Ergonomics in Caring for People
Ergonomics in Caring for People

Preface

From the December 7–9, 2015, about 175 academicians, researchers, teachers, students, consultants, and others, gathered in Mumbai, India and focused on caring for people through humanizing work and work environment. They came not only from all parts of India, but also from all over the globe to present about 260 papers in different forums of the HWWE 2015 conference. These participants represented many different disciplines and interests, and this is reflected in the spectrum of the papers included in this volume.

Of these papers, around 80 papers were considered suitable by the panel of independent referees for acceptance in the Peer Review category, that is, papers which the authors considered were worthy of consideration in a peer-reviewed publication. An internal review of these 80 papers by the editors following the Springer guidelines resulted in a final selection of 43 quality papers for this volume. Apart from quality, the brief given to the selectors was diversity, the result being that agriculture, accessibility, industry (particularly the un-organized sector), occupational health, and psychophysiology are just some of the themes covered here.

Though the conference organizers’ initial paper submission guidelines specified rigorous formatting requirements, there was a fair amount of divergence which needed editorial effort and correspondence with the authors, especially to match the stringent standards of the publisher. The final product is entitled “Ergonomics in Caring for People—Proceedings of the International Conference on Humanizing Work and Work Environment 2015.”

HWWE 2015 was the thirteenth such conference under the aegis of the Indian Society of Ergonomics. As in the case of the first conference, the editors of the present volume hope that it will provide guidance to all concerned in ergonomics application, research, and teaching, and lead to a discussion of needs and strategies for the further growth and development of ergonomics.

Mumbai, India  
Gaur G. Ray
Mumbai, India  
Rauf Iqbal
Kolkata, India  
Anindya K. Ganguli
Mumbai, India  
Vivek Khanzode
The task of organizing a conference is huge and the successful conduction of the conference remains incomplete without the support of many people involved in making the conference a success.

We would like to convey our thanks and gratitude to Prof. Devang Vipin Khakhar, Director, Indian Institute of Technology Bombay (IITB) and Prof. (Ms.) Karuna Jain, Director, National Institute of Industrial Engineering (NITIE), Mumbai. Without their support it would not have been possible to conduct such a mega International Conference on Humanizing Work and Work Environment 2015 and International Symposium on Community Nutrition and Health: A Social Responsibility.

The conference was jointly hosted by the Indian Institute of Technology Bombay (IITB) and National Institute of Industrial Engineering (NITIE); in collaboration with the Punjab Engineering College (PEC) University of Technology, Chandigarh. A special convey of thanks to Prof. Manoj K. Arora, Director, PEC University of Technology, Chandigarh, and Prof. Praveen Kalra Dean Academics, PEC University of Technology, Chandigarh for their continued support.

We take the opportunity to thank International Ergonomics Association (IEA) for endorsing the conference, with special reference to Dr. Yushi Fujita (President, IEA), Dr. Jose Orlando Gomes (Vice President and Treasurer, IEA), Mr. Andrew Todd (International Development Committee Chair, IEA), Dr. Kazutaka Kogi (President, ICOH), Dr. Eric Min-yang Wang (Awards Standing Committee Chair, IEA), and Dr. Rosemary R. Seva (President, Human Factors and Ergonomics Society of The Philippines).

We also would like to thank the Indian Society of Ergonomics, which is the only professional body representing ergonomics/human factors professionals in India with special reference to Dr. A.K. Ganguli (President, ISE), Dr. D. Majumdar (Vice President, ISE), Dr. Debkumar Chakrabarti, (Vice President, ISE), and all other associated members of ISE for their constant support.

We are highly grateful to Dr. P.K. Nag (Conference Chair) for his constant support and guidance in organizing the conference.
We would like to extend our warm greetings to Nutrition Society of India (NSI), Mumbai with special mention to Dr. Kasturi Sen Ray (President), Dr. Meena Godhia (Secretary), Priyadarshini Muley L. (Convener), and very active organizing committee members of NSI for their support throughout the conference making it a grand success.

We would like mention a special thanks to all the International Advisory Committee members and National Advisory Committee members for providing their expertise in helping with the selection and reviewing of the papers received for the conference. We express our gratitude to the scientific committee Dr. A.K. Ganguli and Dr. Vivek Khanzode (Secretary Scientific committee, HWWE2015), and Dr. Rita Patil (Secretary, CNH) for their expert guidance in paper selection for the conference.

A special mention of thanks to Dr. B. Sesikeran (Former Director, National Institute of Nutrition, Vice President, Nutrition Society of India), Dr. Amaresh Chakrabarti (Professor Centre for Product Design and Manufacturing, IISc, Bangalore), Dr. Rosemary R. Seva (President, Human Factors and Ergonomics Society of The Philippines), Dr. Seyed Ali Hosseini (Professor, University of Social welfare and Rehabilitation Sciences, Tehran, Iran), Dr. Anil Kakodkar (Ex-Director, Bhabha Atomic Research Centre (BARC) and Satish Dhawan Chair of Engineering Eminence) who delivered the keynote sessions, and other invited speakers who moderated and also chaired the specific sessions in each of the conference section. We are thankful to all the Invited speakers who shared their experiences from their respective fields during the conference.

We appreciate the efforts of Mr. Nirav Shah (Godrej Interio) Dr. Reena Valecha (Godrej Interio), Charudatta Jadhav (TATA consultancy services), Dr. Arun Garg (Distinguished Professor, University of Wisconsin. Milwaukee), Dr. Deepak Sharan (RECOUP Neuromusculoskeletal Rehabilitation Centre, Bangalore), Mr. Madan Kulkarni (Managing Director Kalakruti Furnitures Pvt. Ltd., MIDC Gokul Shirgaon, Kolhapur), Dr. Prema Ramchandra (Director, Nutrition Foundation of India), and delegates from Mahindra and Mahindra Limited for conducting very effective workshops in the HWWE2015. Participants have been benefited immensely from each workshop.

The gratitude expressed would be incomplete without the mention of the delegates, who came from different parts of the globe and assembled here to share their experiences.

The organizing committee deserves special thanks who worked tirelessly day in and day out to make sure that all things associated with the conference were perfect and in order. A heartfelt thank to all our working team who really need high appreciation and applause for crafting this conference. Special thanks to Ms. Madavi Sathe, Ms. Anuradha Shekhar, Dr. Rupali Sengupta, Ms. Mitra Savanur, Dr. Pooja Singhania C., Dr. Neha Paharia A., Ms. Shama Chavan, Ms. Bijal Lalan, Mr. Amar, Ms. Lavanya, Ms. Payel, Ms. Shreya, Ms. Arundhati, Ms. Shikha, Ms. Priyanka, Ms. Akanksha, Ms. Jayati, Mr. Ankur, Mr. Quashif, and Mr. Himanshu for their endless support in this conference. Endless thanks to Mr. Sajan Pillai who designed the conference website and Mr. Varun Mevada who efficiently designed
all the conference materials including printing and publications. The M. Des student volunteers from Industrial Design Centre (IDC) deserve a huge appreciation for managing the conference and assuring the sessions run as per the time schedule. The Selfless help awarded by IDC and NITIE Faculty and staff during the conference is highly appreciated.

We are extremely grateful to Springer for publishing selected full papers through “Peer review” under a special volume namely “Ergonomics in Caring for People—Proceedings of the International Conference on Humanizing Work and Work Environment 2015.”

Finally, we convey our sincere thanks to all the sponsors, i.e., Glanbia Nutritionals, COSMED, Kelloggs, Mahindra and Mahindra Limited, Pukhya Healthcare, TATA consultancy services, Godrej Interio, Eltek Systems, Qualisys, and Vitamin Angels who have not only generously contributed but also acted as well wishers by providing their suggestions as and when required.

**Conference Co-Chair**
Gaur G. Ray  
Professor  
IDC, IIT Bombay

**Conference Co-Chair**
Rauf Iqbal  
Associate Professor  
NITIE, Mumbai
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About the Editors

Prof. Gaur G. Ray is currently appointed as the Ramkrishna Bajaj Chair Professor of the Industrial Design Centre (IDC) at the Indian Institute of Technology Bombay (IITB). He recently got superannuated and been offered the ‘Professor Emeritus Fellowship’ Position by IITB from July, 2017. He was also the Head of the Department from 2009 to 2013 and responsible as the Head of the Ergonomics program of the institute. His past roles includes being appointed as Visiting Faculty at the Department of Engineering Design, Tufts University, USA, Department of Human Work Sciences, Lulea University of Technology, Sweden, and several other Universities. He was the founder member and served as the Honorary President of the Indian Society of Ergonomics for about 10 years and also was the Chairperson of the Ergonomics Section (PG 15), Bureau of Indian Standard, for 9 years. Professor Gaur G. Ray has also been involved in a number of international relations development projects including research collaborations between the Industrial Design Centre (IDC) at IITB and the Institute of Ergonomics (IAD) at TU Darmstadt in Germany and other universities. His major activities are in the areas on application of ergonomics in product development, for the people at the bottom of the pyramid, agriculture sector, geriatric population, automotive industry and design for the special people. He has published more than 30 papers in International Journals, Presented more than 130 papers in different national and International conferences, completed more that 15 funded projects by DST, MHRD, AICTE, and other organizations, completed more than 8 major consultation projects starting from vehicle design, workstation design, low cost agricultural tools design, etc. He recently completed the entire driver’s cabin design, layout, control panel organisation, and chair design for Mumbai Railway Vikas Limited. He has been awarded “J.N. Maitra” Gold Medal in the year 1998 by the Physiological Society of India for contribution in Indian Ergonomics. He was invited as Keynote Speaker by the International Ergonomics Association in 2015 at Melbourne. He has also received several best paper awards in the International and International conferences. In the year 2014, he received the Ramkrishna Bajaj Chair Professor Fellowship Award from IITB for 3 years. Professor Ray has guided seven PhDs, more than 20 MDes projects, and several M.Tech. and M.Sc. projects. He has published two books,
edited 2 conference proceedings, and obtained three National patents. He has applied for one International patent in the area of product design. Professor Ray is attached with several International and National Publishers as a referee. He is also member of the International Development Standing Committee of the International Ergonomics Association. The Concept of creating HWWE platform in India is his brain child and the first HWWE conference was hosted at IDC, IITB, in the year 2001 under his secretariat.

**Dr. Rauf Iqbal**

Associate Professor—Ergonomics and Human Factors Engineering, Prof. In-Charge—Ergonomics Laboratory, Coordinator—Mind to Market Centre, National Institute of Industrial Engineering (NITIE). His academic qualification is M.Sc. in Ergonomics and Work Physiology (Topper, Gold Medalist, Calcutta University) and Ph.D. His areas of expertise are Ergonomics & Human Factors Engineering and Worksysterm Design. He has published 39 papers in International and National Journals including book chapter. He had presented 57 papers in International and national conferences. Five scholars have been awarded Ph.D. and five more are currently pursuing their Ph.D. under the guidance of Prof. Rauf Iqbal. He is the paper reviewer of (i) ‘Journal of Back and Musculoskeletal Rehabilitation’, published by Roessingh Research and Development, Netherlands.

(ii) ‘Journal of Sports Sciences’, published by Taylor and Francis group on behalf of the British Association of Sport and Exercise Sciences, UK. (iii) ‘Indian Journal of Biological Sciences’ published by Vidyasagar University, West Bengal, and (iv) ‘International Journal of Health Science and wellbeing’, Nigeria. He is the member of various national and international committees like member of the Technical Committee for Prime Minister’s Shram Awards for the year 2015. Member of Tripartite Awards Committee of Vishwakarma Rashtriya Puraskar (VRP) and National Safety Awards (NSA) by the Ministry of Labour and Employment, Govt. of India, since 2014; member of BRICSplus liaison Sub-Committee for collaborative work (training, research, and conference) on ergonomics among BRICS countries; International Editorial Board member of Journal of Health and Safety at work, published by Tehran University Medical Journal publisher; member of Research Progress Committee, external expert and member of Internal Quality Assurance Cell of SNDT Women’s University, Mumbai, etc.

He has Conducted 10 sponsored projects/National studies and more than 50 industrial consultancy studies in the area of Ergonomics, Work-study, and man-power optimization. Recently he has been involved in “Redesigning the palanquin system for use in Mata Vaishno Devi Shrine”, funded by the office of the Principal Scientific Advisor to Govt. of India, New Delhi. He is involved in collaborative research and consultancy with various industries and institutes in the area of Ergonomics, Product, and Worksysterm Design. He has been organizing conferences and seminars at national and international level.

**Dr. Anindya K. Ganguli**

was born and educated in Calcutta. After graduating from Presidency College, Calcutta, in 1975, he completed his postgraduate studies in Physiology (with specialisation in Work Physiology and Ergonomics) from
Calcutta University in 1977, and undertook research in the Ergonomics Laboratory of the Department of Physiology, Calcutta University under the renowned Prof. R. N. Sen. In 1983, he joined the Occupational Health Service of the Bharat Heavy Electricals Ltd., Tiruchirapalli, as the first ever in-house ergonomist in Indian industry, ultimately heading the Work Physiology and Ergonomics unit there. He grew with the organization in its Occupational Health and Safety journey till his retirement as a Senior Deputy General Manager in 2014. He is a Lead Assessor for the Occupational Health and Safety Management System Standard (OHSAS 18001), and Environment Management System Standard (ISO 14001), and has undertaken numerous ergonomics consultancy assignments in different industries. He is the Chairman of the Sectional Committee on Ergonomics Standards (PGD-15) of the Bureau of Indian Standards (BIS). He served as faculty in Ergonomics for the M.E. (Industrial Safety Engineering) course at the National Institute of Technology (Formerly REC), Tiruchirappalli, and as visiting faculty for the M.Des. course at the Industrial Design Centre, IIT Bombay. He has published 30 scientific papers, (including 12 in foreign journals), has contributed to four books. He has received the BEL-IND Award for the Best Research Paper in Industrial Medicine, and the Sadagopan Memorial Oration Award. Currently, he is a member of the Human Factors and Ergonomics Society (USA), and the President of the Indian Society of Ergonomics.

Vivek Khanzode is Associate Professor at National Institute of Industrial Engineering, Mumbai. His academic credentials include Bachelor’s degree in Mechanical Engineering from Walchand College of Engineering, Sangli, and M. Tech. and Ph.D. in Industrial Engineering from IIT Kharagpur. He has been recipient of Director’s Silver Medal at M.Tech. program in IIT Kharagpur. He has 5½ years of industrial experience and 14 years of academic experience. He has helped various organizations including several small-scale units to improve productivity using industrial engineering tools and techniques. He regularly conducts niche training programs in the areas of Industrial Engineering, Worksystem Design, Lean Manufacturing, and Industrial Safety Management for practitioners and academicians. He is also involved in collaborative research activities in these areas. Professor Khanzode has published 13 papers in international journals, and presented 23 papers in international and national conferences. One scholar has been awarded Ph.D. under the guidance of Prof. Khanzode and four more are pursuing doctoral research. Three of his papers are included in the ILO database of Hazard and Injury Risk Assessment. Currently he has been involved in redesigning the palanquin system for Mata Vaishno Devi Shrine, a NITIE–IIT Bombay joint project funded by the Office of the Principal Scientific Advisor, Government of India, New Delhi. Professor Khanzode teaches Operations Management, Lean Manufacturing, Simulation Modeling, Facilities and Layout Planning, and Worksystem Design in different postgraduate programs at NITIE.