

Curriculum Vitae Yousaf Shad Muhammad

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Personal details

Full name: Yousaf Shad Muhammad
Date and place of birth: October 02, 1970, Faisalabad (Pakistan)
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DHA Phase 2, Islamabad.
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Email: yousuf@qau.edu.pk
Nationality: Pakistan
Marital status: Married, one kid
Degree: Doctor rerum socialium Oeconomicarumque
(PhD in Social and Eco. Sciences)
Occupation: Research and Teaching QAU, Islamabad

Profile

Yousaf Shad Muhammad currently working as a chairman, department of Statistics (biggest department in Pakistan), Quaid-i-Azam University, Islamabad. He is a skilled statistician with a strong background in optimization methods. Since 2004 he has been developing and implementing different mathematical programming models. At University of Vienna (2004-2007), Yousaf has a deep knowledge in mathematical programming and has developed new model for Indus basin irrigation system (IBIS). At NTNU and SINTEF (2008-2010), he is developed and implemented Seafood Value Chain Stochastic Optimization Model for Norwegian meat market. Yousaf attended Portfolio Financial Optimization (PFO) workshops in Verbund, Vienna. I conducted risk assessment (credit risk) model for House Building Finance Cooperation Pakistan in 2011. I and my team conducted many computational risk management, credit risk management and portfolio optimization workshops in National University of Science and Technology (NUST), State Bank of Pakistan and commercial banks in Pakistan.

Professional career

Sep. 2010 to date: QAU, Islamabad
Apr. 2010 to Sep. 2010: RCMS, NUST
Feb. 2008 to 2010: post-doctor at NTNU
1995 to 2004: Faculty member at Post Graduate College Rawalpindi, Pakistan.
1994 to 1995: Consultant in Ghazi Barotha Hydro Power Project, Pakistan.

Education

2008 to 2010: Post Doc NTNU, Norway.
2004 to 2008: PhD study at University of Vienna (Austria).
Finished with 'dr. rer. soc. Oec.' (doctor degree in social sciences).
PhD-thesis: 'Stochastic Optimization for Water Resources Management:
A Case Study of IBIS'
1991 to 1994: Study of Statistics at University of Agriculture Faisalabad, Pakistan
1989 to 1991: Bachelor degree with mathematics & statistics as major subjects
1986 to 1989: Pre Engineering studies

Knowledge and experiences

- Statistics: Operations Research, Sampling, Experimental Design, Stochastic Processes, Econometrics.
- Mathematics: Stochastic Optimization and Differential Calculus.
- Programming languages: including C, object oriented (C++), Visual Basic, mathematical (Matlab), modelling (Ampl, Zimple, GAMS) and database (PL/SQL) languages.
- Statistical Packages/language: Minitab, R, S-plus, SPSS, EViews, SAS.
- Familiar with: Windows, Unix ,Linux.

Teaching Courses

- **Financial and Economic Stochastic Models**
- **Credit Risk Modeling and Analysis**
- **Quantitative Methods and System Analysis**
- **Operations Research**

- **Stochastic Processes**
- **Supply Chain Design, Management and Optimization**

Research interests

- Along with my other research internists, my main focus is conducting research where I am using simulation techniques (See my publications no. 25, 23, 19, 14, 13 and 11. Also, publication in review no. 16, 15, 9, 8 and 7). I am working on new computation techniques, methods and algorithms (see my publications). Genetic algorithm, neural network and grid computing is my main area of research.
- Programming: optimization and optimal grid computing.
- Portfolio Optimization, Credit Risk Modelling
- Stochastic programming: generation of scenarios and solution of stochastic programs. Calibrating new stochastic models for complex networking systems.
- Finance: optimal investments, risk management.
- Energy: harvesting natural energies, like wind, waves, water flow, sun shine.

Projects

- **Facility Location Optimization** A QAU project on facility location optimization for rescue 15 services was conducted in 2012-13.
- **Credit Risk Modelling** A one week workshop for credit risk modelers from all leading banks in Pakistan was held at Research Center Modelling and Simulation (RCMS), NUST with collaboration of State Bank of Pakistan in 2011. The participants were given a comprehensive brief on preparing, analyzing and reporting risk factors to their organizations which may poses from individual customers and corporate organizations.
- **Internal Credit Risk Model for HBFC** HBFC is a public sector lending organization. It deals with customers and organizations for borrowing money. This structure require portfolio risk management mechanism. Our team prepared an internal model for them which is being used in the organization.
- **Meat vision Norway** Presently I am working on this project. This project is to calibrate a stochastic optimization model for Norwegian meat market.

- Worked as **YSSPer 2006** (Young Scientist Summer Programme), IAASA Lexamburg, Austria.
- **CRM**computational risk management group, University of Vienna, Austria.
- **GBHPP** worked as consultant in Ghazi Barotha Hydro Power Project. This project was to prepare recommendation for govt. of Pakistan and World Bank for land acquisition to lay a water channel from Ghazi to Barotha. This team successfully established a land acquisition report following that no political, social and economic unrest observed. The recommendations those were given by this team were acceptable both for land owners and implementing bodies, WAPDA and WB.
- **Pension Fund Austria** development of a model for Austrian pension fund.
- **AURORA** Advanced Models, Applications and Software for High Performance Computing.
- **WEBOPT** Webbased solutions for optimization problems (Asia IT&C Programm der EU)
- Coupling Methods in Markov Chain Optimization.
- Facility location Optimization, QAU.
- Integrated supply chain design of natural gas in Pakistan, HEC.

Languages

Urdu/punjabi: native

English: fluent

Arabic: understandable

German: understandable

References

1 o.Univ.Prof. Dr. Georg Ch. Pflug, Department of Statistics and Decision Support Systems University of Vienna, Austria. Tel: +43-1-42 77 38630, email:georg.pflug@univie.ac.at

2 Prof. Dr. Muhammad Aslam, Department of Mathematics and Statistics Riphah International University Islamabad, Pakistan. email:m.aslam@riphah.edu.pk

3 Univ.Prof. Dr. Ubydul Haque, Department of Biostatistics and Epidemiology at the UNT Health Science Center School of Public Health. 3500 Camp Bowie Blvd. Fort Worth, Texas 76107 USA. email:ubydul.kth@gmail.com,Mdubydul.Haque@unth

1 PEER-REVIEWED Publications

Publication summary and metrics				
	First Author	Supervisor	Co-author	Total
Impact Factor	4	9	13	26
PEER-REVIEWED	5	3	4	12
Others	3	3	1	7
Conference Papers	7	0	0	7

publications (* = Corresponding author or First author, S = Student's paper, C = Co-author)

2 Publications

Publications

Year 2021

45. Uzma Yousaf, Aqib Hassan Ali Khan , Asifa Farooqi , Yousaf Shad Muhammad,Rocío Barros, Juan Antonio Tamayo-Ramos, Mazhar Iqbal, Sohail Yousaf(2021).Interactive effect of biochar and compost with Poaceae and Fabaceae plants on remediation of total petroleum hydrocarbons in crude oil contaminated soil. Chemosphere(IF 7.09).
44. Fakhra Batool and Muhammad Yousaf Shad(2021).Seeking a balance between population diversity and premature convergence for real-coded genetic algorithms with crossover operator. Evolutionary Intelligence(IF 2.34).
43. Azhar Mehmood Abbasi and Muhammad Yousaf Shad(2021).Estimation of population proportion using concomitant based ranked set sampling. Communication in Statistics: Theory and Methods (IF 0.884).
42. J. Lubina, Ubydul Haq, Muhammad Yousaf Shad(2021). Climate Change and dynamics in age-related Malaria incidence in South Africa: A focus on Zambia . Environmental Research (IF 5.715).
- 41.Mst. Marium Begum , Osman Ulvi, Muhammad Yousaf Shad and Ubydul Haque (2021). Quantifying Media Effects, Its Content, and Role in Promoting Community Awareness of Chikungunya Epidemic in Bangladesh. Epidemiologia (IF 1.701).
40. Sajid Hussain, Muhammad Daniyal, Roseline Oluwaseun Ogundokun, Muhammad Yousaf Shad, Zafar Iqbal, Rashid Ahmed(2021). Cloning data with unchanged estimates of estimable non-linear functions of parameters, F1000 Research (IF 2.30).

Year 2020

39. Muhammad Yousaf Shad and Azeem Iqbal (Accepted). E-Bayesian estimation of Maxwell Distribution and its evaluation standards: E-Posterior Risks and E-MSEs (Expected mean square errors). *Journal of Statistical Computation and Simulation* (IF 0.92).
38. Muhammad Yousaf Shad and Ubydul Haque (2020). The Impact of COVID-19 on Globalization. *One Health* (IF 4.694).
37. Fakhara Batool, Muhammad Yousaf Shad and Saima Khan (2020). A new Logistic distribution based crossover operator for real-coded genetic algorithm, *Journal of Statistical Computation and Simulation* (IF 0.920).
36. Selam Mihreteab, Jailos Lubinda, Bingxin Zhao, Alfonso J. Rodriguez-Morales, Ajlina Karamelic Muratovic, Aman Goitom, Muhammad Yousaf Shad and Ubydul Haque (2020). Retrospective data analyses of social and environmental determinants of malaria control for elimination prospects in Eritrea, *Parasites and vector*, 2020. DOI.10.1186/s13071-020-3974-x. (IF 3.876).

Year 2019

35. Zulfiqar Ali, Ijaz Hussain, Muhammad Faisal. Shehzad, Y.S. MuhammadC, An Ensemble Procedure for Pattern Recognition of Regional Drought, *Int. Journal of Climatology*(2019), (IF 3.78). doi:http://dx.doi.org//10.1002/joc.6196
34. Abid Hussain, Yousaf shad Muhammad(2019), Trade-off between exploration and exploitation with genetic algorithm using a novel selection operator, *Complex and Intelligent Systems*. pp 1 to 14 (IF 3.791).
33. Yousaf shad MuhammadS, Minimum Cost Multiobjective Programming Model for Target Efficiency in Sample Selection, *Scientific Programming*, 2019. (IF 1.678)
32. Abid Hussain, Yousaf shad MuhammadS, Nauman Sajid (2019), An Efficient Genetic Algorithm for Numerical Function Optimization with Two New Crossover Operators *I.J. Mathematical Sciences and Computing-V4-N4-4*.

Year 2018

- 31) Abid Hussain, Yousaf shad MuhammadNouman and Nauman Sajid (2018), A simulated study of genetic algorithm with a new crossover operator using traveling salesman problem. *Punjab University Journal of Mathematics*.
- 30) Abid Hussain, Yousaf shad MuhammadNouman and Nauman Sajid (2018), An Improved Genetic Algorithm Crossover Operator for Traveling Salesman Problem. *Turk. J. Math. Comput. Sci*.
- 29) Abid Hussain, Yousaf shad MuhammadNouman and Nauman Sajid (2018), An efficient genetic algorithm for numerical function optimization with two cross-over operators. *International journal of mathematical sciences and computing*.
- 28) Fida Hussaina, Imran Hussainb, Aqib Hassan Ali Khana, Yousaf Shad Muhammad, Mazhar Iqbala, Gerhard Sojab, Thomas Gerhard Reichenauerb, Zeshanf, Sohail Yousafa (April 2018), Combined application of biochar, compost, and bacterial

consortia with Italian ryegrass enhanced phytoremediation of petroleum hydrocarbon contaminated soil. *Environmental and Experimental Botany* 153 (2018) 80 to 88. (IF 5.36)

27) Abid Hussain, Yousaf shad Muhammad Nouman and Nauman Sajid (Jan 2018), Optimization through Genetic Algorithm with a New and Efficient Crossover Operator. *International Journal of Advances in Mathematics* Volume 2018, Number 1, Pages 1-14.

Year 2017

26) Abid Hussain, Yousaf shad Muhammad Nouman and Nauman Sajid (November 2017), Performance Evaluation of Best-Worst Selection Criteria for Genetic Algorithm. *Mathematics and Computer Sciences* 2017; 2(6):89-97.

25) M.R. Shahid, R. Ahmed, F. Shehzad, Y.S. Muhammad, Development of some useful generators to obtain partially neighbor balanced designs, *Journal of King Saud University - Science* (2017), doi:<http://dx.doi.org/10.1016/j.jksus.2017.07.009> (IF 2.778).

24) Abid Hussain, Yousaf Shad Muhammad, M. Nauman Sajid, Ijaz Hussain, Alla Mohamd Shoukry, and Showkat Gani (2017). Genetic Algorithm for Traveling Salesman Problem with Modi

ed Cycle Crossover Operator, *Computational Intelligence and Neuroscience* (IF 1.215).

23) Azhar Mehmood Abbasi and Yousaf Shad Muhammad (2017). Manipulation-based ranked set sampling, *Pakistan Journal of Statistics and Operations Research* (PJSOR) 13(4):775.

22) Azhar Mehmood Abbasi and Yousaf Shad Muhammad (Jun 2017). Estimation of population mean and median using double robust truncation based ranked set sampling, *Pakistan Journal of Statistics and Operations Research* (PJSOR): Vol. 13 No. 2.

21) Zulifqar Ali, Ijaz Hussain, Muhammad Faisal, Hafiza Mamoona Nazir, Tajamal Hussain, Yousaf Shad Muhammad, Alaa Mohamd Shoukry and Showkat Hussain Gani (April 2017). Forecasting Drought using Multi Layer Precipitation Artificial Neural Network Model, *Advances in Meteorology*. (IF 1.277)

20) Said Arab Khan, Ijaz Hussain, Muhammad Faisal, **Yousaf Shad Muhammad** and Alaa Mohamd Shoukry (Feb. 2017). Regional Frequency Analysis of Extremes Precipitation using L-Moments and Partial L-Moments, *Advances in Meteorology*. (IF 1.277)

Year 2016 and before

19) **Yousaf Shad Muhammad** (Dec. 2016) Multivariate multi-objective compromise allocation: A game theoretic approach. *PLOS ONE*. (IF 2.806)

18) Sajjid Gul, Ijaz Hussain, **Yousaf Shad Muhammad** (2016) Spatio-Temporal Variability Performance Evaluation of Reference Evapotranspiration Models. International Journal Of Global Warming. (IF 1.286)

17) Aqib Hassan Ali Khan, Sundus Tanveer, Mariam Anees, **Yousaf Shad Muhammad**, Sohail Yousaf. (2016) Role of nutrients and illuminance in predicting the fate of fungal mediated petroleum hydrocarbon degradation and biomass production, Journal of Environmental Management 2016. (IF 4.010)

16) Aqib Hassan Ali Khan, Sundus Tanveer, Mariam Anees, **Yousaf Shad Muhammad**, Sohail Yousaf. (2016) Effects of illuminance and nutrients on bacterial photo-physiology of hydrocarbon degradation Journal: Science of the Total Environment. 2016. (IF 4.900)

15) Muhammad Azhar and **Yousaf Shad Muhammad**.(2016) A family of product estimators for population mean in median ranked set sampling using single and double auxiliary variables, Interstat.

14) Laila Bibi and **Yousaf Shad Muhammad**.(2016) Maximum Coverage Location Model for Emergency Services under Budgetary Condition, NJES, NUST.

13) **Yousaf shad Muhammad** and Ijaz Hussain (2017). Tradeoff between cost and variance for a multi-objective compromise allocation in stratified random sampling, Communication in Statistics- Theory and Methods 03/2016 (IF 0.311)

12) Naima Mubarak, Ijaz Hussain, Muhammad Faisal, Tajammal Hussain, **Yousaf Shad Muhammad**, Nasser M. Abdel-Salam, Javid Shabbir (2015). Spatial Distribution of Sulfate Concentration in Groundwater of South-Punjab, Pakistan. Water Quality Exposure and Health 04/2015; DOI:10.1007/s12403-015-0165-7, (IF 1.692)

11) **Yousaf Shad Muhammad** and G.C. Pflug (2014). Stochastic vs. Deterministic Programming in Water Management: The value of flexibility. Annals of Operation Research. DOI 10.1007/s10479-013-1455-8. (IF 1.217)

10) **Yousaf Shad Muhammad**; Javed Shabbir and Ijaz Hussain. (2014). Multi-objective Compromise Allocation in Multivariate Stratified Sampling Using Gemma Cost Function. Journal of Mathematical Modelling and Algorithms, Springer.

9) Hussain I.; M. Faisal; **Yousaf Shad Muhammad** (2015). Assessment of Spatial Models for Interpolation of Elevation in Pakistan. International Journal of Global Warming. (IF 1.286)

8) Saima Khan, **Yousaf Shad Muhammad** and Javid Shabbir (2014). Comparison of Modified Extended Lexicographic Technique with Fuzzy and Value Function Techniques Using the Auxiliary Information as Attributes. *International Journal of Business and Social Science*, ISSN: 2219-1933, 2219-6021 online.

7) Sidra Naz, **Yousaf Shad Muhammad** and Javed Shabbir (2014). Compromise Allocation For Mean Estimation In Stratified Random Sampling Using Auxiliary Attributes When Some Observations Are Missing. *International Journal of Business and Social Science*, ISSN: 2219-1933, 2219-6021 online.

6) **Yousaf Shad Muhammad**, Nouman Afghan and Fayyaz Ahmed (2014). Impact of Extended Storage Capabilities in IBIS Under Stochastic Hydrologic Regime. *International Journal of Business and Social Science*, ISSN: 2219-1933, 2219-6021 online.

5) **Yousaf Shad Muhammad**, Sadia Aslam, Azhar Mehmood Abbasi and Nouman Afghan (2014). Performance Evaluation of Automated Teller Machine (ATM) With Fuzzy TOPSIS Using Sample Survey Results. *International Journal of Business and Social Science*, ISSN: 2219-1933, 2219-6021 online.

4) Sarhad Ullah Khan, **Yousaf Shad Muhammad** and Nouman Afghan (2014). Multi-objective Compromise Allocation Stratified Sampling in the Presence of Non-response Using Quadratic Cost Function. *International Journal of Business and Social Science*, ISSN: 2219-1933, 2219-6021 online.

3) **Yousaf Shad Muhammad**, Munawar Iqbal, Ijaz Hussain, Shahid Kamal and Nouman Afghan (2014). Modeling Non-Linear Behavior of Independent Variables. *International Journal of Business and Social Science*, ISSN: 2219-1933, 2219-6021 online.

2) **Yousaf Shad Muhammad** (2010). *Water Resources Management by Stochastic Optimization: A Case Study of Indus Basin Irrigation System*. VDM, Berlin, Germany. ISBN: 978-3-639-2863-5.

1) Ahmad M. A., I. Ahmad and **Yousaf Shad Muhammad** (1996). Growth and Instability of Cereal Production in Pakistan. *Pakistan Statistical Association (Faisalabad Chapter)*, P: 76-85.

Conference Papers

1) **Shad M. Y.**; Asgeir Tomsgard; Kristin T. Uggen and Peter Schütz (2009). *Seafood Value Chain and supply chain Stochastic Optimization*. INFORMS Con-

ference, 11-14 October, 2009, San Diego, America.

2) **Shad M. Y.**; Asgeir Tomsgard; Kristin T. Uggen and Peter Schiøtz (2009). Seafood Value Chain and Supply Chain Integrated Stochastic Model. KTH Conference, 2009, Stokholm, Sweden.

3) **Shad M. Y.**; Asgeir Tomsgard; Kristin T. Uggen and Peter Schiøtz (2008). Seafood Value Chain and Supply Chain Integrated Stochastic Model. EURO Conference, 2008, Bonn, Germany.

4) **Shad M. Y.**; Asgeir Tomsgard; Kristin T. Uggen and Peter Schiøtz (2008). Seafood Value Chain Stochastic Optimization Model: A Supply Chain Tool. INFORMS Conference, 12-15 October, 2008, Washington DC, America.

5) **Shad M. Y.**; Asgeir Tomsgard; Kristin T. Uggen and Peter Schiøtz (2008). Seafood Value Chain Stochastic Optimization Model. APMOD Conference, 27-31 May, 2008, Bratislava, Slovak Republic.

6) **Shad M. Y.** and G. Pflug (2007). Water Resources Management by Stochastic Optimization: A Case Study of IBIS, SPXI Conference 27-31 August, 2007, Vienna, Austria.

7) **Shad M. Y.** and G. Pflug (2006). Optimal Water Resources Management by SP, APMOD Conference, 18-21 June, 2006, Madrid, Spain.

PhD Thesis Supervised

Abid Hussain (2018) Genetic Algorithms: Simulation based optimization techniques.

MPhil Thesis Supervised

45 **Tayyaba Shoukat (2021)**

44 **Ghulam Rasool (2021)** Estimation of Finite Population Mean Using Rank and extreme Value of the Auxillary Variable under PPS Sampling Scheme.

43 **Taskeen Saeed (2020)** Comparative study of Environment Geographical Factors Influencing Malaria along with their precautionary Measures.

42 **Attiya Javed (2020)** Pakistan Mercantile Exchange and Volatility Analysis.

41 **Irum Altaf (2019)** Cost and line losses minimization Multi-objective programming for power supply grid.

- 40 **Rida Zainab (2019)** Optimization of electricity power generation grid using multi-objective programming.
- 39 **Samar-un-Nisa (2019)** Combinatorial Optimization using Genetic Algorithm
- 38 **Maryam Iftikhar (2019)** An improved genetic algorithm cross-over scheme and its application
- 37 **Amreen Qamar (2019)** A comparative analysis of genetic algorithm with modified crossover for travelling salesman problem.
- 36 **Raheel Wakeel (2018)** An optimal design for natural gas production and distribution
- 35 **Aneeqa Manawar (2018)** Natural gas production and transportation model
- 34 **Kawanal Zaib (2018)** Stochastic model for optimal contaminated water management .
- 33 **Zaheer Aslam (2018)** Optimization of Electricity distribution network of Pakistan.
- 32 **Saima Ayub (2018)** Power Generation Management Using Multi-objective Optimization Techniques.
- 31 **Saima Majeed (2018)** Time series and frequency analysis of inflow in different dams of Pakistan.
- 30 **Fakhra Bashir (2018)** Stochastic model for optimal water management and crop planning.
- 29 **Muhammad Taqi Khan (2018)** Regression Tree Analysis.
- 28 **Hira Anum (2017)** Spatial Prediction of Water Quality Index by Nonlinear Predictors.
- 27 **Masood Anwar (2017)** Spatial and Temporal Trend Analysis of Reference Evapotranspiration for Different Region of Pakistan.
- 26 **Samia Asghar (2016)** Comparison of diffract irrigation techniques
- 25 **Ammara (2016)** Optimal Crop Planning by Deficit Irrigation
- 24 **Amna Bibi (2016)** Small Scale Irrigation Farming Model
- 23 **Faiza Malik (2016)** An Optimal Irrigation Planning Model For KPK
- 22 **Muhammad Zeshan Ashraf (2016)** Statistical Down Scaling and Future Prediction for Temperature under Different Scenarios Over Punjab, Pakistan

- 21 **Sabir Ahmad Khan (2016)** Spatial Analysis of Aridity Index in Northren Areas and KPK, Pakistan
- 20 **Mussadiq Ibrahim (2015)** Baysian analysis in Half Normal Distribution
- 19 **Aysha Nayab (2015)** Baysian Stochastic Dynamic Programming in water management
- 18 **Uzma Bibi (2015)** Different methods to balance an unbalance transportation problem
- 17 **Samman Ishtiaq (2015)**Credit Risk Modeling, Calibration and Benchmark validation
- 16 **Gul Rukh (2015)** Modified Vogel Approximation Method (MVAM): A Better Approach for finding Initial basic Feasible Solution
- 15 **Sajjid Gul (2015)** Spatio-Temporal Variability Performance Evaluation of Reference Evapotranspiration Models
- 14 **Asad ur Rehman (2015)** Multi-objective compromission allocation in multi-way stratification.
- 13 **Saima Jabeen (2014)** Compromise Allocation in Multivariate Nested Stratified Sampling Design
- 12 **Sarhadullah Khatak (2014)** Multi-objective optimization in Stratified Random Sampling
- 11 **Sidra Naz (2014)** Compromise Allocation For Mean Estimation In Stratified Random Sampling Using Auxiliary Attributes When Some Observations are Missing
- 10 **Sonbia Naz (2014)** Forecasting Earthquake Magnitude
- 9 **Asma Zulfiqar (2014)** Location analysis of warehouse with stochastic demand
- 8 **Sadia Aslam (2014)** Optimal Automated Teller Machine (ATM) Deployment Strategy
- 7 **Laila Bibi (2013)** Maximum coverage location model under budgetary constraint for emergency services
- 6 **Warda Nousheen 2013)** Score card development and credit risk modeling in Pakistani Market
- 5 **Saima Khan (2013)** Optimum allocation in stratified sampling using multi-objective optimization

- 4 **Maryam Murtaza (2013)** Optimal resources deployment strategy for big cities
- 3 **Tatheer Raja 2012)** Optimization of canal water distribution for efficient cropping using stochastic programming
- 2 **Rafaqat Ali (2012)** Stochastic Model for optimal crop planning and use of water resources in a river bed
- 1 **Naila Siddique (2012)** Population estimation by stochastic matrix