Conference Committee

Conference Chairs
- Assoc. Prof. Tan Yan Weng, Head of Programme, Logistics & Supply Chain Management, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Ahad Ali, Associate Professor and Director of Industrial Engineering Program, Lawrence Technological University, Michigan, USA

Honorary Chair
- Dr. Robert de Souza, Executive Director, The Logistics Institute – Asia Pacific and Senior Fellow, Department of Industrial Systems Engineering and Management, National University of Singapore

Program Chairs
- Dr. Aldy Gunawan, Assistant Professor of Information Systems (Practice), School of Computing and Information Systems, Singapore Management University, Singapore
- Dr. Tan Kok Choon, Associate Professor (Practice) & Deputy Head of Department, Department of Analytics & Operations, NUS Business School, National University of Singapore

Technical Chairs
- Dr. M. Affan Badar, Professor and Former Chair, Applied Engineering & Technology Management Dept., Indiana State University, Terre Haute, IN, USA
- Dr. Sugoutam Ghosh, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Tay Huay Ling, School of Business, Singapore University of Social Sciences, Singapore

IEOM Global Engineering Education Chairs
- Dr. Abu Masud, Boeing Global Engineering Professor, Industrial and Manufacturing Engineering Department, Wichita State University, Kansas, USA
- Dr. Hamid Parsaei, Professor of Industrial and Systems Engineering, Texas A&M University (College Station), USA

IEOM Global Business Management Education Chairs
- Prof. Jose Arturo Garza-Reyes, Professor of Operations Management and Head of the Centre for Supply Chain Improvement, College of Business, Law and Social Sciences, The University of Derby, UK
- Prof. Vikas Kumar, Director of Research and Scholarship and Professor of Operations and Supply Chain Management, Bristol Business School, University of the West of England, UK

Industry Solutions Chairs
- Dr. Abdul Talib Bon, UTHM, Malaysia

Industry 4.0 Chair
- Dr. Mehran Doulat, Xiamen University, Malaysia

Publication Chair
- Dr. Mohammed Rahman, Central Connecticut State University, USA

Women in Industry and Academia Chair
- Dr. Tay Huay Ling, School of Business, Singapore University of Social Sciences, Singapore

Sponsors and Exhibitors Chair
- Professor Don Reimer, Lawrence Technological University, Southfield, Michigan, USA

Organizing Committee
- Goh Shao Hung, Associate, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Murphy Choy, MC EduTech, Singapore
- David Chan, Advent2 Labs, Singapore
- Dr. Jafri Mohd Rohani, Universiti Teknologi Malaysia
- Dr. Seyed Mehdi Zahraei, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Maria Cecilica Rojas Lopez, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Dixon So Lok Kan, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Zhao Qitong, School of Business, Singapore University of Social Sciences, Singapore
**Track Chairs**

**Artificial Intelligence (AI)**
- Dr. Rawinun Praserttaweelap, King Mongkut’s Institute of Technology Ladkrabang, Bangkok, Thailand

**Automation and Agility**
- Dr. Tawanda Mushiri, University of Zimbabwe, Harare, Zimbabwe

**Aviation and Aerospace**
- Dr. Hesham Ahmad Fla`ih Al Momani, Assistant Professor, Department of Industrial Engineering, Hashemite University, Zarqa, Jordan

**Business Analytics**
- Yi Wang, School of Management, Hangzhou Dianzi University, Hangzhou, China
- Dr. Tang Hua Jun, Head of Department of Decision Sciences, Macau University of Science and Technology, Macau

**Business Management**
- Dr. Shekar Babu, AMRITA School of Business, Bangalore, India

**Case Studies**
- Dr. Javad Feizabadi, MIT Global SCALE Network in Asia- Malaysia Institute for Supply Chain Innovation, Malaysia

**Computers and Computing**
- Dr. June Tay, Head of Programme, Digital Media Programme, School of Science and Technology, Singapore University of Social Sciences, Singapore

**Construction Management**
- Assoc. Prof. Tan Teng Hooi, Head of Programme, Building and Project Management, School of Science and Technology, Singapore University of Social Sciences, Singapore

**Cyber Security**
- Dr. Shamsul Huda, Lecturer in Computer Science, Cyber Security Research and Innovation Centre (CSRI), School of Information Technology, Faculty of Science Engineering and Built Environment, Deakin University, Burwood, Victoria, Australia

**Data Analytics and Big Data**
- Assoc. Prof. James Tan, Head of Programme, Business Analytics, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Farzad Firouzi, Associate Professor, Industrial Engineering Dept., Faculty of Engineering, University of Sistan and Baluchesta, Iran

**Decision Sciences**
- Dr. Seyed Mehdi Zahraei, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Vassilis C Gerogiannis, University of Thessaly, Larissa, Greece

**Defense and Aviation**
- Mejar Wong Wai Loong, National Defence University of Malaysia
- Lt Kol Zamri bin Ismail, National Defence University of Malaysia

Design

- Prof. Ir. Dr. Mohd Khairul Anuar Mohd Ariffin, University Putra Malaysia, Selangor, Malaysia

Disruptive Technologies / Smart Technologies

- Alfonso, Adrian B., Mapua University, Makati City, Philippines
  e-Business/e-Service/e-Commerce

- Dr. Marcus Lee, Head of Programme, Marketing, School of Business, Singapore University of Social Sciences, Singapore

Energy

- Dr. Md. Mizanur Rahman, University Technology Malaysia (UTM), Johor Bahru, Malaysia
  Engineering Economy / Financial Engineering

- Dr. M. Affan Badar, Indiana State University, Terre Haute, IN, USA
- Prof. Jerekias Gandure, University of Botswana, Gaborone, Botswana

Engineering Education

- Dr. Tony Halim, Associate, School of Business, Singapore University of Social Science, Singapore
  Engineering Education – Industrial Engineering Curriculum Development

- Dr. Jafri Mohd Rohani, Universiti Teknologi Malaysia

Engineering Management

- Dr. Abdul Talib Bon, UTHM, Malaysia

Entrepreneurship and Innovation

- Dr. Indra Gunawan, The University of Adelaide, Australia

Environmental Engineering Systems

- Mrs. Chea Eliyan, Project Coordinator and Deputy Head, Department of Environmental Science, Royal University of Phnom Penh, Cambodia

ERP

- Dr. Juin-Yan Shiau, Department of Logistics Management, National Kaohsiung First University, of Science and Technology, Kaohsiung, Taiwan

Facilities Planning and Layout

- Dr. Zeki Ayağ, Kadir Has University, Turkey

Healthcare Systems

- Dr. Farzad Firouzi, Associate Professor, Industrial Engineering Dept., Faculty of Engineering, University of Sistan and Baluchesta, Iran

Human Factors and Ergonomics

- Yoshiki B. Kurata, Industrial Engineering Department, Technological Institute of the Philippines Quezon City, Philippines
- Dr. Rouf Iqbal, Associate Professor, Ergonomics and Human Factors, NITIE, Mumbai, India
  IE / OM in Asia

- Dr. Ho Hwi Chie, Binus University, Indonesia
  Industrial Management

- Dr. Pravin Tambe, Faculty in Operations Management and Decision Sciences at Indian Institute of Management Tiruchirappalli, India
  Industry Best Practices

- Edly Ramly, Lean Six Sigma Master Black Belt, EFR Certification, Malaysia
  Information Technology and Information Systems

- Dr. Hsieh Cheng-Hsien, School of Business, Singapore University of Social Sciences, Singapore
  Inventory Control and Management

- Dr. Sugoutam Ghosh, School of Business, Singapore University of Social Sciences, Singapore
  Lean

- Dr. Salvatore Miranda, University of Salerno, Italy
  Logistics Management

- Dr. Wahyudi Sutopo, Universitas Sebelas Maret, Surakarta, Indonesia
  Manufacturing

- Dr. Noha Mostafa, Industrial Engineering Department, Zagazig University, Egypt
  Material Flow Cost Accounting (MFCA)

- Dr. Wichai Chattinnawat, Chiang Mai University, Thailand
  Mathematical Sciences

- Dr. Md. Haider Ali Biswas, Khulna University, Bangladesh
  Mechatronics and Predictive Machinery Degradation

- Dr. Jihong Yan, Professor in Industrial Engineering, Deputy Dean of School of Mechatronics Engineering and Head of Intelligent Manufacturing Scientific Research Team, Harbin Institute of Technology, Harbin, China
  Modeling and Simulation

- Dr. Ali ElKamel, University of Waterloo, Canada
  Occupational Safety and Health (OSH)

- Dr. Qutubuddin S.M., P.D.A. College of Engineering, Gulbarga, Karnataka, India
  Operations Management
- Dr. Zhao Qitong, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Fernando González Aleu, Dept. de Ingeniería, Universidad de Monterrey, Mexico

**Operations Research**

- Prof. Rene Estember, Mapua University, Philippines

**Optimization**

- Dr. Haider Ali Biswas, Khulna University, Bangladesh

**Product Design and Development**

- Dr. Leonardo Frizziero, Senior Assistant Professor, DIN – Department of Industrial Engineering, Alma Mater Studiorum University of Bologna, Bologna, Italy

**Product Lifecycle Management (PLM)**

- Dr. Ali Allahverdi, Kuwait University, Kuwait

**Production Planning and Control**

- Mr. Chee Wai Meng, School of Business, Singapore University of Social Sciences, Singapore

**Project Management**

- Dr. Yuan Xuchuan, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Shazia Nauman, Head of Department and Associate Professor, Riphah School of Business & Management, Riphah International University, Pakistan

**Quality Control and Quality Management**

- Assoc. Prof. Park Byung Joon, School of Business, Singapore University of Social Sciences, Singapore
- Dr. Ferdous Sarwar, IPE, BUET, Dhaka, Bangladesh

**Reliability and Maintenance**

- Dr.-Ing. Zied Hajej, Université de Lorraine, France

**Service Engineering and Service Management**

- Dr. Kannapha Amaruchkul, National Institute of Development Administration, Thailand

**Six Sigma**

- Dr. Ashish Dwivedi, Assistant Professor, Jindal Global Business School, O.P. Jindal Global University, India

**Smart Mobility and Smart Cities**

- Dr. Maria Cecilia Rojas Lopez, School of Business, Singapore University of Social Sciences, Singapore

**Statistical Process Control**

- Engr. Maricar M. Navarro, Technological Institute of the Philippines Quezon City, Philippines

**Supply Chain Management**

- Dr. Shao Hung Goh, Part Time Professor, Singapore University of Social Sciences, Singapore

**Sustainability in Supply Chain, Enterprise Operations and Strategies**

- Prof. Jose Arturo Garza-Reyes, Derby Business School, University of Derby, UK
- Dr. Vikas Kumar, Bristol Business School, University of the West of England, UK

**Sustainability and Green Systems**
Assoc. Prof. Park Byung Joon, School of Business, Singapore University of Social Sciences, Singapore
Dr. Asela K. Kulatunga, University of Peradeniya, Sri Lanka

Sustainable Manufacturing

Dr. Khumbulani Mpofu, Gibela Research Chair in Manufacturing and Skills Development, Tshwane University of Technology, Pretoria, South Africa
Dr. Sambil Charles Mukwakungu, University of Johannesburg, South Africa

Systems Dynamics

Dr. Mahdi Bastan, University of Eyvanekey, Garmsar, Iran

Systems Engineering

Dr. Olumuyiwa Asaolu, Department of Systems Engineering, University of Lagos, Nigeria

Technology Management

Dr. Hsieh Cheng-Hsien, School of Business, Singapore University of Social Sciences, Singapore
Dr. Norizah Mohamad, Universiti Sains Malaysia (USM), Pulau Pinang, Malaysia

Total Quality Management (TQM)

Dr. Salah Haridy, University of Sharjah, Sharjah, UAE
Dr. M. Shamsuzzaman, University of Sharjah, Sharjah, UAE

Transportation and Traffic

Dr. Abbas Mahmoudabadi, Mehrastan University, Gilan, Iran

Waste Management

Ms. Sebonkile Thaba, University of Johannesburg, South Africa

Work Design, Measurement, Standardization and ISO

Dr. Peter Baonhe Sob, Vaal University of Technology, South Africa

COMPETITION COMMITTEE
Undergraduate Student Paper Competition Chair

Dr. Aldy Gunawan, Assistant Professor of Information Systems (Practice), School of Computing and Information Systems, Singapore Management University, Singapore

Graduate/Postgraduate Student Paper Competition Chair

Dr. Md. Mizanur Rahman, University Technology Malaysia

Doctoral Dissertation Competition Chair

Dr. Mehran Doulat, Xiamen University, Malaysia

Master Thesis Competition Chairs

Dr. Hayder Zghair, Penn State Berks, Reading, Pennsylvania, USA

Senior Design Capstone Project / FYP Presentation Competition Chair

Mr. Chee Wai Meng and Dr. Dixon So Lok Kan, Singapore University of Social Sciences, Singapore

Undergraduate Research Competition Chair
- Dr. Andy Pandein, SVSU, Michigan, USA
  High School / Middle School STEM Competition Chairs

- Professor Don Reimer, LTU, MI, USA
  Supply Chain and Logistics Competition Chair

- Dr. Yap Wei Yim, Singapore University of Social Sciences, Singapore
  Lean Six Sigma Competition Chair

- Dr. Saso Krstovski, Lean Manufacturing Coach/Six Sigma Master Black Belt, Van Dyke Transmission Plant, Ford Motor Company, Michigan, USA
  IEOM-FlexSim Student Simulation Competition Chair (See details in the simulation competition page)

- David Chan, Advent2 Labs, Singapore

---

**Website Coordinators**
- Christian Forrest, Manager of Web Services, Lawrence Technological University, Michigan, USA
- Suvro Sudip, Michigan, USA

**Conference Secretariat**
- Dr. Taufiqul Islam, Operations Manager, IEOM Society International

---

**Regional Academic Committee**
- Prof. Rene Estember, Mapua University, Philippines
- Dr. Rosemary Seva, De La Salle University – Manila, Philippines
- Ma. Janice J. Gumasing, School of Industrial Engineering and Engineering Management, Mapua University, 658 Muralla St., Intramuros, Manila, Philippines
- Rex Aurelius C. Robielos, School of Industrial Engineering and Engineering Management, Mapua University, Intramuros, Manila, Philippines
- Yoshiki B. Kurata, Department of Industrial Engineering, Technological Institute of the Philippines, Quezon City, Philippines
- Mohammad Yeakub Ali, University Technology Brunei
- Dr. Md. Mizanur Rahman, University Technology Malaysia (UTM), Johor Bahru, Malaysia
- Dr. Abdul Talib Bon, Professor of Technology Management, UTM, Malaysia
- Dr. Jafri Mohd Rohani, Universiti Teknologi Malaysia
- Dr. Mehran Doulati, Xiamen University, Sepang, Selangor, Malaysia
- Dr. Wichai Chattinnawat, Chiang Mai University, Thailand
- Dr. Paveena Chaovasilithongse, Head of IE Department, Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand
- Tuangyot Supeekit, Industrial Engineering Dept., Mahidol University, Bangkok, Thailand
- Dr. Ganda Boonsothonsatit, Technopreneurship Program, Institute of Field roBOTics, King Mongkut’s University of Technology Thonburi, Thailand
- Dr. Mohammed Iqbal, Shahjalal University of Science and Technology, Sylhet, Bangladesh
- Dr. Prof. Mohammad Sarwar Morshed, AUST, Bangladesh
- Dr. A R M Harunur Rashid, IUT, Gazipur, Bangladesh
- Dr. Md. Haider Ali Biswas, Khulna University, Bangladesh
- Dr. John Pumwa, Professor and Head of Mechanical Engineering Department, PNG University of Technology, Papua New Guinea
- Dr. Cecilia Nembou, Divine Word University, Papua New Guinea
- Dr. Kamalakanta Muduli, Associate Professor, Mechanical Engineering Department, Papua New Guinea University of Technology, Morobe Province, Papua New Guinea
- Dr. Asela K. Kulatunga, University of Peradeniya, Sri Lanka
- Dr. Dinusha Gamage, University of Moratuwa, Sri Lanka
N.M. Rasulov, Azerbaijan Technical University, Baku, Azerbaijan
M. Lei, School of Economic and Management, Inner Mongolia University of Science and Technology, Baotou, Inner Mongolia
Dr. Gulnara Abitova, Professor, Eurasian National University, Kazakhstan
Dr. Jihong Yan, Professor in Industrial Engineering and Deputy Dean of School of Mechatronics Engineering, Head of intelligent Manufacturing Scientific Research Team, Harbin Institute of Technology, Harbin, China
Dr. Budi Santosa, Professor at Industrial Engineering, Institut Teknologi Sepuluh Nopember, Surabaya, East Java, Indonesia
Prof. Dr. Abdul Hakim Halim, Industrial Engineering, Institut Teknologi Bandung, Indonesia
Dr. Paulina Kus Arningsih, Industrial Engineering Department, Faculty of Industrial Technology, Parahyangan Catholic University (UNPAR), Bandung, West Java, Indonesia
Siti Mahsanah Budijati, Department of Industrial Engineering, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
Dr. Ho Hwi Chie, Dean, Bina Aso School of Engineering, Bina Nusantara University (Binus), Tangerang, Banten, Indonesia
Dr. Naniek Utami Handayani, Department of Industrial Engineering, Diponegoro University, Semarang, Central Java, Indonesia
Dr. Zulfa Fitri Ikatnasari, School of Industrial Engineering, Mercu Buana University, Jakarta, Indonesia
Dr. Sawarni Hasibuan, School of Industrial Engineering, Mercu Buana University, West Java, Indonesia
Dr. R. Eddy Nugroho, School of Industrial Engineering, Mercu Buana University, Jakarta, Indonesia
Dr. Eng. Muhammad Rusman, Head of Industrial Engineering Department, Hasanuddin University, Makassar, South Sulawesi, Indonesia
Dr. Docki Saraswati, Industrial Engineering, Universitas Trisakti, Jakarta, Indonesia
Dr. Tanika D Sofianti, Industrial Engineering Dept., Engineering Faculty, Swiss German University BSD City Kav. Tangerang, Banten, Indonesia
Dr. Subagyo, Associate Professor, Mechanical & Industrial Engineering Department, Universitas Gadjah Mada, Yogyakarta, Indonesia
Prof. Dr. Sudradjat Supian, Dean of Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Padjadjaran, West Java, Indonesia
Dr. Sugiono, Universitas Brawijaya, Kota Malang, Jawa Timur, Indonesia
Dr. Ishardita Pambudi Tama, Head of Industrial Engineering Department, Universitas Brawijaya, Malang – Indonesia
Dr. Agus Ulinuha, Head, Institute for Research and Community Service (LPPM), Universitas Muhammadiyah Surakarta, Jawa Tengah, Indonesia
Dr. Gede Agus Widyadana, Industrial Engineering Department, Universitas Padjadjaran, Bandung, West Java, Indonesia
Prof. Dr. Ir. T. T. Pambudi Tama, Head of Industrial Engineering Department, Universitas Padjadjaran, West Java, Indonesia
Prof. Dr. Ismail Tag, SVP & Provost, The Petroleum Institute, Abu Dhabi, United Arab Emirates
Dr. Noordin Mohd. Yusof, Dean, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, Malaysia

Honorary Committee
Pr. Moulay Larbi Abidi, Director, École Mohammadia d’ingénieurs (EMI), Rabat, Morocco
Dr. Hesham Kamal Al-Fares, King Fahd University of Petroleum and Minerals, Saudi Arabia
Dr. Hamidi Bashir, Director of Industrial and Engineering Management, University of Sharjah, UAE
Dr. Mohamed Essaaidi, Professor and Director (Dean), ENSIAS College of Engineering – Mohamed V University in Rabat, Morocco
Dr. Devashis Mitra, Dean – Faculty of Business Administration, University of New Brunswick, Fredericton, Canada
Prof. Dr. Mohd Razali Muhamad, Deputy Vice Chancellor (Academic and Internationalization), Universiti Teknikal Malaysia Melaka
Professor Dr. Norazman Mohamad Nor, Deputy Vice Chancellor (Research and Innovation), National Defence University of Malaysia in Kuala Lumpur
Dr. Hamid R. Parsaei, Associate Dean for Academic Affairs, Texas A&M University at Qatar and Professor of Industrial and Systems Engineering, Texas A&M University
Dr. Ismail Tag, SVP & Provost, The Petroleum Institute, Abu Dhabi, United Arab Emirates
Dr. Noordin Mohd. Yusof, Dean, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, Malaysia

Advisory Committee
Dr. Pr. Moulay Larbi Abidi, Director, École Mohammadia d’ingénieurs (EMI), Rabat, Morocco
Dr. Muhammad Abid, Ghulam Ishaq Khan Institute of Engineering Sciences & Technology, Pakistan
Dr. Oluwemimi Adetunji, University of Pretoria, South Africa
Dr. Umar AL-Turki, King Fahd University of Petroleum and Minerals, Saudi Arabia
Dr. Ronald G. Askin, Arizona State University, USA
Dr. Shekar Babu, Founding Head, AMRITA School of Business, Bangalore, India
Dr. Mohammed Ben-Daya, King Fahd University of Petroleum and Minerals, Saudi Arabia
Dr. Abdul Talib Bon, Universiti Tun Hussein Onn Malaysia
Dr. Raj Das, University of Auckland, New Zealand
Dr. Kudret Demirli, Khalifa University, Abu Dhabi, UAE
Dr. Jose Arturo Garza-Reyes, University of Derby, UK
Dr. Alireza Ghasemi, Dalhousie University, Halifax, NS, Canada
Dr. Moncer Abdelhamid Hariga, American University of Sharjah, United Arab Emirates (UAE)
Dr. Mohammad D. Al-Tahat, The University of Jordan, Amman, Jordan
Dr. Arun Kumar, Royal Melbourne Institute of Technology (RMIT) University, Australia
Dr. Ho Thanh Phong, International University – VNUHCM, Vietnam
Dr. Yassine Ouazene, University of Technology of Troyes, France
Dr. Ho Hwi Chie, Bina Nusantara University (Binus), Indonesia

Global Engineering Education Committee

- Dr. Abu Masud, Wichita State University, Kansas, USA (Chair)
- Dr. Hamid Parsaei, Texas A&M University (College Station) and Texas A&M University, Qatar (Co-Chair)
- Dr. Mukondeleli Grace Kanakana, Executive Dean, Faculty of Engineering and the Built Environment, Tshwane University of Technology, Pretoria, South Africa
- Dr. Syed Ahmad Helmi Al Haddad, Program Coordinator for MSc in Industrial Engineering and Associate Fellow, Center for Engineering Education (CEE), Universiti Teknologi Malaysia, Skudai, Johor, Malaysia
- Dr. Mehmet Savsar, Professor, Department of Industrial and Management Systems Engineering, Kuwait University, Safat, Kuwait
- Dr. Vitor M. Caldana, Professor, Depto. de Eletroeletrotônica, IFSP – Instituto Federal de São Paulo – Campus Sorocaba, Santana de Parnaíba, SP, Brazil
- Dr. Jafri Mohd Rohani, Universiti Teknologi Malaysia
- Dr. Chan Chee-Ming, Associate Professor and Deputy Dean (Academic and Research), Universiti Tun Hussein Onn Malaysia
- Dr. Ilham Kissani, Faculty of Engineering & Management Science, Al Akhawayn University, Ifrane, Morocco
- Dr. Ho Hwi Chie, Bina Nusantara University (Binus), Indonesia
Program Committee

- Dr. M. Khadem, Sultan Qaboos University, Muscat, Oman
- Dr. Abdul Talib Bon, Universiti Tun Hussein Onn Malaysia
- Dr. Rushan Ziatdinov, Department of Industrial & Management Engineering, Keimyung University, Daegu, South Korea
- Dr. Lina Aboueljinane, Industrial Engineering Program, École Nationale Supérieure des Mines de Rabat (ENSMR), Morocco
- Dr. Bouloiz Hafida, Industrial Engineering Department, National School of Applied Sciences (ENSA), Ibn Zohr University, Agadir, Morocco
- Dr. Jihong Yan, Professor in Industrial Engineering and Deputy Dean of School of Mechatronics Engineering, Head of intelligent Manufacturing Scientific Research Team, Harbin Institute of Technology, Harbin, China
- Dr. Jaouad Boukachour, Université Le Havre, France
- Ms. Rocksana Ahmed, Senior, Engineering Technology, Lawrence Technological University, Southfield, Michigan, USA
- Ms. Letci Truc Dao from Afnor Vietnam
- Dr. Zeki Ayağ, Kadir Has University, Turkey
- Amine Belhadi, Industrial Engineering Research Team, Higher School of Technology, Safi, Cadi Ayyad University, Marrakech, Morocco
- Navpreet Singh Chandok, O2i Technologies, India
- Dr. Rahul Chougule, Caterpillar India Pvt Ltd, Bangalore, India
- Sameh Moh. Nour El-Din A-Razek, Al Ezz Dekheila Steel Co., Alexandria, Egypt
- Abdulllah Y Dhafer, Aramco, Saudi Arabia
- Natasha Dzulkarnain, Construction Research Institute of Malaysia (CREAM)
- Dr. Adel Hejaaji, Engineering Services Management (ESM) Limited, Essex, UK
- Dr. Anwar Hossain, Daikin Applied, Minneapolis, Minnesota, USA
- Ilfasuziella Ibrahim, Construction Research Institute of Malaysia (CREAM)
- Hwa Kooi Kok, Intel Malaysia
- Ali Massaeli, National Iranian Gas Company, Iran
- Bob Mathur, Sr. Project Manager, Phillips 66 Refinery (Exxon), Linden, NJ, USA
- German Moya, President at IEEE Costa Rica Section, Costa Rica
- Paul Moore, International Mining, England, UK
- Dr. Gerard O’Connor, Adelaide and Meath Hospital, Dublin, Ireland
- Dr. Bagu Ozkeser, Istanbul, Turkey
- Dr. Sushil K. Shetty, Wilsonart LLC, Temple, Texas, USA
- Masaru Tezuka, Hitachi Solutions East Japan, Ltd., Japan
- Nesreen M. Abdelghafar, Medical Engineering Department, Assiut University, Egypt

Industry 4.0 / Industry Solutions Committee

- Ms. Letci Truc Dao from Afnor Vietnam
- Dr. Zeki Ayağ, Kadir Has University, Turkey
- Amine Belhadi, Industrial Engineering Research Team, Higher School of Technology, Safi, Cadi Ayyad University, Marrakech, Morocco
- Navpreet Singh Chandok, O2i Technologies, India
- Dr. Rahul Chougule, Caterpillar India Pvt Ltd, Bangalore, India
- Sameh Moh. Nour El-Din A-Razek, Al Ezz Dekheila Steel Co., Alexandria, Egypt
- Abdulllah Y Dhafer, Aramco, Saudi Arabia
- Natasha Dzulkarnain, Construction Research Institute of Malaysia (CREAM)
- Dr. Adel Hejaaji, Engineering Services Management (ESM) Limited, Essex, UK
- Dr. Anwar Hossain, Daikin Applied, Minneapolis, Minnesota, USA
- Ilfasuziella Ibrahim, Construction Research Institute of Malaysia (CREAM)
- Hwa Kooi Kok, Intel Malaysia
- Ali Massaeli, National Iranian Gas Company, Iran
- Bob Mathur, Sr. Project Manager, Phillips 66 Refinery (Exxon), Linden, NJ, USA
- German Moya, President at IEEE Costa Rica Section, Costa Rica
- Paul Moore, International Mining, England, UK
- Dr. Gerard O’Connor, Adelaide and Meath Hospital, Dublin, Ireland
- Dr. Bagu Ozkeser, Istanbul, Turkey
- Dr. Sushil K. Shetty, Wilsonart LLC, Temple, Texas, USA
- Masaru Tezuka, Hitachi Solutions East Japan, Ltd., Japan
- Nesreen M. Abdelghafar, Medical Engineering Department, Assiut University, Egypt

Women in Industry and Academia (WIIA) Committee

- Resh Plaha, Crystal Quality, UK
- Dr. Chan Chee-Ming, Associate Professor and Deputy Dean (Academic and Research), Universiti Tun Hussein Onn Malaysia
- Dr. Mey Goh, Assoc Professor in Product Design, Loughborough University, UK
- Dr. Ilham Kissani, Faulty of Engineering & Management Science, Al Akhawayn University, Ifrane, Morocco
- Dr. Stefanie Pillai, Dean and Associate Professor, Faculty of Languages & Linguistics, University of Malaya, Kuala Lumpur, Malaysia
- Dr. Funda Sivrikaya Şerifoğlu, Bilgi University, Istanbul, Turkey
Technical Committee / Reviewers

- Dr. Zhiwei Gao, Associate Professor, Department: Mathematics, Physics and Electrical Engineering, Northumbria University, UK
- Prof. Rene Estember, Mapua University, Philippines
- Dr. A.O. Adewumi, University of KwaZulu-Natal, South Africa
- Dr. Kondo H. Adjallah, Paul-Verlaine University, France
- Dr. Abdollah Aghaie, K.N. Toosi University of Technology, Iran
- Dr. Abdul-Rahman Al-Ali, American University of Sharjah, United Arab Emirates
- Gasim Al-Hawarii, Senior Fleet Management Engineer, Dubai Municipality, United Arab Emirates
- Ali I. Al-Mosawi, Miskolc University, Faculty of Materials Science and Engineering, Hungary
- Dr. Fernando González Aleu, Departamento de Ingeniería, Universidad de Monterrey, Mexico
- Dr. Kuchkarov Atamurat, Uzbekistan National University, Uzbekistan
- Dr. Faieza Abdul Aziz, Universiti Putra Malaysia, Selangor, Malaysia
- Dr. Amir Azizi, Universiti Malaysia Pahang, Malaysia
- Amine Belhadi, Industrial Engineering Research Team, Higher School of Technology, Safi, Cadi Ayyad University, Marrakech, Morocco
- Dr. Behnam Bahrami, Eastern Mediterranean University, Famagusta, Cyprus
- Dr. D. K. Banwet, IIT-Delhi, India
- Dr. Abdelaziz Berrado, The Ecole Mohammadia d’Ingénieurs (EMI), Rabat, Morocco
- Dr. Mahdi Bashiri, Shahed University, Iran
- Dr. Vladimir Beresnev, Sobolev Institute of Mathematics, Russia
- Dr. Haider Ali Biswas, Khulna University, Bangladesh
- Dr. Miguel Sanz Bobi, Comillas Pontifical University, Spain
- Dr. Nejib Chouaibi, Polytechnic School of Tunisia, Tunisia
- Dr. Mohammad Ishak Desa, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
- Dr. Mehran Doulat, Center for Quality and Sustainability, School of Engineering and Advanced Technology, UTM Kuala Lumpur, Malaysia
- Dr. Omar Elmabrouk, Bengazi University, Libya
- Dr. Dinusha Gamage, University of Moratuwa, Sri Lanka
- Dr. Rodrigo Garrido, Universidad Adolfo Ibaez, Chile
- Dr. Vassilis Gerogiannis, Department of Project Management, Greece
- Dr. Jahara bint Ghani, UKM, Malaysia
- Dr. Salah Haridy, Department of Industrial Engineering and Engineering Management, University of Sharjah, Sharjah, UAE
- Dr. Ravi Gor, St. Kabir Institute of Professional Studies, Ahmedabad, India
- Dr. Kannan Govindan, University of Southern Denmark, Denmark
- Dr. Indra Gunawan, The University of Adelaide, Australia
- Dr. Md. Mamun Habib, Brac University, Bangladesh
- Dr. Ramy Harik, University of South Carolina, USA
- Dr. Maruf Hasan, University of New South Wales, Australia
- Dr. Ahmed Khamisabadi, Islamic Azad University, Tehran, Iran
- Dr. Raja Kothandaraman, Alpha College of Engineering, Chennai, Tamilnadu, India
- Dr. Brigitte Jaumard, Concordia University, Canada
Dr. Rashmi Jha, Gitarattan International Business School (GIBS), Affiliated to Guru Gobind Singh Indraprastha University, New Delhi, India
Dr. Shahrul B. Kamaruddin, Universiti Sains Malaysia
Prof. Dr. Anand Kumar, M.S. Engineering College, Bangalore Karnataka, India
Dr. Nani Kurniati, Institute of Technology Sepuluh Nopember (ITS), Surabaya, East Java, Indonesia
Dr. Francis Leung, City University of Hong Kong, China
Dr. Motah Mahendrenath, University of Technology, Mauritius
Dr. Boudoua Malik, University of Champagne-Ardenne, France
Dr. Ilias Mamat, Quest International University Perak, Ipoh, Perak, Malaysia
Dr. Fulufhelo Masithulela, University of South Africa, Johannesburg, South Africa
Dr. Abderrahmane Mellak, University of Boumerdes, Algeria
Dr. Yuan Xue Ming, SIM Tech: Singapore Institute of Manufacturing Technology, Singapore
Dr. Ruchi Mishra, Institute of Management, Nirma University, Ahmedabad, India
Dr. Vladimir Modrak, TUKE, Slovakia
Dr. Norhamidi Muhamad, UKM, Malaysia
Dr. Michael Mutingi, University of Botswana, Botswana
Dr. Arun N. Nambari, California State University – Fresno, USA
Dr. Cecilia Nembou, Divine Word University, Papua New Guinea
Dr. Sawat Pararach, Thammasat University, Thailand
Dr. Ratri Parida, National Institute of Construction Management and Research (NICMAR), Pune, Maharashtra, India
Dr. Eui H. Park, North Carolina A&T State University, USA
Dr. Md. Mizanur Rahman, Universiti Malaysia Sabah (UMS), Kota Kinabalu, Sabah, Malaysia
Dr. T. Ramayah, School of Management, Universiti Sains Malaysia
Dr. Raja Zuraidah Raja Mohd Rasi, Universiti Tun Hussein Onn Malaysia
Dr. Bhuvnesh Rajamony, University Malaysia Perlis (UniMAP), Malaysia
Dr. Ramakrishnan Ramanoothy, Yanbu Industrial College, Yanbu, Saudi Arabia
Dr. Mohd Abdul Rashid, University Malaysia Perlis (UniMAP), Malaysia
Dr. Syed Asif Raza, Qatar University, Qatar
Dr. Nubia Milena Velasco Rodriguez, Universidad de Los Andes, Colombia
Dr. P. Sanjeevikumar, Dublin Institute of Technology, Ireland
Dr. Mahmood Shafiee, Cranfield University, Bedfordshire, United Kingdom
Dr. Sharan Shetty, School of Management & Business, Manipal International University, Putra Nilai, Malaysia
Dr. Abdussalam Shibani, Coventry University, UK
Dr. Sarbjit Singh, National Institute of Technology, Jalandhar, Punjab, India
Dr. Shahrzad Sorooshian, University Malaysia Pahang, Malaysia
Dr. Jayakanth Srinivasan, MIT Sloan School of Management
Dr. Gopalan Srinivasan, University of New Brunswick, Canada
Dr. Zuraidah Sulaiman, Universiti Teknologi Malaysia (UTM), Johor, Malaysia
Dr. Balan Sundarakani, University of Wollongong in Dubai, UAE
Dr. Murat Caner Testik, Hacettepe University, Ankara, Turkey
Dr. Theodore B. Trafalis, University of Oklahoma, USA
Dr. Vladimir I. Tsurkov, Russian Academy of Sciences, Moscow, Russia
Dr. Hui-Ming Wee, Chung Yuan Christian University, Taiwan
Dr. Yong Yin, Yamagata University, Japan
Dr. Norzaiahahwati Zaidin, Universiti Teknologi Malaysia, Johor, Malaysia
Dr. Suhaiza Hanim Zailani, University of Malaya, Malaysia
Dr. Linda L. Zhang, IESEG School of Management, Lille-Paris, France
Dr. Suat Kasap, Industrial Engineering, American University of the Middle East, Kuwait
Nesreen M. Abdelghafar, Mechanical Engineering Department, Assiut University, Egypt
M Chairul Basrun Umanailo, University of Iqra Buru, Namlea, Maluku, Indonesia
Ashish Dwivedi, Senior Research Fellow, Operations and Supply Chain Management, Indian Institute of Technology Delhi, New Delhi, India

Editorial Board
- Dr. Ahad Ali
- Dr. Taufiq Islam
- Dr. Hayder Zghair
- Dr. Andy Padian
- Dr. Mizanur Rahman
- Dr. Anwar Rahman
- Professor Don Reimer
- Dr. Abdul Talib Bon
- Dr. Wahyudi Sutopo
Factors Encouraging the Pangandaran Female Entrepreneurs’ Sturdiness in Pandemic Time
(A Case Study in Pangandaran Regency)

Ikeu Kania  
Faculty of Social and Political Sciences of Garut University
ikeukania@fisip.uniga.ac.id

Siti Anisa Silvia  
Indonesian Institute of Sciences
sitiannisasr@gmail.com

Nani Rohaeni  
Garut Regency Regional Secretariat
nani16667@gmail.com

Dodi Yudiardi  
Faculty of Social and Political Sciences of Garut University
dodiyudiardi@uniga.ac.id

Iwan Ridwan Stiaji  
Indonesian Institute of Sciences
ridwanstiaji@gmail.com

Abstract  
The number of female populations in Indonesia is nearly a half of total population number. In economic sector, women play vital role despite no recognition sometimes. Woman as business performer, particularly the performer Micro-, Small-, and Middle-scale Enterprises in Indonesia is very meritorious in supporting the nation’s economy. Out of 64 millions MSMEs existing in Indonesia, about 50 percents are established and run by women. In difficult times like this Covid-19 pandemic era, MSMEs become a hope to keep maintaining the economic stability. The role of women as MSME performer has large potency and becomes the nation’s power, particularly in dealing with crisis. The objectives of research are to see and to analyze the factors encouraging the women’s sturdiness in running entrepreneurship in pandemic time. The research method employed was qualitative one, while techniques of collecting data used were observation, interview, and questionnaire distribution to MSME female performers, consisting of 98 women. Technique of analyzing data used was exploratory factor analysis with 20 variables. The result of research showed that out of 20 variables tested, there are 4 new factors encouraging the women’s role in pandemic era. They are character role, reproductive role, productive role, and social role factors.

Keywords: Role, Women, MSMEs, Covid-19
1. INTRODUCTION

Simply, national development can be said as a process experienced by a community referring to a better living condition (Mensah, 2019). Its process is generally planned (Reese & Fasenfest, 2003) and done intentionally. Thus, national development is basically an attempt of improving human resource quality into the better one (Okeye & Ezejiofor, 2013). National development will not come into reality without active participation of community components, either male or female (Abebe, 2017). Improving the reasonable life quality can be accomplished, among others, through implementing community empowerment by activating entire national economic power, particularly micro-, small-, and middle-scale enterprises (T. T. H. Tambunan, 2011). The contribution of MSMEs to national economy is undoubted, particularly in absorbing workers, establishing National Gross Domestic Product (GDP), export and national investment values. MSME’s success in Indonesia is inseparable from women’s participation. More than 50% of MSME economic performers are females.

The strategic value of MSMEs is their ability of being a medium to distribute the people wellbeing evenly. Because of its large amount, it is usually labor-intensive in nature, thereby can absorb a large number of workers (Maulina & Fordian, 2018). Internal and external problems encountered by MSMEs indicate that business world run by small- and middle-scale business performers is inhibited by economic political power and social kinship relations. MSMEs are recognized to be the basic source of economic and job opportunity growth. Women-led MSMEs have been recognized to play important role (Teoh & Chong, 2008). One of interesting developments is more women running micro-, small-, and middle-scale business, either independently or in partnership with men (Chirwa, 2008). As the performers of small- and middle-scale business, women are faced with not only a number of very exploitative world business problem but also the constraints related to gender issue or structural and cultural inequality, so that women’s participation in entrepreneurship is lower than the men’s (Singh & Raina, 2013).

MSMEs managed by women until today has not attracted many parties’ attention seriously (Jamali, 2009). People often assume that women-led MSMEs operate more in small industry, home industry (Susanti & Mas’udah, 2017), and etc. It also makes women-led MSMEs often fluctuating, because it still has weak capitalization and management (T. Tambunan, 2019). Some women-led MSMEs are even managed based on kinship principle, despite good chance and market and large capital and credible management supports.

The role of women in MSME sector is generally related to trading and processing industry areas such as food stall, small shop, food processing and handicraft industries (T. Tambunan, 2009), because this business can be conducted at home, thereby not forgetting women’s role as housewife. Although, MSMEs are operated by women as side job rather than to help husband and to increase household income (Harkness, 2010), it can be the main source of household income gradually when it is managed seriously (Roy et al., 2017).

Women’s participation is very important to achieve the objective of development. This attempt taken by women to develop MSMEs becomes important (T. Tambunan, 2019), because women are faced with some so inherent constraints called “triple burden of women” (McLaren et al., 2020), i.e. they are asked to undertake reproductive, productive, and social functions within society all at once. As women’s income and access to economic resources improve (Akram et al., 2015) through this MSMEs, their negotiating ability and opportunity improve in household. Their bargaining position changes and their opinion begins to be taken into account in each decision making process in household (Colfer et al., 2015). Most women still take part in informal sector (Kumari & Singh, 2016) or in the job not requiring knowledge quality and specific skill. These jobs usually give inadequate law protection and welfare guarantee, in addition to worrying work condition and relatively low income (Harkness, 2010). Many small businesses operated by women in its beginning stage or in its business developing stage often encounter many constraints (Raghuwanshi et al., 2017). Meanwhile, the constraints encountered by women-led MSMEs are inadequate capitalization, marketing difficulty, tight business competition, difficulty in finding basic material, poor production technique and skill, inadequate managerial skill (Fallahi & Mehrad, 2015), inadequate knowledge on financial management, and less conducive business climate (licensing, regulation/legislation).

In Covid-19 pandemic condition occurring today, women in the world, particularly those operating MSMEs, are affected by pandemic (McLaren et al., 2020). This Covid-19 pandemic phenomenon makes the small- and medium-scale business women surviving difficulty (Foss & Henry, 2020). The situation is not easy, as women are required to look for the solution to their family’s economic difficulty. Women’s contribution to family’s economy is one of important elements in family resilience (Herdiana et al., 2018).

MSMEs-operating women undertakes not only productive role as the business performers who safeguard the family’s economy but also reproductive role as the guard and manager of family’s life with a large amount of domestic chores such as preparing food, collecting water, finding fuel wood, shopping, maintaining family’s health and nutrition, taking care of husband, and rearing and educating children (Austen, 2014). During Covid-19
pandemic time, women remain to be required to share its role for family, occupation, and community (McLaren et al., 2020).

Amid Covid-19 pandemic, women’s responsibility for rearing children and dealing with domestic chores increases (Power, 2020). It is also confirmed by the MSMEs-operating women in Pangandaran Regency. The worse pandemic condition makes MSMEs-operating women should find solution to keep surviving. Some attempts have been taken, among others: helping buy each other’s product. Table 1 presents number and type of women-led business in Pangandaran Regency.

<table>
<thead>
<tr>
<th>No</th>
<th>Type of Business</th>
<th>No of MSMEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Processing industry (Salted Fish, Tempe, Dodol, Doughnut, Sale Pisang Processing, etc.)</td>
<td>912</td>
</tr>
<tr>
<td>2.</td>
<td>Accommodation and food &amp; Beverage</td>
<td>1,109</td>
</tr>
<tr>
<td>3.</td>
<td>Wholesaler and retailer</td>
<td>2,931</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4,952</td>
</tr>
</tbody>
</table>

Source: Trading, Cooperatives, and MSME Service Office of Pangandaran Regency

From Table 1, it can be seen that about 4,952 MSMEs are operated by women in Pangandaran Regency, including processing industry (salted fish, tempe, dodol, sale pisang (banana chip), doughnut, and cassava chip processing), accommodation and food & beverage supplier (food stall, baso stall, coffee shop, etc), and large-, and small-scale sellers (vendor, counter, groceries, etc). The businesses operated are varying and easy to operate because many of them operate business according to their hobby to fulfill their personal and family needs.

In this Covid-19 pandemic condition and the implementation of large-scale social restriction (PSBB) policy in Pangandaran Regency from April-June 2020 leads to their reduced income. Fortunately, they can think quickly and move with their entire effort not to let panic and trouble affect their family situation. In pandemic condition, Pangandaran Regency plays active role in helping MSME performers survive and vigorously providing business training and building using online method.

Considering the result of survey and interview with informants (Chairperson of PPK/Regent’s Housewife, Secretary of Trading, Cooperatives and MSME Service Office and Chairperson of Women Empowerment Division of DKBP3A of Pangandaran Regency, it can be said that MSME-operating women belong to sturdy and creative one, and hard worker, so that even in pandemic condition, they keep attempting to look for a way of earning living. An attempt taken is, among others, to shift their business to processed food selling; even some of them sell their product online in group through social media and some other help buy each other’s product.

Considering the perseverance and persistence of MSME-operating women in Pangandaran Regency in dealing with Covid-19 pandemic is interesting to study further and more in-depth. Therefore, the objective of research is to see and to analyze the factors encouraging the women’s persistence in running business in pandemic time.

II. LITERATURE REVIEW

Woman plays a very big role in bringing the family’s happiness and intactness into reality (Lyubomirsky et al., 2005). Woman serves as mother, wife, and child. All of those roles require the duty according to the role. As a mother, a woman’s basic duty is to do any domestic chores (Poduval & Poduval, 2009) and to educate the new generations.

In her position as a member of community, woman has right and obligation equal to man, entitled to be treated well by community and obliged to create a healthy community (Blesio & Disciplines, 2014). The role of woman within community is manifested into the activities built together, solidarity, and maintaining the community’s integrity (Bayeh, 2016).

Moser (1989) in (Fajarwati et al., 2016) distinguishes the role of women into three categories (triple role of women):

a. The productive role is a role undertaken by men and women to get paid / wages in cash or to produce goods that are not consumed (used) by themselves. Including market production with an exchange rate, and household production (subsistence) with a use value, but also a potential exchange rate. For example, working in formal and informal sectors such as farming, trade, farming laborers and so on.
b. Reproductive role is a role that is associated with the responsibilities of child care and domestic tasks required to ensure the maintenance and reproduction of labor regarding the continuity of the family. For example, giving birth, cooking, nurturing, and care for children, fetching water, washing, cleaning, and so on.

c. The role of the public and political management. The roles of community management (social activities) are all activities undertaken as an extension of the reproductive role. This role includes activities that are built together, solidarity between people, and maintain the needs of the community as a social gathering, weddings, funerals, ceremonies, and others, volunteer and unpaid. While the political management (political activity) is performed at the level of the role of community organizing in the formal political level, usually paid (direct / indirect) and the increase of power or status. This role aims to take decisions that affect people's lives such as the election of the head of the village / hamlet, land division meetings, meetings to arrange water and others.

In productive role, women do some activities with wage resulting from the product and service produced, thereby can help improve the family’s economic income (T. Tambunan, 2009). Labor absorption occurs through a business conducted by women through micro-, small-, and middle-scale enterprises (MSMEs), thereby reducing unemployment and poverty rates, and smoothing the economy (T. T. H. Tambunan, 2011).

In Indonesia, the definition of MSMEs is governed in Republic of Indonesia’s Law No. 20 of 2008 about MSMEs. Article 1 of the Law states that micro-scale business is a productive business belonging to an individual and/or individual corporate with the criteria of micro-scale business as governed in the Law. Traditionally, many women participating actively as employer or business owner are found in Indonesia in micro-, small-, and middle-scale enterprises (MSMEs) (T. Tambunan, 2009). Small business is a productive economic business standing alone with limited resources (Makmur et al., 2018), run by individual or corporate rather than subsidiary or branch of business owned, mastered, or being the part, either directly or indirectly.

The empowerment of women operating micro-, small-, and middle-scale enterprises (MSMEs) is very important and strategic to anticipate the future economy (Teoh & Chong, 2008), particularly in strengthening national economic structure. National economic crisis as occurring today highly affects the national, economic, and political stabilities having an impact on the troubled activities in large-scale businesses, while MSMEs and cooperatives still relatively maintain their business activity. Historically, MSMEs in Indonesia always become the main actor in domestic economic activities (T. T. H. Tambunan, 2011).

MSMEs are a standing-alone productive business unit, run by an individual or a corporate in all economic sectors. In principle, the differentiation of Micro-, Small-, Middle-, and large-scale businesses is basically based on original asset value (excluding land and building), average sale volume per year, or number of permanent workers (T. T. H. Tambunan, 2011).

### III. METHOD

The research method employed in this study was qualitative one with two data collection stages. The first stage was to interview a number of informants. The second one was to distribute questionnaire to respondents specified. The first stage was conducted to acquire information, furthermore becoming the indicator tested, consisting of 20 indicators. For detailed information on those variables, see Table 2 below.

<table>
<thead>
<tr>
<th>No</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Independency</td>
</tr>
<tr>
<td>2.</td>
<td>Innovativeness</td>
</tr>
<tr>
<td>3.</td>
<td>Discipline</td>
</tr>
<tr>
<td>4.</td>
<td>Hard working</td>
</tr>
<tr>
<td>5.</td>
<td>Sturdiness</td>
</tr>
<tr>
<td>6.</td>
<td>Creativity</td>
</tr>
<tr>
<td>7.</td>
<td>Self confidence</td>
</tr>
<tr>
<td>8.</td>
<td>Competitiveness</td>
</tr>
<tr>
<td>9.</td>
<td>Preparing Food</td>
</tr>
</tbody>
</table>
10. Shopping
11. Maintaining health
12. Rearing and educating child
13. Producing product and service
14. Supporting Family’s Economy
15. Gaining profit
16. Increasing income
17. Wanting to get experience
18. Participation in Women Organization
19. Participation in Development
20. Participation in Community

In the second stage, the distribution of questionnaire was conducted by considering population, minimum sample, and sampling technique. Research population was the MSME-operating women in Pangandaran Regency, consisting of 4,952 MSMEs. Then, to calculate the size of research sample, Slovin’s formula was employed (Bungin, 2012) with error value of 10%. Therefore, the minimum size of sample taken was 98 MSMEs in Pangandaran Regency. The data collected was then analyzed using exploratory factor analysis and with SPSS 23 software help.

### IV. RESULT AND DISCUSSION

1) Determining the Variables to be analyzed

The first stage in examining the factors encouraging Pangandaran female entrepreneur’s sturdiness in Pandemic time (A Case Study in Pangandaran Regency) is to find the variable feasible to be included into the next analysis. The following test was conducted.

a. Barlett’s test of sphericity value is used to find out the adequacy of variable in the correlated sample.

b. Kaiser-meyerolkin (KMO) test was conducted; in this analysis, the factor is considered as feasible when KMO value > 0.5. KMO test is used to find out the adequacy of sample or to measure the feasibility of sample.

c. Measure of sampling adequacy (MSA) test was used to measure the degree of correlation between variables with the criterion of MSA > 0.5.

The result of KMO and Barlett’s tests can be seen in Table 3.

#### Table 3 KMO and Barlett’s Tests

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>.823</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>1976.235</td>
</tr>
<tr>
<td>Df</td>
<td>190</td>
</tr>
<tr>
<td>Sig.</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 3 shows that the value obtained from Barlett’s test of sphericity is 1976.235 at significance level of <0.05, 0.000; it means that there is a correlation between variables. Value of 0.823 is obtained from Kaiser Meyer Olkin test. The figure is > 0.05, meaning that the variables in this research can be processed further.

The next stage is to test the measure of sampling adequacy, to find out what variable is processed further and what variable is excluded. MSA value can be seen from anti image correlation table with “α” sign to upper left and lower right diagonal directions and the requirement of MSA value should be 0.5. Therefore, it can go to the next process. The result of MSA is presented in table below.

#### Table 4 Anti Image Correlation

© IEOM Society International 4582
From the table above, it can be seen that anti image matrices value of the 20 (twenty) variables above is 0.500. Therefore, the 20 variables can go to the next process.

The second stage is to determine the number of factors.

2) Determining the Number of Factor

To determine the number of factors created, eigen value is used, with the criterion eigen value > 1. To see the number of factors created, see Table 5 below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative</td>
</tr>
<tr>
<td>1</td>
<td>5.010</td>
<td>25.048</td>
<td>25.048</td>
</tr>
<tr>
<td>2</td>
<td>3.531</td>
<td>17.654</td>
<td>42.702</td>
</tr>
<tr>
<td>5</td>
<td>1.000</td>
<td>4.998</td>
<td>67.450</td>
</tr>
<tr>
<td>6</td>
<td>.832</td>
<td>4.160</td>
<td>71.611</td>
</tr>
<tr>
<td>7</td>
<td>.822</td>
<td>4.112</td>
<td>75.723</td>
</tr>
<tr>
<td>8</td>
<td>.661</td>
<td>3.303</td>
<td>79.025</td>
</tr>
<tr>
<td>9</td>
<td>.582</td>
<td>2.908</td>
<td>81.933</td>
</tr>
<tr>
<td>10</td>
<td>.553</td>
<td>2.764</td>
<td>84.697</td>
</tr>
<tr>
<td>11</td>
<td>.450</td>
<td>2.251</td>
<td>86.947</td>
</tr>
<tr>
<td>12</td>
<td>.418</td>
<td>2.090</td>
<td>89.037</td>
</tr>
<tr>
<td>13</td>
<td>.396</td>
<td>1.981</td>
<td>91.018</td>
</tr>
<tr>
<td>14</td>
<td>.311</td>
<td>1.557</td>
<td>92.576</td>
</tr>
<tr>
<td>15</td>
<td>.295</td>
<td>1.477</td>
<td>94.053</td>
</tr>
<tr>
<td>16</td>
<td>.277</td>
<td>1.386</td>
<td>95.439</td>
</tr>
</tbody>
</table>
From Table 5, it can be seen that out of 20 variables, there are 4 new factors created. It can be seen from the eigen value, indicating that only 4 factors shows eigen value > 1. So, it can be seen that 4 (four) factors is the most optimum number.

3) Factor Interpretation

The next stage is to interpret the factors created by seeing table, rotated component matrix indicating the distribution of the 20 (twenty) variables in the 4 (four) new factors. Table 4 shows the result of rotated component matrix.

Table 6 Rotated Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independency</td>
<td>.753</td>
<td>-.130</td>
<td>-.023</td>
<td>-.105</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>.819</td>
<td>-.018</td>
<td>-.092</td>
<td>-.003</td>
</tr>
<tr>
<td>Discipline</td>
<td>.739</td>
<td>.000</td>
<td>.084</td>
<td>.133</td>
</tr>
<tr>
<td>Hard working</td>
<td>.629</td>
<td>.093</td>
<td>-.042</td>
<td>.103</td>
</tr>
<tr>
<td>Sturdiness</td>
<td>.807</td>
<td>.074</td>
<td>-.097</td>
<td>-.060</td>
</tr>
<tr>
<td>Creativity</td>
<td>.606</td>
<td>.389</td>
<td>-.029</td>
<td>-.033</td>
</tr>
<tr>
<td>Self confidence</td>
<td>.561</td>
<td>.481</td>
<td>-.111</td>
<td>-.133</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>.541</td>
<td>.536</td>
<td>-.053</td>
<td>-.080</td>
</tr>
<tr>
<td>Preparing Food</td>
<td>.301</td>
<td>.771</td>
<td>-.140</td>
<td>-.132</td>
</tr>
<tr>
<td>Shopping</td>
<td>-.057</td>
<td>.846</td>
<td>.064</td>
<td>.061</td>
</tr>
<tr>
<td>Maintaining health</td>
<td>-.017</td>
<td>.854</td>
<td>.017</td>
<td>.115</td>
</tr>
<tr>
<td>Rearing and educating child</td>
<td>.019</td>
<td>.867</td>
<td>.076</td>
<td>.074</td>
</tr>
<tr>
<td>Producing product and service</td>
<td>.148</td>
<td>.096</td>
<td>.669</td>
<td>.099</td>
</tr>
<tr>
<td>Supporting Family’s Economy</td>
<td>-.170</td>
<td>-.007</td>
<td>.802</td>
<td>-.003</td>
</tr>
<tr>
<td>Gaining profit</td>
<td>.005</td>
<td>-.053</td>
<td>.796</td>
<td>.107</td>
</tr>
<tr>
<td>Increasing income</td>
<td>-.102</td>
<td>-.034</td>
<td>.804</td>
<td>.045</td>
</tr>
<tr>
<td>Wanting to get experience</td>
<td>-.081</td>
<td>-.045</td>
<td>.837</td>
<td>.157</td>
</tr>
<tr>
<td>Participation in Women Organization</td>
<td>-.186</td>
<td>.139</td>
<td>.389</td>
<td>.499</td>
</tr>
<tr>
<td>Participation in Development</td>
<td>.093</td>
<td>.194</td>
<td>-.005</td>
<td>.808</td>
</tr>
<tr>
<td>Participation in Community</td>
<td>.024</td>
<td>-.241</td>
<td>.234</td>
<td>.668</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Table 6 shows clearer and more real distribution of variables. The categorization of variables into factors can be observed from the largest value of each component; therefore the following results are obtained.
a. First factor: independency, innovativeness, discipline, hard working, sturdiness, creativity, self-confidence, and competitiveness.
b. Second factor: preparing food, shopping, maintaining health, rearing and educating child.
c. Third factor: producing product and service, gaining profit, increasing income, wanting to get experience, supporting the family’s economy.

d. Fourth factor: participation in women organization, participation in development, and participation within community

The detailed distribution of variables based on the created factors can be seen in the table below. The variables are ordered based on factor loading value in descending manner. The naming of newly created factors is subjective in nature (Ghozali, 2005).

Table 7 The Distribution of Created Variable

<table>
<thead>
<tr>
<th>Factors created</th>
<th>Indicator</th>
<th>Eigen Value</th>
<th>Loading Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Character Role Factor</td>
<td>Independency</td>
<td>5.010</td>
<td>.753</td>
</tr>
<tr>
<td></td>
<td>Innovativeness</td>
<td></td>
<td>.819</td>
</tr>
<tr>
<td></td>
<td>Discipline</td>
<td></td>
<td>.739</td>
</tr>
<tr>
<td></td>
<td>Hard working</td>
<td></td>
<td>.629</td>
</tr>
<tr>
<td></td>
<td>Sturdiness</td>
<td></td>
<td>.807</td>
</tr>
<tr>
<td></td>
<td>Creativity</td>
<td></td>
<td>.606</td>
</tr>
<tr>
<td></td>
<td>Self confidence</td>
<td></td>
<td>.561</td>
</tr>
<tr>
<td></td>
<td>Competitiveness</td>
<td></td>
<td>.541</td>
</tr>
<tr>
<td>Reproductive Role Factor</td>
<td>Preparing Food</td>
<td>3.531</td>
<td>.771</td>
</tr>
<tr>
<td></td>
<td>Shopping</td>
<td></td>
<td>.846</td>
</tr>
<tr>
<td></td>
<td>Maintaining health</td>
<td></td>
<td>.854</td>
</tr>
<tr>
<td></td>
<td>Rearing and educating child</td>
<td></td>
<td>.867</td>
</tr>
<tr>
<td>Productive Role Factor</td>
<td>Producing product and service</td>
<td>2.704</td>
<td>.669</td>
</tr>
<tr>
<td></td>
<td>Supporting Family's Economy</td>
<td></td>
<td>.802</td>
</tr>
<tr>
<td></td>
<td>Gaining profit</td>
<td></td>
<td>.796</td>
</tr>
<tr>
<td></td>
<td>Increasing income</td>
<td></td>
<td>.804</td>
</tr>
<tr>
<td></td>
<td>Wanting to get experience</td>
<td></td>
<td>.837</td>
</tr>
<tr>
<td>Social Role Factor</td>
<td>Participation in Women Organization</td>
<td>1.247</td>
<td>.499</td>
</tr>
<tr>
<td></td>
<td>Participation in Development</td>
<td></td>
<td>.808</td>
</tr>
<tr>
<td></td>
<td>Participation in Community</td>
<td></td>
<td>.668</td>
</tr>
</tbody>
</table>

Source: Data Processing of 2021

The result of research shows that out of 20 (twenty) variables analyzed, 4 (four) factors are newly created, affecting the Factors Encouraging the Sturdiness of Pangandaran Female Entrepreneur in Pandemic Time (A Case Study in Pangandaran Regency). The four factors are: character role, reproductive role, productive role, and social role.

Considering the result of data processing, it can be said that the highest value is 5.010, found in the character role factor. It proves that MSME-operating women have very strong character. They belong to independent, persistent or sturdy, innovative, and creative women in running their business. These strong characters make them ignore other roles. This is indicated with their incapability of undertaking reproductive role in dealing with household chores. Similarly, they found insignificant constraints in productive role. They can produce product (good) and service, so that they can support the family’s economy by earning living and getting adequate profit. They undertake the social role in daily life through active participation in social organization. Through their participation in organization, either women or community organization, they have higher self-confidence, so that they can be competitive.

V. CONCLUSION

From the result of data analysis, the author can conclude that out of twenty variables studied, through factoring process, four new factors can be obtained. Then, the four newly created factors consist of character role including independency, innovativeness, discipline, hard working, sturdiness, creativity, self-confidence, and
competitiveness; reproductive role: preparing food, shopping, maintaining health, rearing and educating child; productive role factor: producing product and service, gaining profit, increasing income, wanting to get experience, supporting the family’s economy; and social role: participation in women organization, participation in development, and participation within community.

Acknowledgement

This research was supported by the Ministry of Research and Technology / National Research and Innovation Agency, the Ministry of Finance / Education Fund Management Institute (LPDP) and the Indonesian Policy Analysts Association (AAKI). We thank our colleagues who provided insight and expertise that greatly assisted the research for the support, comment, and assistance that greatly improved the manuscript.

References


BIOGRAPHY

Ikeu Kania is a Head Lecturer and lecturer at the Faculty of Social and Political Sciences, Garut University, born in Garut, 21 April 1968, undergraduate education at STISIP Garut in social welfare study program, master education in State Administration study program at Garut University and a doctorate in administration study program state at Padjadjaran university.
Nani Rohaeni is an Associate Policy Analyst, born in Bandung, June 16, 1967. Undergraduate education at Padjajaran University majoring in agricultural cultivation and master's education at Winayamukti University majoring in Agricultural Development.

Iwan Ridwan Stiaji was born on May 10, 1981, working at ASN LIPI as a Young Policy Analyst. Undergraduate education at Padjadjaran university in state administration study program and master education at STIA LAN in state administration study program.

Siti Annisa Silvia Rosa was Garut, March 30, 1984, Policy Analyst at the Indonesian Institute of Sciences. Undergraduate education at STIA LAN in the Public Administration study program and master education at STIA LAN in the Public Administration study program, doctorate at Padjadjaran university in public administration study program.

Dodi Yudiardi was born in Garut, October 15, 1972, working as a lecturer with a functional position as Lector. Undergraduate education at STISIP Garut in state administration study program, master education at Garut University in state administration study program and doctoral education at Padjadjaran university in state administration study program.