Risk and Road Traffic Accidents in Uttarakhand– Present Scenario, Analysis, Interpretation and Preventions.

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Abstract: India being the developing and the second largest populated country with one of the fastest growing economy in the world. It paved the way to very fast urbanization in the country. The country faces many problems including transportation and road safety. The road patterns in Indian cities are very different as compared to western world.During the period 1970–2009, the nation's road length increased at a compounded annual growth rate (CAGR) of 3.2%, whereas the number of registered vehicles, RTCs, and fatalities grew at 12%, 3.8%, and 5.7% CAGR respectively. Exposure risk dropped from 103 to 11 fatalities per 10 000 vehicles but increased from 2.7 to 10.8 fatalities per 100000 people. In 2001, Andhra Pradesh had 7.5% of the nation's population but 10.4% fatalities. There is an alarming increase in road accidents in the country, which takes away more than 90,000 lives every year.Four major districts of Uttarakhand, namely, Dehradun (213), Haridwar (233), Nanital (134) and Udham singh nagar (223) - accounted for about 82% of total road accidents in Uttarakhand in 2018.In this research work, we tried to study the present road traffic crashes in the hilly state of India – Uttarakhand. We have also tried to identify and analyze the different types of risks involved in road traffic crashes and tried to analyze and interpret the ongoing and the latest trends in road traffic crashes in Uttarakhand (RTC). We also tried to suggest the preventive measures to be taken in Uttarakhand, regarding RTC. Analysis is done with the help of primary and secondary data using appropriate statistical tools.It is evident from the study that road accidents in Uttarakhand have decreased by 7% but fatalities rose by 8.2% as per 2017-18. From the combined analysis of the three variables, namely road conditions, individual factors and poor vehicle maintenance, all three factors have their own impact on the RTC.

Index Terms: Fatalities, LPG ,Prevention Strategies, Road Traffic Crashes (RTC).

I. INTRODUCTION

Road accidents are caused by numerous inter-related factors such as length of roads, increasing population of vehicles, explosion in human population, driver's carelessness, violation of traffic rules etc. All different types of road accidents results in injuries, fatalities, disabilities-partial or complete etc.

Road safety is a burning issue, not only at national level but also at international level. In fact United Nations declared the decade i.e. 2011 -20, as the Decade of Action on Road Safety. (government of india ministry of road transport & highways transport research wing new delhi. (WWW.MORTH.NIC.IN) India is growing rapidly and the compounded annual growth rate (CAGR) was marked as 3.1%, 5.4%, 5.6% and 10.2% in GDP as on 1970-80, 1980-90, 1990-2000 and 2000-2010 respectively. This clicked to the need for developing infrastructure and transportation of the country. [1]

The Government of India's New Economic Policy, 1991, aimed to motivate the participation of private sector and foreign direct investment in many related and unrelated sectors. Transport and communication was also in the list and the share of FDI inflow is around 6% in this sector.

Investments in transport sector, is evident from increased road length during 1990-2010 (3.9% CAGR) [2] Growing population demand transportation resulting in severe traffic congestion and poor air-oxygen quality. Being a developing economy, the road use pattern in India is different from developed economies. Roads are crowded not only by motorized vehicles but also by non-motorized vehicles. [3]

Speedy urbanization results in faster and speedy development of metropolitan cities and at the same time there is an increase in the road accidents. It is a major concern as it takes away more than 90000 lives every year in metropolitan cities. There is an annual average growth rate of approx 11% for cars and motorized two wheelers and 7% for trucks and buses in India. [4] Fatalities in road traffic are increasing by about 8% annually and show no signs of decrease. Prediction by Cropper and Kopits was regarding fatalities in India to reach about 198000 by 2042 per year.(4) India is a signatory to Brasilia Declaration and the promise is to bring down the number of road accidents and fatalities to half by 2020.[5] Number of road accidents rose by 2.5% from 2014 to 2015. Above that the number of persons killed in road accidents go up by 4.6% from 2014 to 2015, whereas, road accident injuries rose by 1.4% from 2014 to 2015. [5] Out of total persons killed in road accidents, 54% lie in the age group of 15-34.[5] Several studies were conducted and concluded that driver's fault had always been the prime cause of road accidents and casualties. It may be over speeding, overloading, use of alcohol, hit and run, ignorance, carelessness or any other related reason. A research demonstrates that the annual accidental fatalities increase at the rate of 8% per year in India. However, different studies reveal different statistics regarding fatality during 2030 to 2042 on Indian roads, which will be the highest rate till then.

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Data analysis of 2015 road accidents reveals that about 1374 accidents took place every day, in which 400 people died. [5] Translating the same on hourly basis, 57 accidents happen every hour leading to 17 deaths in India. Talking state-wise, Tamil Nadu is reported with the highest number of road accidents, whereas, the highest numberp of deaths are reported in Uttar Pradesh. [5] It was also revealed that rural areas are more sensitive to road accidents. Traffic Junctions are also accident prone areas. There is a need to develop reliable transportation solutions. Indian Railways are contributing to Nation's mobility since more than 150 years. National Highway authority of India is contributing to the growth and improvement in country's interstate network. Indian National Highway authority worked for the improvement of mobility and increased route commercialization. They followed a policy of public private partnership (PPP). Investment on infrastructure in India was very poor between 1947(after independence) and 1991, since LPG concept was adopted by India in this year .The real focus on the infrastructure was initialized at national level under the guidance of the then Prime Minister Shri Aatal Bihari Bajpaee and the then transport minister Gen. B. C. Khanduri. They initiated a movement and as a result reforms of the planned economy (as a result of libralization, privatization and globalization), roads were constructed all over the country from the hills of Uttarakhand to the far south Kannyakumari. A national highway popularly known as "Golden Quadrilateral" was planned in the year 1999 and launched in the year 2001. It is a highway network which was developed from Chennai to New Delhi , roads connecting the four major metropolitan cities of India, namely Delhi (North), Kolkata (East), Chennai (South)and Mumbai (West) and connecting many of the major industrial and cultural cities of India. It covers a length of 5,846 km. The project was completed in the year 2012. As a result, the Indian annual growth rate in terms of GDP reached to 9.6% for the first time in 2006.The ever best for the NDA led coalition Government since 1991. Cities and town are becoming overcrowded as people migrated to urban areas in hunt of employment and better life. We can have an example from Uttarakhand only. For the establishment of Tehri Dam, several families are displaced and migrated to Dehradun leading to overcrowding in Dehradun.

Uttarakhand, also known as Dev Bhoomi, was formed on 9th November 2000 as the 27th state of India. It was carved out of northern Uttar Pradesh. It is a hilly state and shares International boundaries with China and Nepal. The state has two divisions- Garhwal and Kumaon, with 13 districts.

Uttarakhand is growing very fast and ranked as the second growing state in India, with a per-capita income of Rs 1,03,000, which is higher than the National average of Rs 74,900. Major occupation in Uttarakhand is agriculture. The other key industries are tourism and hydropower, biotechnology, pharmaceuticals, information technology etc. Uttarkhand has a road network of 30753.7 kms, including 2047 km national highway and 1575.5 kms as state highway (2007-08). The air transport network is improving in the state but railway services are very limited in the state because of the physical unevenness.

As per 2016 latest data, total number of accidents in India

was 480652 out of which Uttarakhand reported 1591 accidents, making it 0.33 %. The accident severity of India as a whole is 31.4 whereas, accident severity of Uttarakhand is 60.46. (Accident severity is the number of persons killed per 100 accidents). Accident severity of Uttarakhand is almost double than that of India. The Times of India news reports that Road accidents in Uttarakhand decrease by 7% in 2018 (and little over 10% since 2016) but fatalities rise by 8.2%. First eight months of 2018, reported 976 accidents against 1049 in the similar period in 2017, but nearly 694 killed between January to august 2018 against 641 in 2017. On 1st. July 2018, 48 people were killed and many injured as the overload bus fell into a gorge in Dhumakot, Udham Singh Nagar district. It is one of the maximum recorded fatalities with 131 people posing their lives in road accidents while 115 people were killed in Haridwar. Dehradun also witnessed 72 deaths during the same time period. Four major districts of Uttarakhand, namely, Dehradun (213), Haridwar (233), Nanital (134) and Udham singh nagar (223)- accounted for about 82% of total road accidents in Uttarakhand in 2018. Tehri and Pauri districts reported maximum number of people killed in road accidents this year. Tehri reported 72 fatalities in 2018 against only 36 in 2017, while Pauri witnessed 72 fatalities in 2018 against 17 in 2017. Road safety committee of Supreme Court mandated to reduce the number of accidents by 10% annually. Special drives are conducted by State Police to curb road accidents and it is recommended to State Transport department to cancel the driving licenses of over 7400 serious traffic violators.

II. LITERATURE REVIEW

Raj V.Ponnaluri in his paper focused to study the road traffic crash of Andhra Pradesh and to identify the types of risks involved. He studied the trends in RTC and concluded the deficiencies therein. The study concluded that fatalities tripled itself from 2001 to 2009. Fatal crashed were because of heavy vehicles, motorized two-wheelers, old vehicles, over-turning, head-on collisions and the major cause was driver's error. RTC occurred at uncontrolled intersection as well as at police-regulated locations. Study gave certain recommendations too.[1] Raj V. Ponnaluri in another study developed generalized Smeed and Andreassen Model to evaluate if traffic fatalities were impacted by structural changes. Seven models were developed and tested. This work concluded that fatality rate dropped during four analysis periods because of the improvement in medical facilities.[2] P.Pramada Valli aimed in his paper to develop models by analyzing the road accident data at country level as well as for major metropolitan cities. The data for 25 years were analyzed to understand the nature and extent of the causes of accidents using Smeed's formula and Andressen's equations. Study suggested that in order to minimize accidents, there should be a reduction in the use of personalized vehicles and encourage the use of public transport vehicles.[3] Dinesh Mohan in a study studied that Road traffic fatalities have been increasing and

shows no signs of decrease. He suggested that road safety policies in India must focus to reduce the incidence of road traffic injuries: pedestrians and other non-motorist in urban areas; pedestrians, other non-motorists, and slow vehicles on highways; motorcycles and small cars in urban areas; over-involvement of trucks and buses; night-time driving; and wrong side drivers on divided highways. There is an urgent need to revamp police data in order to collect necessary information for analysis. [4]

III. OBJECTIVES OF THE STUDY

1. Present the National Road Traffic Crash framework, with special
2. Analysis and interpretation of the trends in RTC reference to Uttarakhand..
3. Identification and analysis of types of risk involved and their impact.
4. Suggesting preventive measures

IV. RESEARCH METHODOLOGY

As far as secondary data is concerned, the references from the internet (government reports), related books, reputed and academic journals like Elsevier (IATSS Research), Springer and Shod Ganga have been taken. . The data has also been referred to the secondary data available in Uttarakhand official records.

Simple random sampling has been done to collect the primary data. A structured undisguised personally administered questionnaire has been developed to get the required primary data from the respondents.

The questionnaire comprises of three variables namely risk factors (road conditions), individual factors and the poor vehicle maintenance, consisting of 16 units.

To check the reliability of the primary data collected and the content validity, Cronbach alpha test was carried. the alpha value of 0.7 and above should be considered (Nunnally, 1978). To get the outcome we have used the statistical tools like correlation, anova etc. For calculations Five point Likert scale has been used and the complete calculations and analysis has been done with Excel.

A. Reliability of Data

The value calculated from the collected primary data came out to be CronBach Alpha=0.7 shows that the primary data is consistent (reliable).

V. DATA ANALYSIS

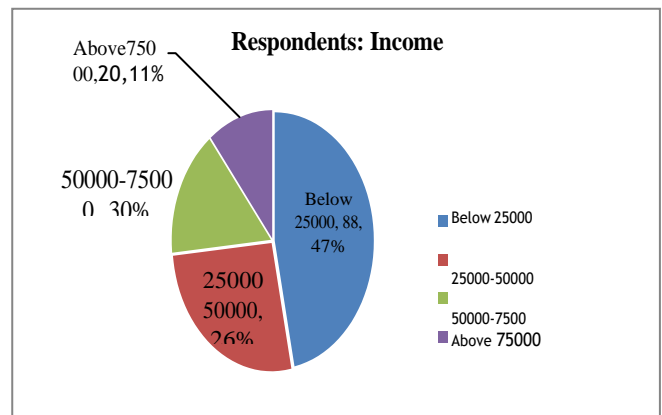On the basis of the primary data collected the following analysis is done.

A. Respondents: Income Group

Table:1 Total Respondents: 188

Below 25,000= 88	47%
25,000-50,000= 50	27%
50K -75K = 30	15%

Above 75K = 20	11%	

CHART:1

Respondents: Income

B. Correlation analysis was done between the three variables i.e. the risk factors, individual factors and the poor vehicle maintenance.

1. **Table:2 Correlation between the factors shown below.**

	Risk Road Conditions	Individaul	*Vehicle*
Risk (Road Conditions)	1		
Individual	0.349123	1	
Poor Vehicle maintenance	0.427707	0.509861	1

Interpretation of Table No.2

It is evident from the above table that the correlation of Individual Factors and Poor Vehicle maintenance is (0.5068). It is more correlated as compared to other factors. Poor Vehicle Maintenance and Road Conditions are 0.427707. Individual factors and Road Conditions are least correlated.

C. To study the relations ship between Male, Female and Accidents in Uttarakhand. One way ANOVA is used

H_o: There is no significant difference between the accidents of males and Females in Uttarakhand.

H_1: There is a significant difference between the accidents of males and females in Uttarakhand.

Table No. 3.

Groups	Count	Sum	Average	Variance
Male	100	386.6815	3.866815	0.269908
Female	88	354.6704	4.030345	.164212

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.251761	1	1.251761	5.677695	0.01819	3.89194
Within Groups	41.00739	186	0.22047			

Interpretation of Table No.3

It is evident that the F calculated value > F-Critical value and p= 0.01819 < 0.05, from calculations, the averages shows that the males=3.866815, females=4.030345 indicates that female drivers are more prone to accidents in Uttarakhand. We do not accept null hypothesis.

Chart :2

Gender Status: Total=188

Female, 53 (100)
Male, 47
■Male ■Female
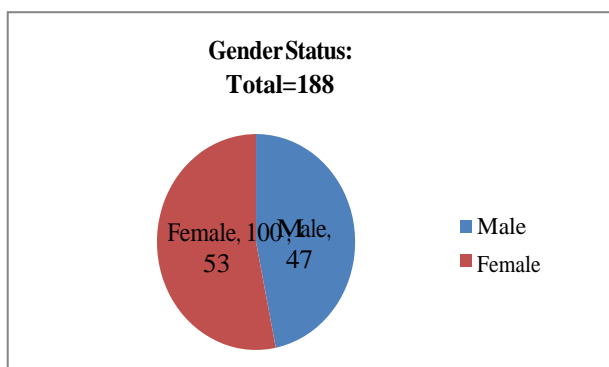
D. To study the relationship between the Married, Unmarried individuals and accidents in Uttarakhand. The following hypothesis were used with ANOVA

H_0: There is no significant difference between the accidents of married and unmarried people.

H_1: There is a significant difference between the accidents of married and unmarried individuals Of Uttarakhand.

Table No 4.

Groups	Count	Sum	Average	Variance
Married	84	330.3704	3.932981	0.284943
Unmarried	104	410.9815	3.951745	0.18051

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.016362	1	0.016362	0.072042	0.788684	3.89194
Within Groups	42.24279	186	0.227112			
Total	42.25916	187				

Interpretation of Table No. 4

From the table above it is clear that F calculated value < F-Critical value and p-value (0.788684) >0.5. Do not reject null hypothesis, it is also evident from the averages that, Married =3.932981 and Unmarried = 3.951745. It is more or

less the same i.e. both males and females have equal probability of being prone to accidents in Uttarakhand.

CHART 3

MaritalStatus

Unmar, 104.
Married. 45
■Married ■Unmarrie
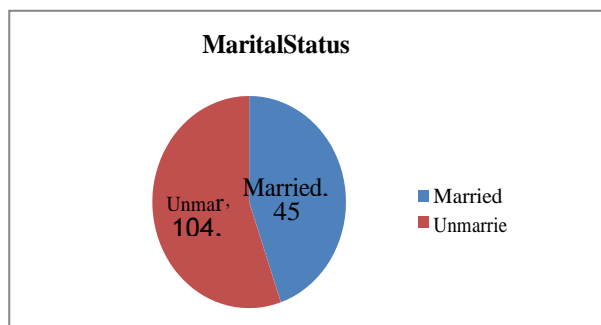
E. To determine the impact or effect of different age groups on accidents, ANOVA is used to determine the effect.

H_0: There is no significant difference between the accidents and different age groups of people.

H_1: There is a significant difference between the accidents and different age groups of people.

Table No 5.

Groups	Count	Sum	Avg.	Var.
A	50	196.38135	3.92763	0.137368
B	54	14.8741	3.97915	0.24412
C	46	184.9111	4.019807	0.274306
D	38	145.1852	3.820663	0.251987

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.922444431	3	0.307481	1.368677	0.253807	2.653695
Within Groups	41.33671071	184	0.224656			
Total	42.25915514	187				

Interpretation of the table No.: 5

From the table above F-calculated value < F-Critical value value > 0.05, It is also evident that the averages of different age groups do not show much variations except age group of 31-40. i.e. accidents may occur at any age group. We do not reject null hypothesis.

Below 20 years (A) =50, Average=3.92 21-30 years (B) = 54, Average=3.9731-40 years

(C) = 46,Average=4.019 Above 41 years
(D) = 38. Average=3.820

Chart 4

Different Age Groups Prone to Accidents
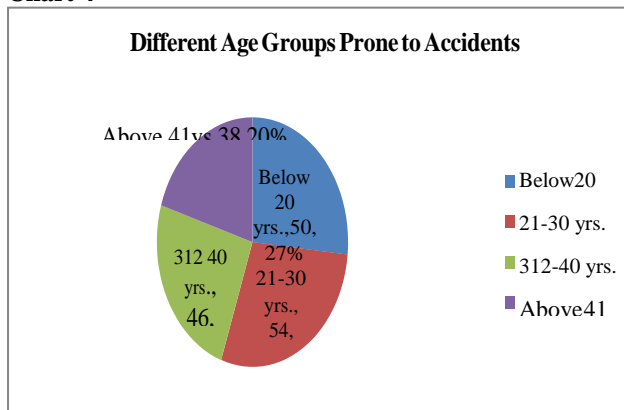
F. Association between Risk factors, Individual factors and Poor Vehicle Maintenance On road accidents:

The combined effect of all three variables has also been analyzed with a view to find out the impact of all three variables on road accidents. ANOVA has been used to determine the results.

H_0: Risk factors, Individual factors and Vehicle Maintenance have no significant difference on road accidents.

H_1: Risk factors, Individual factors and Vehicle Maintenance have significant difference on road accident

Table: 6

Groups	Count	Sum	Avrg.	Var.
Risk	188	711.05 55556	3.7822 1	0.16 5566
Individual	188	772	4.1063 83	0.31 4611
Vehicle	188	741	3.9414 89	0.65 1638

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	9.879 247	2	4.93962 3	13.0 9301	2.77E-06	3.01178 7
Within Groups	211.6 495	561	0.37727 2			
Total	221.5 288	563				

Interpretation of Table No.6

It is clearly evident the F-calculated value> F-Critical Value, and P value is very less than 0.05 hence null hypothesis is rejected. It shows that risk factors, individual factors and poor vehicle maintenance have greater significance on road accidents and must be given utmost priority.
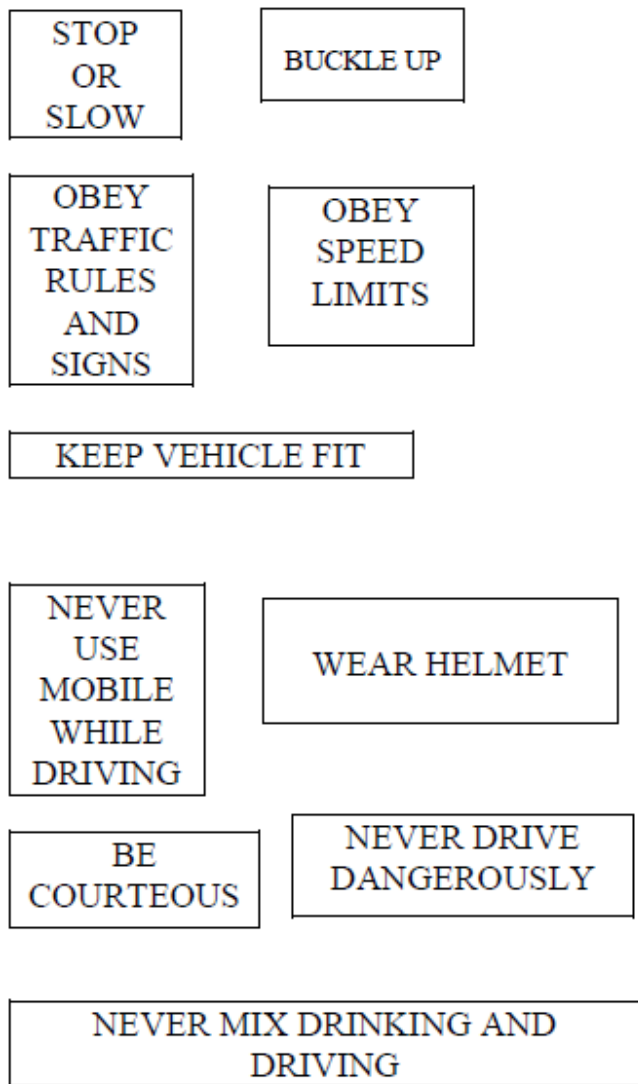
VI. CONCLUSION

i. It is evident from the study that road accidents in Uttarakhand has decreased by 7% but fatalities rose by 8.2% as per 2017-18.

ii. Due to migration from the hill of Uttarkhand and from the neighboring states due to several reasons, cities like Dehradun have been over crowded and are in need of proper management of road traffic.

iii. Tourist season also witnesses heavy congestion in the state, many inexperienced drivers' visits the state. Thus increasing the probability of RTC.

iv. From the interpretations above it is evident that all the three factors i.e. risk factors (road conditions), individual factors and the poor vehicle maintenance, have their own impact on road crashes in the hills of Uttarakhand.

v. From the combined analysis of the three variables, it is seen that all three factors have their own impact on the RTC.

vi. There is lot more to be addressed by the State and the Center governments in Uttarakhand. It has been considered by the present Government to some extent (all weather roads)..

VII. RECOMMENDATIONS AND SUGGESTIONS

i. Raise the awareness about the road safety issues.

ii. Drivers should be given driving license only after proper driving tests and regular review of licenses to be done.

iii. Only hill driving trained drivers to be allowed to drive on hills.

iv. Establish a road safety information data base of the state.

v. Ensure safer road infrastructure including street lighting, speed breakers, broad road turns etc.

vi. Road traffic safety education and training should be imparted to drivers free of cost.

vii. Enforcement of safety laws like over speeding, overloading etc.

viii. There should emergency management services for post incident trauma care for RTC victims.

ix. There should be wire ropes and rollers on ropes to be used as hedges on hills. It can take 90 tons loads and hence will safeguard the travelers.

x. The conditions of roads should be improvised after every weather change especially after monsoons.

xi. There should be all weather roads on highways especially the hills.

xii. The study recommends developing a reliable road accident recording system and expanding RTC emergency services.

xiii. Driving license should be cancelled for serious traffic violators.

| STOP OR SLOW | BUCKLE UP |

OBEY TRAFFIC RULES AND SIGNS

OBEY SPEED LIMITS

KEEP VEHICLE FIT

NEVER USE MOBILE WHILE DRIVING

WEAR HELMET

BE COURTEOUS

NEVER DRIVE DANGEROUSLY

NEVER MIX DRINKING AND DRIVING

VIII.   LIMITATIONS

There are certain limitations of the study:

i.   Secondary data on the related topics were very limited.

ii.   It is not easy to get the primary data collected in spite of repeated follow up with the respondents.

iii.   The study is restricted to the state of Uttarakhand only.

iv.   People are not much aware about the actual realities of the fatalities due to RTC in India which is a shortcoming for us in collection of data. .

v.   The percentage of responses was quite low.

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Dr. Amit Kumar Uniyal- has done MSc. (Statistics), MBA-HR, PGDBM-HR, PhD. in Statistics. He has got certification from University of London and SOAS and University of Illinois. He has got a number of publications in Web of Science, SCI and Scopus indexed journals. He has got two books under his name published (Management Subjects). He has also got the life time membership of (Statistics) DDU University –Gorakhpur. He has been a registered and a regular reviewer of the Elsevier and Springer Journals.

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