

12th Simulation Workshop (SW25)

Exeter, United Kingdom
31 March – 2 April 2025

Editors:

**Alison Harper
Martino Luis**

**Thomas Monks
Navonil Mustafee**

ISBN: 979-8-3313-1507-8

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2025) by The Operational Research Society
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact The Operational Research Society
at the address below.

The Operational Research Society
Seymour House
12 Edward Street
Birmingham
B1 2RX
United Kingdom

Phone: +44 (0)121 233 9300

www.theorsociety.com

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

PAPERS

MULTI-SCALE AND MULTI-PERSPECTIVE DIGITAL TWIN: EXPERIENCE WITH AN URBAN LIVING LAB	1
<i>Mamadou Kaba Traoré</i>	
DIGITAL TWIN SIMULATION FOR OPERATIONAL DECISION MAKING	12
<i>Christine Currie</i>	
A TUTORIAL ON KRIGING-BASED STOCHASTIC SIMULATION OPTIMIZATION	18
<i>Sasan Amini, Inneke Van Nieuwenhuysse</i>	
BUILDING HEALTHCARE DISCRETE-EVENT SIMULATION MODELS IN FREE AND OPEN SOURCE SOFTWARE: AN INTRODUCTORY TUTORIAL.....	32
<i>Thomas Monks, Alison Harper, Amy Heather, Andrew Mayne, Navonil Mustafee</i>	
WANT TO BUILD A MOONBASE? THE SIMULATION EXPLORATION EXPERIENCE (SEE).....	47
<i>Maziar Ghorbani, Simon J E Taylor, Nura Tijjani Abubakar, Hridyanshu Aatreya, Damon Curry, Anastasia Anagnostou</i>	
SYSTEM DYNAMICS POLICY IMPACT ASSESSMENT OF THE WATER-ENERGY-FOOD-ECOSYSTEM NEXUS IN THE INKOMATI-USUTHU WATER MANAGEMENT AREA, SOUTH AFRICA	57
<i>Janez Susnik, Blaine Haupt, Daniella Kristensen, Gareth Simpson, Antonio Trabucco, Roberto Roson</i>	
SOLVING A REAL COMPLEX SCHEDULING PROBLEM WITH A SIMULATION-BASED OPTIMIZATION METHOD	66
<i>Chakib Medjkane, Yasmine Rihane, Nacira Chikhi</i>	
SIMULATION MODELING FOR SURGERY ROOM SCHEDULING PROBLEM.....	73
<i>Ibrahim Kridi, Tawfiq Tabouche, Imène Ait Abderrahim</i>	
OPTIMIZING WASTE TREATMENT CENTER LOCATIONS: A MATHEMATICAL MODELING AND SIMULATION APPROACH.....	79
<i>Younes Abderrahim, Salah Eddine Bellal, M'Hammed Sahnoun</i>	
IMPROVING DIABETES TREATMENT OUTCOMES: AN AGENT-BASED MODEL OF PATIENTS' SELF-MANAGEMENT BEHAVIOURS AND TREATMENT OUTCOMES IN GHANA	88
<i>Eunice Twumwaa Tagoe, Itamar Megiddo, Robert Van Der Meer</i>	
EVALUATING POOLED PROCUREMENT AND INVENTORY MANAGEMENT FOR ESSENTIAL MEDICINES IN NIGERIA.....	99
<i>Viraj Joshi, Mikaella Polyviou, John Fowler, Eugene Schneller, Adegoke Oke</i>	
CHIP AWAY EVERYTHING THAT DOESN'T LOOK LIKE AN ELEPHANT	109
<i>John Salt</i>	
DEVELOPING A CONCEPTUAL MODEL TO EVALUATE SHELF-LIFE EXTENSION AS A RESILIENT STRATEGY IN HUMAN MILK BANKS.....	117
<i>Marta Staff, Navonil Mustafee, Natalie Shenker</i>	

DEVELOPING HYBRID KIDNEY CARE MODELS WITH FACILITATED MODELLING	126
<i>Stacey Croft, Antuela Tako, Yun He, Sally Thompson, Lucy Morgan, Mark Lambie</i>	
DISCRETE-EVENT SIMULATION MODEL OF TURNAROUND OPERATIONS TO EVALUATE AIRLINE SCHEDULE ROBUSTNESS.....	136
<i>Elisa Guardo-Martinez, Stephan Onggo, Martin Kunc, Maurizio Tomasella, Silvia Padron</i>	
ISOCHRONE MAPS FOR MILITARY GROUND MOVEMENT: INFORMATION INFERENCE BY INTERSECTION	145
<i>Alexander Roman, Oliver Rose</i>	
NETLOGOPY: UNLOCKING ADVANCED SIMULATION AND INTEGRATION FOR NETLOGO USING PYTHON.....	149
<i>Nourddine Bouaziz, Belgacem Bettayeb, M'Hammed Sahnoun, Adnan Yassine</i>	
SIMULATION METAMODELLING VIA LOCAL LINEAR INTERPOLATION.....	157
<i>Varun Ramamohan, Deep Bansal, Harsh Vardhan Singh, Yash Sarju Shah</i>	
ONTOLOGICAL GRAPH BASED MODELLING AND SIMULATION	167
<i>Steven Jones, Ben Lomax Thorpe, César Mardomingo Alonso</i>	
TOWARDS CONTAINER-BASED SIMULATION: A CONCEPT FOR A DISTRIBUTED AND SCALABLE SIMULATION FRAMEWORK	182
<i>Daniel Seufferth, Falk Stefan Pappert, Oliver Rose</i>	
THE SIMPLEST, BUT NO SIMPLER, AGENT-BASED MODEL	190
<i>Charles Macal</i>	
HIERARCHICAL HYBRID SIMULATION MODELING OF BACTERIAL DISEASE INFECTION.....	199
<i>Avi Roy Chowdhury, Jayendran Venkateswaran, Om Damani</i>	
APPLICATION OF HYBRID AGENT-BASED MODELING AND SYSTEM DYNAMICS SIMULATION: COLLABORATION TO IMPROVE SUPPLY CHAIN RESILIENCE.....	209
<i>Davoud Hosseinneshad, Cathal Heavey, Foorooogh Goodarzi</i>	
MULTI-OBJECTIVE AIRPORT SIMULATION-BASED OPTIMISATION USING DES AND RESPONSE SURFACE METAMODELS	219
<i>Ahmad Attar, Mahdi Babaei, Sadigh Raissi, Majid Nojavan</i>	
GENERATORS FOR LARGE-SCALE STOCHASTIC SIMULATION-OPTIMIZATION EXPERIMENTS	229
<i>Renee Oswald, David Eckman</i>	
DO WE NEED SIMULATION OPTIMISATION FOR QUEUEING ALLOCATION PROBLEMS?.....	239
<i>Luke Rhodes-Leader, Yu-Ting Lin</i>	
A DES-BASED ONLINE DIGITAL TWIN FRAMEWORK FOR FESTO'S CYBER-PHYSICAL SYSTEM: INDUSTRY 4.0	249
<i>Muhammad Alfaz, Yanyan Tian, Ahmad Attar, Martino Luis, Voicu Ion Sucala</i>	
FROM BLUE-SKY CONCEPT TO INDUSTRIAL DEPLOYMENT: HOW OCADO TECHNOLOGY USED SIMULATION TO GUIDE THE DEVELOPMENT OF THE WORLD'S MOST ADVANCED GROCERY PICKING ROBOT	258
<i>Robert Backhouse, Sean Schrauben, Gareth Siret</i>	

DISCRETE EVENT SIMULATION WITH REINFORCEMENT LEARNING FOR ADVANCED MANUFACTURING DECISION-MAKING	266
<i>Cansu Kandemir, Marco Franchino</i>	
TOWARDS A DIGITAL TWIN FOR EMERGENCY RESPONSE: A HYBRID SIMULATION FOR MULTI-SECTORAL RESOURCE ALLOCATION.....	276
<i>Otto Chen, Navonil Mustafee, Qian Li, Barry Evans, Mehdi Khoury, Lydia Vamvakeridou- Lyroudia, Albert Chen, Slobodan Djordjevic, Dragan Savic</i>	
CREATING AND OPERATING A SIMULATION-BASED DIGITAL TWIN SERVICE FOR HYDROLOGIC FLOOD	286
<i>Gareth Lewis, Mehdi Khoury, Qian Li, Barry Evans, Albert Chen, Lydia Vamvakeridou- Lyroudia, Nav Mustafee, Slobodan Djordjevic, Dragan Savic</i>	
ENHANCING RESILIENCE OF INTERDEPENDENT INFRASTRUCTURE NETWORKS THROUGH A CRITICALITY RANKING APPROACH.....	299
<i>Georgios Alexandros Chatzistefanou, Albert Chen, Slobodan Djordjevic, Lydia Vamvakeridou-Lyroudia, Dragan Savic</i>	
STRATEGIC WORKFORCE MODELLING AND ANALYSIS AT NHS WALES: TOWARDS A STRATEGIC DIGITAL TWIN OF THE WELSH HEALTHCARE WORKFORCE	302
<i>Siôn Cave, Ryan Cunningham</i>	
LESSONS LEARNT FROM THE DESIGN AND DELIVERY OF A NATIONAL SYSTEM DYNAMICS TRAINING PROGRAMME TO THE NATIONAL HEALTH SERVICE IN ENGLAND.....	308
<i>Siôn Cave, Vanessa Perez Perez, Stephen Curram, Emma Woodham</i>	
A CONCEPTUAL FRAMEWORK FOR PROMOTING SUSTAINABILITY IN SIMULATION OF HOSPITAL PHARMACY ASEPTIC UNITS	315
<i>Fatemeh Alidoost, Navonil Mustafee, Thomas Monks, Alison Harper, Alice Harrison</i>	
EVALUATING THE IMPACT OF STAFFING RECOMMENDATIONS IN MATERNITY UNITS IN FRANCE	329
<i>Louis Niffoui, Oualid Jouini, Marija Jankovic, Pierre-François Ceccaldi, Guillaume Lamé</i>	
SIMULATION MODELLING OF DELAYED DISCHARGE FROM HOSPITAL.....	339
<i>Ranga Abeysooriya, Nirmani Amarasinghe, Laura Boyle, Christine Currie, Carlos Lamas- Fernandez</i>	
MODELLING LONG-TERM CHANGES IN POPULATION HEALTH STATE AND ASSOCIATED HEALTHCARE RESOURCE REQUIREMENTS	349
<i>Zehra Onen-Dumlu, Luke Shaw, Richard Wood, Christos Vasilakis</i>	
DISCRETE EVENT SIMULATION TO UNDERSTAND AMBULANCE PERFORMANCE AND IMPROVEMENT STRATEGIES	360
<i>Martina Bargeman Fonseca, Jonathan Pearson</i>	
NAVIGATING HOSPITAL OPERATIONS THROUGH SIMULATION: A STUDY OF URBAN FLOODING DISASTERS AND PHYSICAL DAMAGE IMPACT.....	371
<i>Sorour Farahi, Steffen Bayer, Sally Brailsford, Stephan Onggo</i>	
DEVELOPING, VERIFYING AND VALIDATING A SIMULATION PLATFORM TO IMPROVE RESOURCE PLANNING FOR THE NSPCC HELPLINE	379
<i>Jess Cole, Stephen Pollard</i>	

MODELLING FOR SIMULATION MULTI-USE – TOWARDS A FRAMEWORK FOR COST-EFFECTIVENESS ANALYSES OF REPERFUSION TREATMENTS FOR ACUTE STROKE	385
<i>Chi Nguyen, Durk-Jouke Van Der Zee, Maarten M. H. Lahr, Maarten Uyttenboogaart, Erik Buskens</i>	
OPERATIONAL VALIDATION USING SIMULATION MODELS DESIGNED AND CREATED WITH DIFFERENT PARADIGMS	395
<i>Bozena Mielczarek</i>	
SUPPLY CHAIN DEVELOPMENT FOR CIRCULARITY IN AEROSPACE: AIRCRAFT SEAT CASE STUDY	405
<i>Marco Franchino, Christopher Haynes, Cansu Kandemir</i>	
LOGISTICS NETWORK DESIGN FOR A SUSTAINABLE BLOOD SUPPLY CHAIN UNDER DISASTERS USING A SIMULATION APPROACH.....	415
<i>Lama Soliman Khaled, Ahmad Attar, Martino Luis, Baris Yuce</i>	
DOES CUSTOMER ORDER MATTER? EXPLORE THE DYNAMICS OF LOST-SALES REMANUFACTURING SYSTEM UNDER AR(1) DEMAND.....	425
<i>Yan Lu, Junyi Lin</i>	

PANEL ABSTRACT

THE PRACTICE OF M&S RESEARCH FROM A COUNTRY-SPECIFIC PERSPECTIVE AND THE CHALLENGES AND OPPORTUNITIES FOR INTERNATIONAL COLLABORATIONS.....	436
<i>Navonil Mustafee, Anastasia Anagnostou, Masoud Fakhimi, John Fowler, Varun Ramamohan, Oliver Rose, Mehdi Souier, Mamadou Kaba Traore, Jayendran Venkateswaran</i>	

POSTER ABSTRACTS

AUTOMATED TEXTILE PROCESSING TO ENABLE CIRCULAR TEXTILE MATERIALS, EXPLORATION OF CONFIGURATION REQUIREMENTS OF AN AUTOMATED TEXTILE SORTING AND PRE-PROCESSING FACILITY (ATSP).....	437
<i>Michael-Manuel Mendoza-Bollam, Matthew Watts, Jack Bowen, Stephen Murphy, Jacqui Snow, Terie Purse</i>	
THE DYNAMICS OF SCALE-UP CREATION IN ENTREPRENEURIAL ECOSYSTEMS	437
<i>Vahid Hajiebrahimi Farashah, Susan Howick, Bernd Wurth</i>	
EVALUATING PRODUCTION EFFICIENCY IN AN ALGERIAN PLASTIC PACKAGING COMPANY USING ARENA SIMULATION	437
<i>Sara Fatima Zohra Megaiz, Fouad Maliki, Mehdi Souier, Mohammed Dahane</i>	
DEVELOPMENT OF A VIRTUAL FARM FOR EVALUATING CLIMATE CHANGE ADAPTATION STRATEGIES IN SALMON AQUACULTURE.....	438
<i>Suleiman Yakubu, Lynne Falconer</i>	
A FREE AND OPEN-SOURCE CROSS-LIBRARY ANIMATED VISUALISATION PACKAGE FOR DISCRETE EVENT SIMULATIONS.....	438
<i>Samantha Rosser, Daniel Chalk</i>	
A SIMULATION-BASED APPROACH TO IMPROVE EMERGENCY DEPARTMENT EFFICIENCY AND MEET NHS TARGETS.....	438
<i>Thamer Almohaya, James Batchelor, Edilson Arruda</i>	

SYSTEM DYNAMICS MODELLING OF CONTAINER SHIPPING SYSTEM UNDER DISRUPTIONS - THE IMPACT OF THE 2024 POLYCRISIS: RED SEA ATTACKS, PANAMA DROUGHT AND U.S. TARIFFS ON EAST ASIA – NORTH AMERICA TRADE ROUTE.....	439
<i>Hongdan Chen, Haobin Li, Lavanya Meherishi</i>	
MULTI-FIDELITY MODELLING AND OPTIMISATION FOR LONG-TERM PUBLIC SECTOR CAPACITY PLANNING	439
<i>Graham Burgess, Luke Rhodes-Leader, Rob Shone, David Worthington, Dashi Singham</i>	
DYNAMIC LEGO-BUILDING: A BUILDING-BLOCK APPROACH ENABLING MODULARITY IN SYSTEM DYNAMICS	439
<i>Lucas Meneguim, Daniel Guzzo, Daniela Pigosso</i>	
MODELLING STRATEGIC INTERACTIONS BETWEEN REGIONAL AND NATIONAL WAITING LISTS TO IMPROVE PATIENT OUTCOMES.....	440
<i>Euan Barlow</i>	
A SUPPLY CHAIN FRAMEWORK FOR EXTENDED BLOOD TYPE MATCHING IN SICKLE CELL PATIENTS	440
<i>Folarin B. Oyebolu, Nicholas Gleadall, William J. Astle</i>	
SIMULATION-BASED OPTIMISATION OF OFFSHORE WIND INSTALLATION SUPPLY CHAIN UNDER UNCERTAINTY	440
<i>Ahmad Attar, Martino Luis, Shuya Zhong</i>	
SIMULATING AMBULANCE SERVICES IN COMPLEX ENVIRONMENTS.....	441
<i>Mark Tuson, Geraint Palmer, Vincent Knight, Paul Harper, Sarie Brice, Leanne Smith, Daniel Gartner</i>	
CLINICAL PATHWAY MODELLING OF A TRAUMA & ORTHOPAEDICS DEPARTMENT	441
<i>Matthew Howells, Paul Harper, Daniel Gartner, Geraint Palmer, Antonio Riccioli</i>	
TRANSFORMING THE PRODUCTION SPEED MANAGEMENT SYSTEM INTO A SIMPLE ONLINE DIGITAL TWIN: A DES-BASED TUNING APPROACH.....	441
<i>Ahmad Attar, Rongxu Liu, Tzu-Chun Lin, Martino Luis, Shuya Zhong, Voicu Ion Sucala</i>	
OPTIMISING CARDIOLOGY SERVICES: FORECASTING AND SIMULATION FOR STRATEGIC PLANNING	442
<i>Elizabeth Williams, Mark Tuson</i>	
A HYBRID SIMULATION APPROACH FOR ADVANCING SAFETY IN CONNECTED AUTOMATED VEHICLES	442
<i>Traey Elezi, Anastasia Anagnostou, Fotios Spyridonis</i>	
AFRICAN FEDERATION OF OPERATIONAL RESEARCH SOCIETIES: AN OPPORTUNITY TO BUILD BRIDGES TO OPERATIONS RESEARCH AND SIMULATION DEVELOPMENT IN AFRICA	442
<i>Mehdi Souier, Safa Bhar Layeb</i>	

Author Index