lot of viewpoints and having people from many backgrounds and places in life brings a lot of those viewpoints into the mix.

Organizations' will break down barriers, using the information and experience that a diverse hires bring. Organizations' will be able to attract a new customer base. Various other advantages of having a diverse workforce are it helps motivating employees, it enhances the innovation and creativity of employees, it helps in reducing cost. It creates flexibility in the organization. Immediate access to problem solving, easy transfer of knowledge, better marketing structure, Innovative work environment, immediate outcomes, Fulfillment of social responsibility. It helps attract and retain employees.

The most successful companies have successfully integrated workforce diversity into their corporate vision. They provide mentorship, networking and career development opportunities. They create, update and execute regular inclusiveness training. They establish in-house diversity councils and committees, and assign leadership roles. They target for hire those diverse groups in which their research shows they are lacking. And they adapt their interviewing and hiring criteria as necessary to ensure opportunities are available to everyone.

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### Selection of the sample

Annexure-I

250 employees will be the unit of information in the presentation excluding clerk & peons.

State (U.P.) No. of districts (76)

Selected district Agra, consist of 8 regional offices

Regional office	Selecte d regiona l offices	Branche s in Agra	Selected Branches	No. of employee s	Selected employees 50%
<b>Canara Bank</b>	1	24	05	70	35
<b>Punjab national bank</b>	1	27	05	70	35
<b>Bank of India</b>	1	14	05	50	25
<b>Allahabad Bank</b>	1	11	05	60	30
<b>Syndicate Bank</b>	1	09	05	50	25
<b>Central bank of India</b>	1	24	05	70	35
<b>Union bank of India</b>	1	14	05	60	30
<b>State bank of India</b>	1	55	05	70	35
<b>Total</b>	8	251	40	500	250

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Annexure-II

I would like to inform you that the aim of the proposed study is to understand the impact of diversified workforce on productivity in your esteemed organization.

The data which is being collected will be exclusively used for my research work only and will not be divulged to another person or organization. Please tick (✓) in front of the correct option.

**Age:** a) 20-30    ↑    b) 30-40    ↑    c) 40-50    ↑    d) 50-60    ↑

**Gender:** M / F

**Qualification:** a) Intermediate    ↑    b) U.G.    ↑    c) P.G.

↑

**Designation:**

**Duration of service (in yrs):** a) 0-10    ↑    b) 10-20    ↑    c) 20-30    ↑    d) 30-40    ↑

**Marital Status:** Married / Unmarried

**Mother tongue:** a) Hindi    ↑    b) English    ↑    c) Any other (plz specify)    ↑

**Tenure of staying in Agra:**

a) 0-5    ↑    b) 5-10    ↑    c) 10-15    ↑    d) 15-20    ↑    e) 20 & above    ↑

**Region you belong**

a) Eastern India    ↑    b) Western India    ↑    c) Northern India    ↑    d) Southern India    ↑

**Region your colleagues belong to**

a) All of them are natives of U.P.

↑

b) Majority of them are from U.P. and some of them are from other N. Indian States

↑

c) Majority of them are from N. India and some of them are from South also

↑

d) Majority of them are from N. India and remaining are from other parts of India apart from South †

**Language of communication**

a) Hindi †      b) English †      c) Urdu †      d) Punjabi    †      e) Any other please specify    †

**DIVERSITY**

<b>Statements</b>	<b>Strongly agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
I do not prefer to go back to my home region to settle down in my job					
I do not feel any communication problem at my workplace					
I feel that all the employees of different gender are treated equally					
I have not been discriminated on the basis of professional qualifications with my peer group					
I think that I have not been discriminated as regard to my gender					

**INTERPERSONAL RELATIONSHIP**

<b>Statements</b>	<b>Strongly agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
In some situations I do not feel some differences in					

the thoughts and perceptions of me and my colleagues					
I would like to visit all of my colleagues personally					
I have similar relations with all of my colleagues					
All of my colleagues share similar relations with each other					
I have an equal repo with all of my colleagues					
I would not like to work with some selected colleagues					
I feel comfortable in helping all of my colleagues equally in their task					
All of my colleagues helps me equally in my task					

## PRODUCTIVITY

<b>Statements</b>	<b>Strongly agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
Performance appraisal in the organization is not affected by the age of employees					
Performance appraisal in the organization is not affected by the seniority of employees					

Workforce diversity helps in increasing the productivity of an organization					
My job is very challenging and provides me opportunity to use my full potential					
My job requires the use of a variety of skills					
After finishing my day's work, I feel that I have done something meaningful					
There is direct linkage between work performances and rewards such as pay increase, promotion etc.					
The work environment is such that I like to put extra efforts even after office schedule					
The organization provides training and development facilities to all personnel according to their needs					
The organization encourages creativity and innovation in work performance and participation in decision making on issues related to my work.					
I do not feel exhausted after accepting 80 deposits in a day					
I do not feel exhausted after submitting 80 payments in a day					
I do not feel exhausted after submitting 2 advances in a day					
I do not feel exhausted after					

giving 5 advances in a day					
I do not feel exhausted after dealing 5 clients for insurance in a day					
I can deal a customer effectively in 10 min					
I do not feel exhausted after selling 4 gold coins in a day					
I do not feel exhausted after opening 4 demat accounts in a day					
I do not feel exhausted after operating 8 lockers in a day					

### OPEN-ENDED QUESTIONS

Which changes would you prefer at workplace related to diversified workforce?

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How frequent would you like to visit your colleagues personally after working hours?

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How frequent do your colleagues also visits your home with their family?

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If you do not have equal repo with all of your colleagues plz give reasons

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If you would like to work with some selected colleagues only (give reasons)

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# **RULE BASED LEARNING INTRUSION DETECTION SYSTEM USING KDD AND NSL KDD DATASET**

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## **ABSTRACT**

*With the rapid expansion of computer networks during the past few years, security has become a crucial issue for modern computer systems. A good way to identify malicious use is through monitoring unusual user activity. To identify these malicious activities various data-mining and machine learning techniques have been deployed for intrusion detection. The manual tuning process required by current systems depends on the system operators in working out the tuning solution and in integrating it into the detection model. This paper proposes RULE LEARNING Intrusion Detection System (RLIDS) to make tuning automatically. The key idea is to use the binary SLIPPER as a basic module, which is a rule learner based on confidence-rated boosting. This system is evaluated using the NSL KDD intrusion detection dataset. An experimental result shows the RLIDS system with SLIPPER algorithm gives better performance in terms of detection rate, false alarm rate, total misclassification cost and cost per example on NSL-KDD dataset than that of on KDD.*

**Keywords-Intrusion, Attacks, Misuse Detection, Anomaly Detection, False Prediction, Confidence Value, Tuning.**

## **I. INTRODUCTION**

Attacks on network infrastructure presently are the threats against network and information security [1]. With rapidly growing unauthorized activities on the network, Intrusion Detection System (IDS) is very necessary because traditional firewalls cannot provide the complete security against the intrusion. Intrusion Detection (ID) is an active and important research area of network security. The goal of Intrusion Detection is to identify all the true attacks and negatively identify all the non-attacks [2].

The goals of the IDS provide the requirements for the IDS policy. Potential goals includes [3, 4]

- Detection of attacks
- Prevention of attacks
- Detection of policy violations
- Enforcement of use policies
- Enforcement of connection policies
- Collection of evidence

The rest of this paper is organized as follows. Section **II** covers the related work in IDS. Section **III** describes proposed work in briefly. Section **IV** includes datasets used in RLIDS and experimental results and finally, this paper ends with concluding remarks in section **V**.

## **II. RELATED WORK**

Sabhnani and Serpen et al. [5] built a multiclassifier system using multilayer perceptrons, K-means clustering, and a Gaussian classifier after evaluating the performance of a comprehensive set of pattern recognition and machine learning algorithms on the KDDCup'99 dataset. This paper evaluates performance of a comprehensive set of pattern recognition and machine learning algorithms on four attack categories as found in the KDD 1999 Cup intrusion detection dataset. Results of simulation study implemented to that effect indicated that certain classification algorithms perform better for certain attack categories. A specific algorithm specialized for a given attack category. The TMC of this multiclassifier system is 71 096, and the cost per example is 0.2285. However, the significant drawback of their system is that the multiclassifier model was built based on the performance of different sub classifiers on the test dataset.

L. Khan and et al. [6] proposed an approach with a scalable solution for detecting the various attacks and anomalies. For classification of attack they used Support Vector Machines (SVM). The approach was compared with the Rocchios Bundling technique and random selection in terms of accuracy loss and training time gain using a single benchmark real data set. Accuracy rate of this SVM + DGSOT is the best for DOS type of attack, which is 97% and it is better as compared to pure SVM. FN is lowest (3% for DOS) for SVM + DGSOT and FP rate is as low as pure SVM (2%). Whereas for U2R type of attacks the performance is poor. In this case the accuracy is found only 23% with FP 100% and FN 76%.

Tsong and et al. [7] introduced a three-tier architecture of intrusion detection system which consists of a blacklist, a whitelist and a multi-class support vector machine classifier. They designed a three-tier IDS based on the KDD'99 benchmark dataset. Thus to build a blacklist at the first tier and a whitelist at the second tier. Then they used one against one multiclass SSVMs classification method at the third tier to classify those anomalies detected by whitelist into the four attack categories. The detection performance was found up to 94.71% and the false alarm rate was only 3.8%. They concluded that their results are better than those of KDD'99 winner's.

Weiming Hu and et al [8] proposed an intrusion detection algorithm based on the AdaBoost algorithm. The discrete AdaBoost algorithm was selected to learn the classifier. In their algorithm, they selected decision stumps as weak classifiers. By using algorithm False alarm rate ranges from 0.31-1.79% with detection rate 90.04%-90.88% as compared to Genetic Clustering method giving 0.3% false alarm rate with detection rate as 79%. and RSS-DSS method giving 0.27%-3.5% false alarm rate with detection rate varying from 89.2% to 94.4%.

Agarwal and Joshi [9] proposed an improved two stage general-to specific framework (PNrule) for learning a rule-based model and developed a new solution framework for the multi-class classification problem in data mining. The method is especially applicable in situations where different classes have widely different distributions in training data. They applied the technique to the Network Intrusion Detection Problem (KDD-CUP'99). The proposed model consists of positive rules (P-rules) that predict presence of the class, and negative rules (N-rules) that predict absence of the class. For multiclass classification, a cost-sensitive scoring algorithm was developed to resolve conflicts between multiple classifiers using a misclassification cost matrix, and the final prediction was determined according to Bayes optimality rule. The TMC is 74 058, and the cost per example is 0.2381 when tested on KDDCup'99 dataset.

Amit Kumar Choudhary and et al [10] proposed a neural network approach to improve the alert throughput of a network and making it attack prohibitive using IDS. For evolving and testing

intrusion the KDD CUP 99 dataset were used. They proposed the Generalized Regression Neural Network (GRNN) paradigm as an alternative to the popular Back propagation training algorithm for feed forward neural networks. The promising results of the present study shown the potential applicability of ANNs for developing high efficiency practical IDSs. This Neural Network model solved normal attack attack patterns, and the type of the attack. When given data was presented to the model, the results obtained revealed a great deal of accuracy app. 100%.

Stefano Zanero and et al. [11] proposed a novel architecture which implements a network-based anomaly detection system using unsupervised learning algorithms. They described how the pattern recognition features of a Self Organizing Map algorithm can be used for Intrusion Detection. Their final goal was to detect intrusions, separate packets with anomalous or malformed payload from normal packets The prototype was ran over various days of the 1999 DARPA dataset. A 66.7% detection rate with as few as 0.03% false positives was obtained. The detection rate was maximum up to 88.9% for threshold 0.09% with a false positive rate 0.095%.

Zhenwei YU and et al. [12]. They presented an automatically tuning intrusion detection system, which controls the number of alarms output to the system operator and tunes the detection model on the fly according to feedback provided by the system operator when false predictions are identified. The system was evaluated using the KDDCup'99 intrusion detection dataset. They proposed an adaptive and automatically tuning intrusion detection system, ADAT: Here, a prediction filter is used to push only the most suspicious predictions to the system operator to be verified.. Second, the system tunes the detection model when false predictions are identified and adjusts the tuning strength based on monitoring the performance of the detection model on earlier data. ADAT reduced total misclassification cost (52294 as compared to 70177 of MC Slipper) by 25.5%, while increasing overall accuracy by 1.78%. Compared to the automatically tuning IDS with delayed tuning, ADAT reduced TMC by 6.76%.

Stefano Zanero et al. [13], presented a tool for network anomaly detection and network intelligence which was named as ULISSE. It uses two tier architecture with unsupervised learning algorithms to perform network intrusion and anomaly detection. It was concluded that their architecture can reach the same detection rate of 66.7% with a false positive rate below 0.03%, thus an order of magnitude better than PAYL, or on the other hand reach a 88.9% detection rate with no more than a 1% rate of false positives.

From the literature survey it is observed that most of the researchers may used a KDDCup'99 dataset and RIPPER binary rule algorithm for evaluating the performance of existing IDS. KDD dataset suffers from two deficiencies:

### ***A. Redundant Records***

The first important deficiency in the KDD data set is the huge number of redundant records. Analyzing KDD train and test sets, it may found that about 78% and 75% of the records are duplicated in the train and test set, respectively. This large amount of redundant records in the train set will cause learning algorithms to be biased towards the more frequent records, and thus prevent it from learning infrequent records which are usually more harmful to networks such as U2R attacks.

### ***B. Distribution of Connection Types***

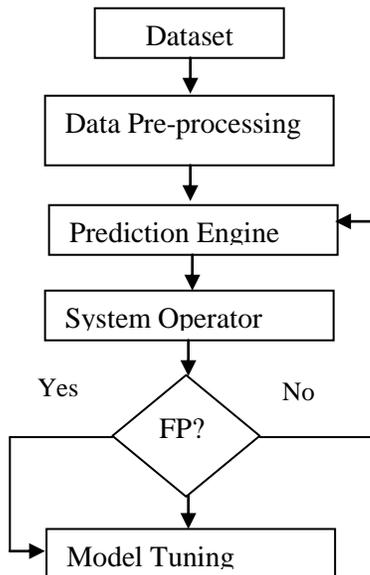
The second shortcoming of the Data set lies with the distribution of its 5 classes – Normal connections and the 4 intrusion types: DOS, probe, U2R, R2L. The first two classes comprise a whopping 98% of the entire original data set, and 97% of the improved dataset, after removing duplicate instances. This imbalance makes it very difficult to train classifiers on the training set, and results in having extremely poor detection rates.

RIPPER was used in MADAM ID [14] to select features and build classifier models. This algorithm also facing some problems as follows:

- The rulesets produced by RIPPER & IREP are larger in a size
- It achieves higher error rates
- Less efficient on the larger size datasets

### III. PROPOSED WORK

From above figure data preprocessor prepares the binary training dataset from the original training dataset and then create the ruleset by using SLIPPER algorithm. Then next prediction engine analyzes and evaluates each obtained data record according to the prediction model and reports the prediction result to system operator. System operator then verifies the result and marks false predictions which are then fed back to the model tuner. The model tuner automatically tunes the model according to the feedback received from the system operator.



IV.

Figure 1 Flowchart of RLIDS

The RLIDS uses NSL KDD dataset and SLIPPER binary rule learning algorithm.

### NSL KDD DATASET DESCRIPTIONS

NSL-KDD is a data set [15] suggested to solve some of the inherent problems of the KDDCup'99 data set and has some advantages over KDDCup99. This dataset is a solution to solve the two issues mentioned in last section. This data set has the following advantages over the original KDD data set [16]:

- It does not include redundant records in the train set, so the classifiers will not be biased towards more frequent records.
- There are no duplicate records in the proposed test sets and train set; therefore, the performances of the learners are not biased by the methods which have better detection rates on the frequent records.
- The number of selected records from each difficulty level group is inversely proportional to the percentage of records in the original KDD data set.

## STEPS OF IMPLEMENTATION

### A. Pre processing of Data

To build a binary classifier for each class, preprocessing is done on training data to generate proper training data for each class. An optimized preprocess procedure to reduce disk read is shown in figure below. For each training example, if the label is not the target class name, then change the it to an unused class name, such as "other", otherwise, keep the label same.

```

Training Set T: {(featurei, labeli)}, i= 1....N &
Class Set C: {(cnamej, counterj, fnamej)},
j= 1.... M, where labeli ∈ { c.cname | c ∈ C }
For each training example t ∈ T
  For each class c ∈ C
    If t.label ≠ c.name then
      assign "other" to t.label
      c.Counter + +
    output t to c.fname
  restore t.label
Optimized preprocessing algorithm
  
```

### B. Creation of Rule set

To learn the set of binary classifier from the binary training dataset SLIPPER algorithm is used. Formally, it is based on confidence-rated boosting, a variant of AdaBoost. SLIPPER is fast, robust, and easy to use, and its hypotheses are compact and easy to understand.

1. Train the weak-learner using current distribution D:

- Split data into GrowSet and PruneSet
- GrowRule: Starting with empty rule, greedily add conditions to maximize the equation
 
$$Z = \sqrt{W^+} + \sqrt{W^-} \quad \text{----- (1)}$$
- PruneRule: Starting with the output of GrowRule, delete some final sequence of conditions to minimize where  $C_R$  is computed using equation (3) and GrowSet
- Return as  $R_t$  either the output of PruneRule or the default rule, whichever minimizes the equation

$$Z = 1 - (\sqrt{W^+} - \sqrt{W^-}) \quad \text{----- (2)}$$

2. Construct  $ht: X \rightarrow R$

Let  $C_R$  be given by

$$C_R = \frac{1}{2} \ln \left( \frac{W^+ + 1/(2n)}{W^- + 1/(2n)} \right) \quad \text{----- (3)}$$

Then

$$ht(x) = \begin{cases} C_{R_t}, & \text{if } x \in R_t \\ 0, & \text{otherwise} \end{cases} \quad \text{----- (4)}$$

3. Update:

- For each  $x_i \in X$ , set  $D(i) = D(i) / \exp(y_i \cdot C_{R_t})$
- Let  $Z_t = \sum_{i=1}^m D(i)$
- For each  $x_i$ , set  $D(i) = D(i) / Z_t$

Output final hypothesis

$$H(\infty) = \text{sign} \left( \sum_{Rt: x \in R_t} \epsilon_{R_t} C_{R_t} \right) \text{-----} (5)$$

In SLIPPER, a rule  $R$  is forced to abstain on all data records not covered by  $R$  and predicts with the same confidence  $C_R$  on every data record  $x$  covered by  $R$

$$C_R = \begin{cases} \frac{1}{2} \ln \left( \frac{W_+}{W_-} \right), & \text{if } \infty \in R \\ 0, & \text{if } \infty \notin R \end{cases} \text{-----} (6)$$

$W_+$  and  $W_-$  represent the total weights of the positive and negative data records, respectively, covered by rule  $R$  in the round of boosting the rule, which was built in.

### C. Prediction Engine

The prediction engine in this system consists of five binary prediction engines together with a final arbiter. Each binary prediction engine outputs a prediction result on the input data according to its binary classifier, and the final arbiter determines and reports the result to the system operator.

The binary prediction engine is the same as the final hypothesis in SLIPPER, which is

$$H(\infty) = \text{sign} \left( \sum_{Rt: x \in R_t} C_{R_t} \right) \text{-----} (7)$$

### D. Model Tunner

During tuning, the associated confidence values is improved to adjust the contribution of each rule to the binary prediction. Consequentially, tuning ensures that, if a data record is covered by a rule in the original model, then, it will be covered by this rule also in the tuned model and vice versa. To limit possible side effects, change the associated confidence values of positive rules as a default rule covers every data record.

## IV. EXPERIMENTAL RESULTS AND ANALYSIS

### A. Creating Rule set

In the experiment, Binary classifiers are learned from the Simple learner with iterative pruning to produce error reduction (SLIPPER). Output of binary classifiers is rule set which contains the rules for particular type of attack and default rule.

### B. False Prediction

In the experiment, the KDD dataset is used with the RIPPER learning algorithm for finding the false prediction count. It is calculated by comparing the inputs files in the datasets with the output files. Here the selected rule with positive confidence is compared with a default rule with negative confidence to determine the result of boosting.

TABLE I FALSE PREDICTION ON KDD DATASET

Attack	Input	Output	False Pre...
DoS	391194	363420	27774
R2L	1061	1061	20
U2R	52	43377	43325
Probe	4436	11443	7007
Normal	97228	74651	22577
Total	493971	493972	100703

TABLE II FALSE PREDICTION ON NSL- KDD DATASET

Attack	Input	Output	False Pre...
DoS	377556	349191	28365
R2L	444	453	9
U2R	26	35444	35418
Probe	3272	10965	7693
Normal	74522	59773	14749
Total	455820	455826	86234

In the experiment, the NSL-KDD dataset is used with the SLIPPER learning algorithm for finding the false prediction count. It is calculated by comparing the inputs files in the datasets with the output files.

*C. Tunned Confidence Value*

Here the KDD dataset is used with RIPPER algorithm to determine the confidence value and tunned confidence value. Here the automatic tuning is not happen.

TABLE III TUNNED CONFIDENCE VALUE ON KDD DATASET

Attacks	Confidence	Tunned Conf...
DoS	66.69443	66.69443
R2L	100.4819075	100.4819075
U2R	62.9627025	62.9627025
Probe	99.31768767	99.31768767

Detection rate is: 93.77932282881474  
FalseAlarm Rate is: 6.220677171185255

TABLE IV TUNNED CONFIDENCE VALUE ON NSL-KDD DATASET

Attacks	Confidence	Tunned Confli.
DoS	66.69443	46.6861009999
R2L	100.4819076	100.4819076
U2R	62.9627025	62.9627025
Probe	99.31768757	99.31768757

Detection rate is: 97.2085290249859  
FalseAlarm Rate is: 2.791470975014093

Here the NSL-KDD dataset is used with SLIPPER algorithm to determine the confidence value and tuned confidence value. Here the model tuning algorithm is used to improve the tuned confidence value.

#### D. Graph

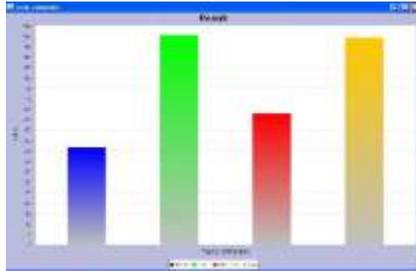


Figure 7. Graph showing confidence value on NSL-KDD Dataset

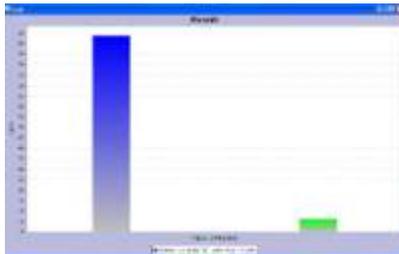


Figure 8 .Graph showing Detection Rate and False Alarm Rate on NSL-KDD Dataset

The figure above shows the confidence value, detection rate and false alarm rate on NSL-KDD.

TABLE V PERFORMANCE COMPARISON ON DATASETS

Parameter	KDD	NSL-KDD
Detection Rate	93.77 %	97.20 %
False Alarm Rate	6.22 %	2.79 %
T M C Value	63449	54291
C P E Value	0.2038	0.1745

Above table shows performance comparison of various parameters on KDD & NSL KDD Datasets. The detection rate is increased by 3.43 % on NSL-KDD dataset and false alarm rate is decreased by 3.41 % on NSL-KDD dataset. The result on NSL-KDD dataset with the SLIPPER algorithm is better than that of on KDD with RIPPER algorithm.

## V. CONCLUSION

Attacks on the network infrastructure presently are main threats against network and information security. Therefore the security is one of the crucial issues in modern computer system. Intrusion detection plays one of the key roles in computer security techniques and is one of the prime areas of research. The proposed work aims at discovering an efficient binary rule learning algorithm and applying that algorithm on NSL KDD dataset. Experimental results and analysis shows that the RLIDS by using SLIPPER algorithm as a basic module on NSL-KDD gives better performance in terms of

1. High detection rate which is increased by 3.43 %
2. Low false alarm rate which is decreased by 3.41 %
3. Less Misclassification cost
4. Less Cost per example

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## **THE ONSET OF THE NEON TOOL AND ITS MANY BENEFITS AND POPULARITY IN WORKFORCE PLANNING IN ERICSSON INDIA**

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## **ABSTRACT**

*Ericsson Global services India Pvt Ltd (EGI) is one of the largest ICT companies in the world which offers both products and services for IT, as well as for wired & wireless telecommunication networks. Amongst many other departments and functions within Ericsson, the department of Network Engineering plays an important role within the company to build and expand networks, support latest services and also to blend and deal with different technologies. Ericsson, being the world leader has been the driving force behind the expansion and improvement in connectivity worldwide. Around 40 percent of the global mobile interchange happens due to the networks supplied by Ericsson. Apparently more than 1 billion subscribers around the world rely everyday on networks managed by them. They have industry's strongest intellectual property rights portfolio with more than 37000 granted patents. As a company they strongly believe that through mobility the society can be transformed for better. The company comprises of strong Workforce of 5000 plus knowledge workers including service engineers, solution architects and project managers. This Case Study focuses on how the complicated phenomenon of planning and managing the humongous Workforce is executed in Ericsson and also investigates the Network Engineering Online Tool which was developed by a small team in the function of Network Engineering(NE) based in DLF Cyber city, Gurgaon, Haryana in order to facilitate first-rate handling of large volume of off shoring business at EGI(NE). Being the largest NE organization which caters to providing managed services, project related services and system integration business lines, it is imperative that it has the sufficient talent pool and skilled workers. And this study explores how the NEON tool enables the same.*

*The strength of NEON lies in giving reports at a click of a button by facilitating 'dip stick measurement' for various levels of demand forecast for workforce; Be it Competence-Domain*

*wise or Region-wise or Technology or Sub-technology-wise or Vendor wise or Business Line wise for the company. Today NEON is a way of life within Network Engineering and gradually being accepted by the interfacing organization and support function. The advent and acceptability of NEON also proves that a home grown solution is better in terms of adaptability, cost and interfacing as compared to its other counterparts which take a lot of time for the implementation and customization. Tracing back around time one can easily realize the sea change that has been brought by the advent of Information and Communication Technology. Even workforce planning is not untouched by its magic. Apart from providing infrastructure for almost all the industries, ICT is also transforming the workplaces and evolving the way we work. It also enables the society to stay connected in multifarious ways. It can be seen that new innovations and forms of expressions are finding a greater audience, industries and hierarchies are revolutionized and we are seeing a fundamental change in the way we communicate, socialize and take decisions together. While the case study concludes that more research is required to come up with better practices in talent management and workforce planning. It weighs the various workforce planning tools and provides managers contemplating the same with extensive resources and valuable information that will help them take the right decision.*

**Keywords: Network Engineering, Workforce, Talent Management,**

## **ICT-The Ruler of the World**

Tracing back around time one can easily realize the sea change that has been brought by the advent of Information and Communication Technology. And in the current scenario ICT can be perceived as an *Enabler* in so many ways. Since it enables the society to stay connected in multifarious ways and provide infrastructure for almost all the industries. The so called *Digital Era*, on one hand has changed the way we lead our personal and social lives and on the other it is transforming the workplaces and is evolving the way we work at a pace as quick as a flash. In different industries ICT has different connotations. Be it the Primary industries like farming, mining, forestry and fishing etc. Or be it the manufacturing industry which involves in transforming raw materials to sellable products using assembly lines etc. Or be it the service industry for that matter, which includes healthcare, banking and also the high-tech industries including the R&D companies involving highly qualified and technically skilled professionals.

Talking about the manufacturing sector the advent of ICT has resulted in *automation* of the processes and extensive use of assembly lines. And as far as the service industries are concerned, though no products are manufactured per say but still they extensively make use of ICT as an *infrastructure* to get things done. The service industries happen to contribute substantially to the GDP of a country. And ICT is the *backbone* of all service industries.

Broadly speaking ICT has been a *scene changer* in more ways than one. Looking at the transformation brought by ICT to the big picture is really interesting, to put it mildly. Just a few decades ago, connectivity between two computers in the same vicinity was a bizarre joke. And at that time if somebody would have mentioned about video calling a person sitting in another continent, people would have laughed at him or her or take him to the psychiatrist.

Truth is, technology has changed everything viz. the way we do business, the way we mingle socially, the way we shop or sell, the way we find help, the way we live in a nutshell.

In the 1980s when the emergence of the LANs was taking the whole world by awe, the usage of the *optical fibre* completely turned around the state of affairs. Suddenly we could transfer data at the *speed of light*. And it was actually possible to see people sitting in another continent in real time through a computer. The world was not the same anymore.

We took our first step towards the world which was driven by technology. It had tremendous impact on the society and humongous implications on the way people did business. One of the path breaking implications was that in 1990s the developed nations decided to leverage on technological innovations and *outsource* their business to developing countries to save on cost because of the expensive labour. The term '**outsourcing**' never had so much importance.

### **Telecommunication and Mobile Communication**

Amongst the diverse repercussions of the ICT in all areas of business and life, one of the key repercussions was the initiation of the *mobile communication* and the *telecommunication*.

Before the nineteenth century, long distance communications included techniques like visual signals such as beacons, smoke signals, semaphore telegraphs, signal flags and optical heliographs. Things have come an astoundingly long way ever since the advent of telecommunication through the Radio Frequency (RF) and Microwave (MW) came into being.

It's extremely interesting to observe how different technological innovations and inventions cumulatively had an impact on the whole scenario. For instance, on one hand optical fibre and the subsequent technological innovations changed the data transfer rates tremendously making internet a reality, shrinking the whole world into a small village and on the other hand IT also became the major building block for industries like the *mobile communication* and the *telecommunication*.

Talking about the present scenario, companies like Ericsson, Siemens, Nokia, Motorola etc. are providing the infrastructure and service to network operators like Airtel, Idea, Vodafone, Docomo and Reliance etc.

### **Ericsson-The World Leader**

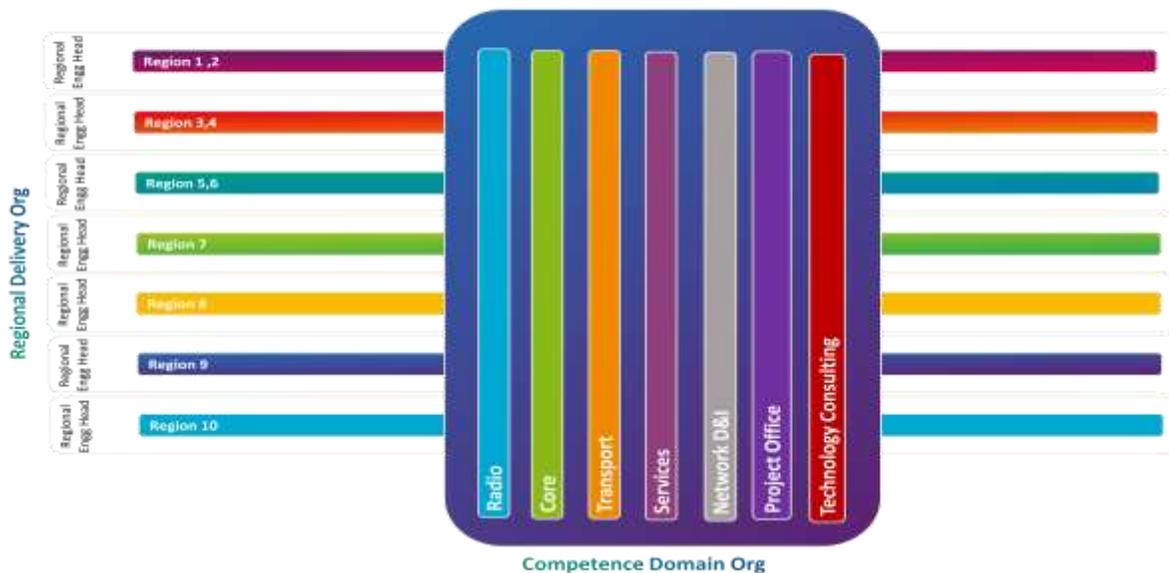
Currently, Ericsson Global services India Pvt Ltd (EGI) is one of the largest ICT companies in the world which offers both products and services for IT, as well as for wired & wireless telecommunication networks. Ericsson, being the world leader has been the driving force behind the expansion and improvement in connectivity worldwide. Around 40 percent of the global mobile interchange happens due to the networks supplied by Ericsson. Apparently more than 1 billion subscribers around the world rely everyday on networks managed by them. They have industry's strongest intellectual property rights portfolio with more than 37000 granted patents. As a company they strongly believe that through mobility the society can be transformed for better.

There are numerous departments and functions within Ericsson. The department of **Network Engineering** is one such department that plays an important role within the company to build and expand networks, support latest services and also to blend and deal with different technologies. The company comprises of a humongous workforce amongst which the *Network Engineering function* itself has a strong **Workforce of 5000 plus** knowledge workers including **service engineers, solution architects** and **project managers**.

## Organization Structure in Ericsson NE

The Organization structure followed in Ericsson is **Matrix Structure** in which the reporting relationships are arranged in the form of a **matrix or a grid** and that is why the name. The main purpose of this kind of arrangement is to encourage horizontal flow of skills and information.

### Matrix Org structure



Its different from the more traditional structures based on hierarchy. In Matrix, an employee usually has a *dual reporting*. The authority flows horizontally and vertically both. It necessitates multiple command and control structure and has a great impact on the organizational culture and behavioural patterns of the employees. The strength of Matrix is Employees can contribute to multiple projects without leaving their current position in the organization.

## Workforce Planning in Ericsson

Workforce planning and talent management in Ericsson is a complicated phenomenon and managing a huge Workforce requires great deal of attention and effort. To cater to this extremely challenging task, in the year 2013 NEON i.e. Network Engineering Online Tool was developed by a small team in the function of Network Engineering (NE) based in DLF Cyber city,

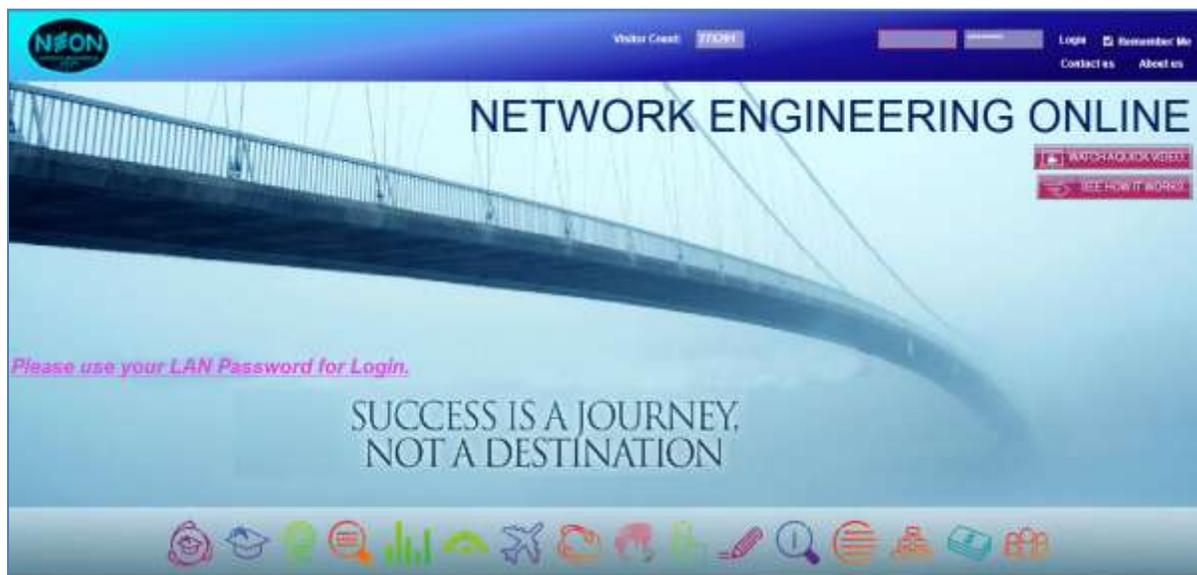
Gurgaon, Haryana, India in order to facilitate first-rate handling of large volume of off shoring business at EGI (NE) after lot of speculation and anticipation.

Being the largest NE organization which caters to providing managed services, project related services and system integration business lines; it was imperative that it had the sufficient talent pool and skilled workers. And this study explores how the NEON tool enables the same.

### **Talent Management and Role of NEON in Network Engineering**

There are 10 different regions across the globe. Each region has got Workforce Planning department. This department prepares the Workforce Plan based on the on-going opportunities as well as the business in pipeline. It is responsible **to ascertain the various competence & skillset requirement** which these opportunities demand for its deliveries.

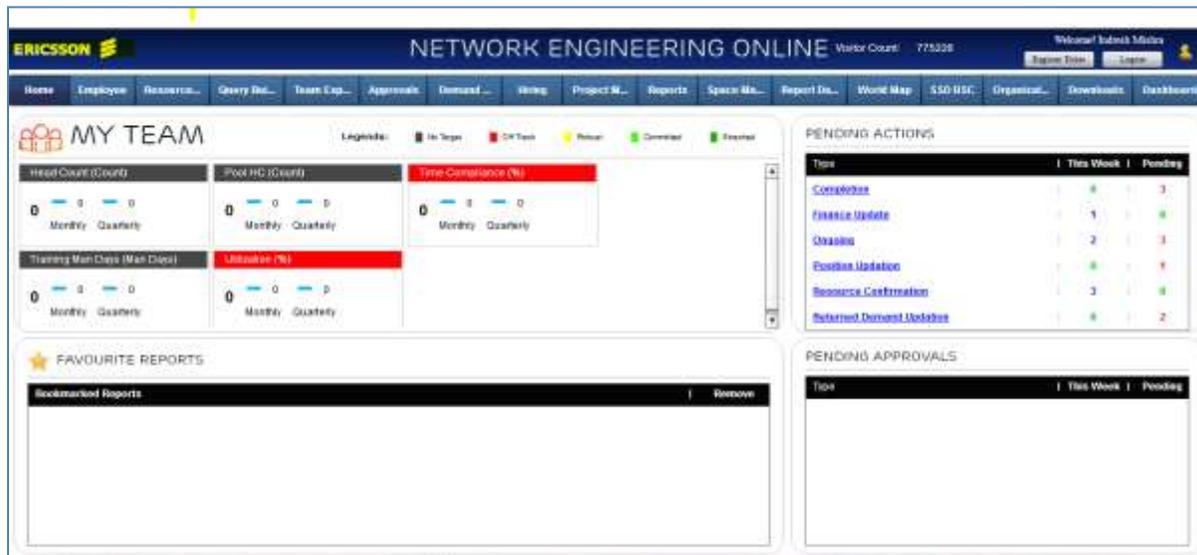
This department, based on the total requirement of the resources gives a forecast for off-shoring to EGI. And within EGI various service delivery units picks up the respective business lines/competence domains forecast and prepare for resource fulfilment either through existing pool or through new hiring.



The birth of NEON lies in the fact that, they have a large volume of Off shoring business to handle at Ericsson Global India Pvt.ltd (Network Engineering)-EGI (NE).The Head of Network Engineering felt the need of a tool to facilitate better handling of the workforce as the resource was too huge to be handled by the HR department alone.

Other viable options included SAP which enables ERP with the help of modules. It incorporates an HR module for workforce planning. The only major downside was that the implementation was extremely expensive and customizing the same took a lot of time and money as well. Similarly Salesforce.com was another avenue to be explored.

After a lot of brainstorming and weighing the available options within the NE it was decided that a *home grown solution* will be better in terms of **adaptability**, **cost** and **interfacing** with the existing system.



It is the largest NE organization which provides services into managed services and project related services and system integration business lines. It's a remote/on-site delivery model for customer units, in parts of 10 different regions across the Globe. It comprises of strong 5000plus workforce with service engineers, solution architects and project managers.

Hence looking at the complex matrix of the region, business lines and to predict and determine resource demands & fulfillment, business trend analysis, achieve local efficiencies through tools and automation and control finances, there was an imperative need of deploying a tool which can give visibility to both the staff as well as the management, of the above mentioned parameters.

NE delivery managers, project managers register forecast/confirmed demand of resources into the NEON tool and await fulfillment by (Competence Domain). Each demand is given a unique project Id. This Id is maintained across the lifecycle of the project for resource, finances, quality and service evaluation. Since its inception the NEON tool has come a long way. Today NEON is a way of life within Network Engineering and gradually being accepted by interfacing organisation and support functions.

ERICSSON														NETWORK ENGINEERING ONLINE				Water Count	TT0228	Welcome! Subash Mitra									
Home														Employee	Resource...	Query Def...	Team Exp...	Approvals	Demand...	Wiring	Project M...	Reports	Specs Ma...	Report Da...	Work Mail	S30 BSC	Organizat...	Downloads	Dashboard
Select Required Columns														Search	Update														
Post.	ProjectID	Region	ParentID	Priority	Start Date	End Date	Position Status	Resour...	Resource	Red.	Job Stage	Domain	Priority																
1050480	8161	RNA	1050480		05-07-2015	10-17-2016	Initiation				Job Stage 4	Radio Access Networks																	
1057798	8854	RNA	1057798	1	06-11-2015	06-31-2015	Resource Proposal	EMSOBAB	M.S. Ganesh Bai	abnatha	Job Stage 7	Core	1																
1055778	8338	RNA	74261	4	07-14-2015	06-31-2015	Resource Proposal	EMPOOAH	Sandeep Kumar	esupban	Job stage 5	Radio Access Networks	4																
74719	8386	RNA	74719		12-15-2014	01-01-2016	Return back to Creator				Job Stage 6	Radio Access Networks																	
1057700	8854	RNA	1057700	1	06-11-2015	06-31-2015	Resource Proposal	EJAREBI	J Anil Raja Singh	abnatha	Job Stage 7	Core	1																
1050478	8161	RNA	1050478		05-07-2015	10-17-2016	Initiation				Job Stage 4	Radio Access Networks																	
1057789	8854	RNA	1057789	1	06-11-2015	06-31-2015	Resource Proposal	EMMMVIV	M Venkatesh	abnatha	Job Stage 7	Core	1																
1057706	8854	RNA	1057706	1	06-11-2015	06-31-2015	Fulfilled	ELVSDA	Vikas Singh	abnatha	Job Stage 7	Core	1																
1050481	8161	RNA	1050481		05-07-2015	10-17-2016	Initiation				Job Stage 4	Radio Access Networks																	
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1057120	8854	RNA	1057120	3	06-01-2015	06-31-2015	Resource Proposal	EACEFHJ	S PRASADHARA	abnatha	Job Stage 6	Core	3																
1057809	8338	RNA	74263	2	06-13-2015	06-31-2015	Resource Proposal	ESACBEP	Satish Kumar D	esupban	Job stage 5	Radio Access Networks	2																
1044483	8961	RNA	1044483		04-01-2015	09-30-2016	Return back to Creator				Job Stage 5	Radio Access Networks																	
1057009	8854	RNA	1057009	2	06-01-2015	06-31-2015	Resource Proposal	ENQRSLR	K Raghuram Raj	emmmggg	Job Stage 5	Radio Access Networks	2																

## NEON-A Super hit

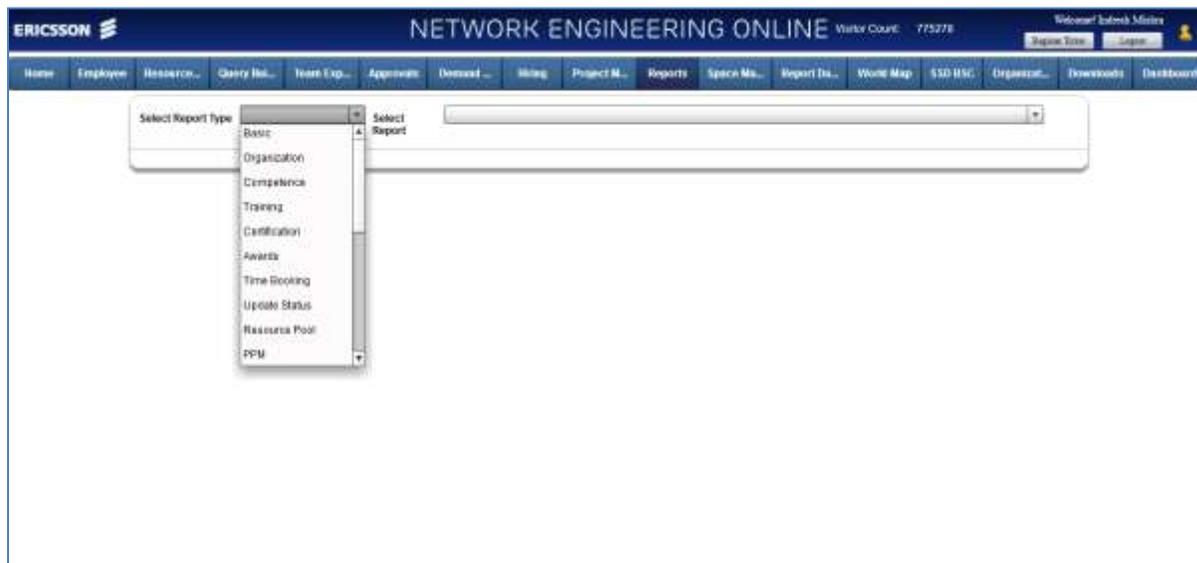
NEON has been **adding value** at various levels all over the NE organization by enabling at the click of a button, various **reports** giving **"dipstick measurements"** for the following:-

- *Competence Domain wise Demand forecast*

The Competence Domains can be classified as follows:-

- ✓ Radio-access,
- ✓ Core,
- ✓ Transmission,
- ✓ Project Office,
- ✓ Services and Consulting.

NEON helps forecast and fulfil the Demand each Competence Domain.



- *Region wise Demand forecast*

The various regions taken care of by Ericsson are as follows:-

- ✓ Region India,
  - ✓ Region Latin America,
  - ✓ North America,
  - ✓ Region Mediterranean,
  - ✓ Region western and central Europe,
  - ✓ Region North-east Asia,
  - ✓ Region South-east Asia and Oceania,
  - ✓ Region Middle-east,
  - ✓ Region Sub-Saharan Africa and Region East and Central Asia.
- NEON helps forecast and fulfill the Demand.

- *Technology wise Demand forecast*

As on date, the various technologies supported by Ericsson are as follows:

- ✓ GSM (2G),
  - ✓ WCDMA (3G), and
  - ✓ LTE (4G).
- NEON helps forecast and fulfill demand.

- *Job Stage wise Demand v/s fulfillment*

The different Job Stages in Ericsson are as follows:

- ✓ Job Stage-4(Engineer) to Job Stage-5(Senior Engineer)
- ✓ Job Stage-6(Specialist/Solution Architect) to Job Stage-7 (Senior Specialist/Senior Solution Architect)
- ✓ Job Stage-8 (Expert) to Job Stage-9(Senior Expert/Principle Consultant)

- *Vendor wise Demand forecast*

The different vendors are as follows:-

- ✓ Ericsson
- ✓ Nokia
- ✓ Alcatel Lucent
- ✓ Huawei
- ✓ ZTE
- ✓ Samsung
- ✓ Cisco
- ✓ Juniper
- ✓ Marconi
- ✓ ECI

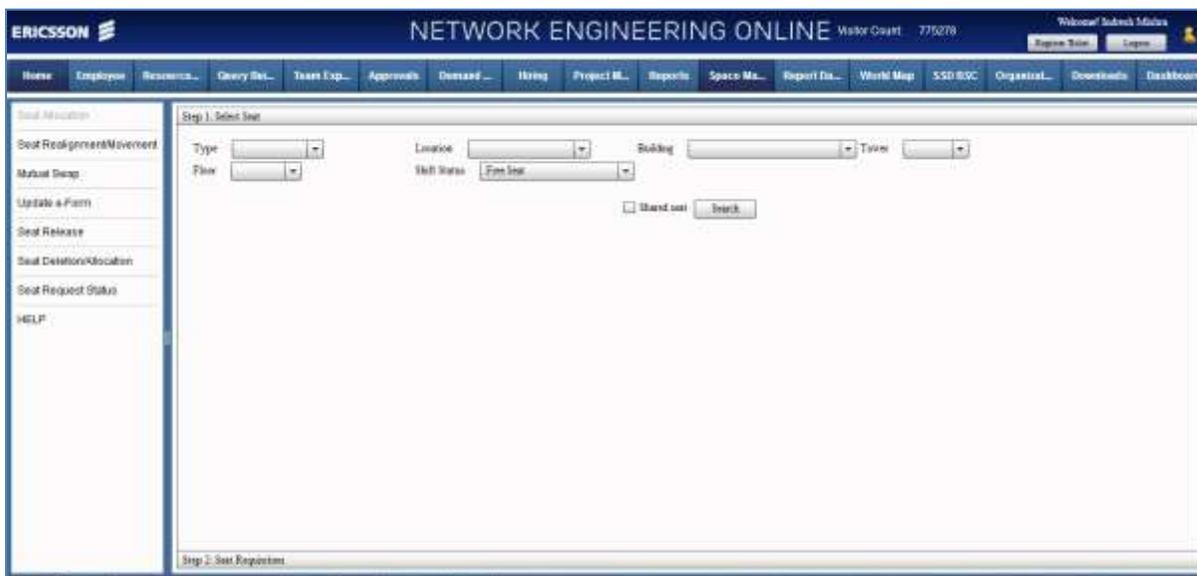
- *Service Business line wise Demand forecast*

The various Service Business lines are:-

- ✓ Managed Services
- ✓ Network Design & Optimization (NDO)
- ✓ Network Rollout(NRO)
- ✓ System Integration(SI)



- *Status of availability of service order/ Network Ids for time booking/ Finances*

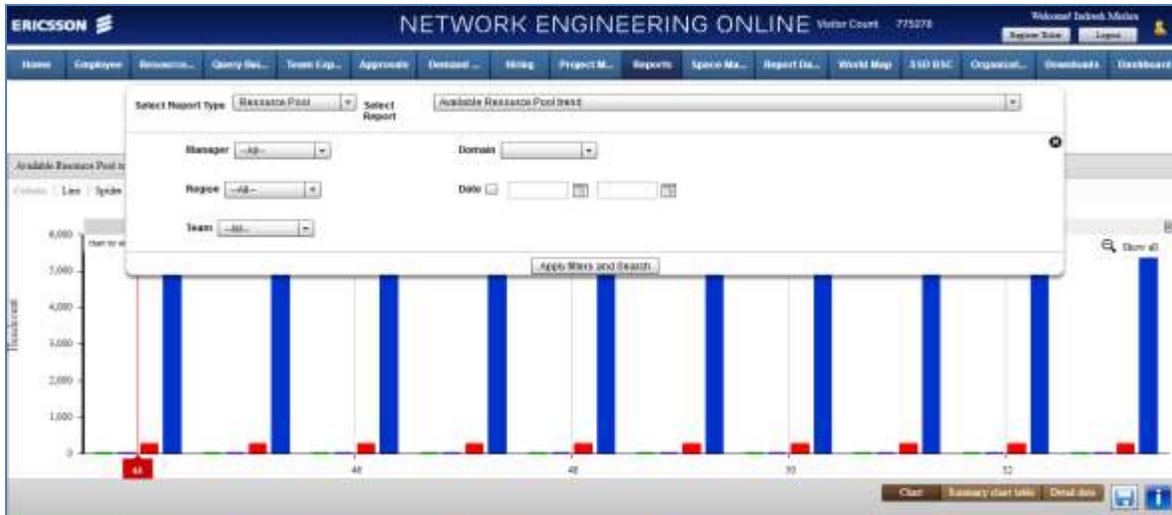


- *Budget v/s Incurred Cost for On-site assignments*  
Manual update of budget for each Project Id is done and on every day basis budget v/s cost incurred (time-booking done), number of hours booked on a particular network Id by a specific job stage resource

**No. Of hours booked\*Man hourly rate (MHR)\*No. Of resources of a specific job stage**

- *Resources Travel Request for On-site assignments*

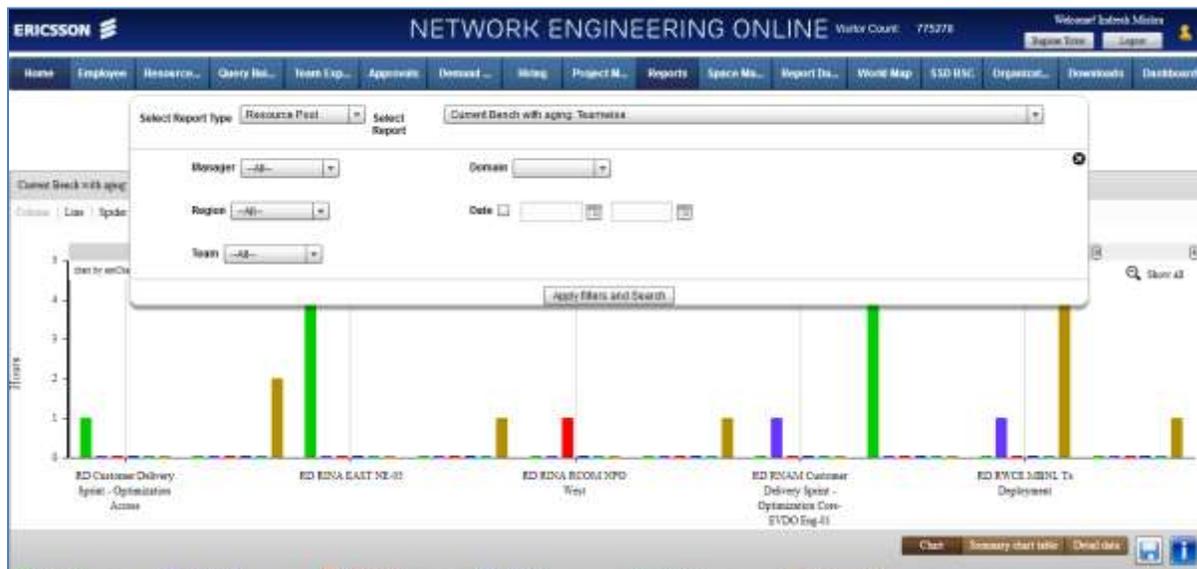
To control travel cost budget and track on-site assignment, travel request of all the resources is registered and approved in NEON.



- *Resource Competence, skill set and work experience*

The Curriculum vitae of each and every resource is maintained in a specific template/format which is easily searchable using keywords.

- *Project Network elements' Name Type and Coordinates and Activity performed list.*  
Each of the Network elements which is managed has a unique identity (name) and each of the project delivered has its own unique scope (activities)



NEON tool helps publish the report out of the huge number of network elements which network elements are touched the most/ the least and which activities are performed the least.

## CONCLUSION

As we can see even workforce planning is not untouched by the magic of ICT. Apart from facilitating infrastructure for almost all the industries, ICT is also transforming the workplaces and evolving the way we work. It can be seen that new innovations like the NEON and similar forms of developments are finding a greater audience, industries and hierarchies are being revolutionized and we are seeing a fundamental change in the way we communicate, socialize and take decisions together.

While the study concludes that more research is required to come up with better practices in talent management and workforce planning. It weighs the various workforce planning tools and provides managers contemplating the same with extensive resources and valuable information that will help them with valuable insights aiding to take the right decision timely.

## References

How new platforms are mobilizing social enterprises. (2015, December 16). Retrieved from [http://www.ericsson.com/thinkingahead/networked\\_society](http://www.ericsson.com/thinkingahead/networked_society).

