



OPERATIONS RESEARCH  
SOCIETY OF THE PHILIPPINES



# Data-Driven OR and Analytics for National Resilience and Sustainability

14th National Conference

November 17, 2023 | 8:30am - 5:30pm  
De La Salle University - Manila

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# *From the Conference Chairs*



It is with great pleasure that I extend a warm welcome to each of you to the 14th National Conference of the Operations Research Society of the Philippines. Your presence at this annual event adds immense value, contributing to the vibrant exchange of ideas and knowledge that has become a hallmark of our organization's conferences.

This year's theme, "Data-Driven Operations Research and Analytics for National Resilience and Sustainability," reflects the critical role that data and analytical insights play in shaping the resilience and sustainability of our nation. As we navigate through an era marked by unprecedented challenges, the fusion of Operations Research and Analytics becomes pivotal in formulating effective strategies for a more resilient and sustainable future.

Today we expect an engaging lineup of keynote speakers, panel discussions, paper presentations, and interactive workshops. It is an opportunity to delve into the latest advancements in the field, share innovative research findings, and foster collaborations that will pave the way for groundbreaking solutions.

We encourage you to actively participate in discussions, ask questions, and engage with your fellow participants. The success of this conference lies in the collective expertise and enthusiasm of our diverse community. Whether you are a seasoned professional, a faculty researcher, or a promising student, your unique perspective is integral to the richness of our discussions.

Thank you for being a part of this significant gathering. We are confident that the 14th National Conference will not only broaden your horizons but also inspire new avenues for research, collaboration, and practical applications of Operations Research and Analytics for the greater good.

Wishing you an intellectually stimulating and rewarding experience at the conference!

***Edwin J. Loma***  
*Conference Chair*



I would like to welcome all of you to the 14<sup>th</sup> National Conference on Data Driven OR and Analytics for National Resilience and Sustainability. The topics are timely and relevant to our current global situation on environment where sustainability is very crucial for national resilience.

To enhance resilience and sustainability, it is important to use data-driven approaches. By harnessing data and analytics, we can make informed decisions, monitor environmental changes and optimize resource allocation to mitigate risk and promote sustainable practices. This synergy of data resilience empowers us to build a more resilient and sustainable future.

See you all in the national conference!

***Juanito S. Chan***  
*Conference Co-Chair*



# *From the President*



In the spirit of resilience forged through challenges, I extend a heartfelt welcome to each one of you as we gather for the 14<sup>th</sup> ORSP National Conference under the theme, *"Data-driven OR and Analytics for National Resilience and Sustainability."*

The pandemic highlighted the critical role of operations research and analytics in responding to unforeseen challenges. Data became a lifeline, guiding us through uncertainties, optimizing resource allocation, and enabling agile responses. Now, more than ever, we understand the power of data-driven decision making in fortifying our nations against future crises.

This conference provides a timely platform to share experiences, exchange insights, and collectively pave the way forward. How can we leverage the lessons from the pandemic to build more resilient and sustainable systems? How can data-driven approaches not only aid in crisis response but also contribute to long-term national well-being?

I invite you to immerse yourselves in discussions that bridge the gap between the challenges we've faced and the solutions we can collectively envision. This will show our commitment to national resilience and sustainability, using the transformative potential of data-driven OR and analytics.

To our distinguished speakers, authors, board members, and participants, thank you for your hard work in moving the field forward, and I look forward to the positive results we'll achieve together.

***Marie Shella T. Mariscal***  
*President, ORSP*

# Program Schedule

0730 - 0815	Registration
0815 - 0830	Opening Ceremonies
0830 - 0925	Keynote
	<i>The Philippines in the Face of Climate Change: Towards Sustainability and Resilience</i>
	Angela (Gia) Consuelo S. Ibay
	Director, Earth Hour Philippines
0925 - 1020	Plenary Talk
	<i>From Fuzzy to Neutrosophic Sets: Mathematical Programming Approaches Considering Data Uncertainty in Emerging Technologies for Sustainability</i>
	John Frederick D. Tapia
	Professor, De La Salle University
1020 - 1040	Coffee Break
1040 - 1135	Plenary Talk
	<i>Engineering Ethics into GenAI</i>
	Dominic Ligot
	Founder, CEO and CTO, Cirrolytix
1135 - 1155	Paper in Focus: OR Modeling for Logistics
1155 - 1300	Lunch Break
1300 - 1400	Paper Presentations
	OR for Nation Building
1400 - 1500	Transportation and Queueing
1500 - 1600	Inventory and Production Planning
1600 - 1620	Coffee Break
1620 - 1710	Closing Plenary
	<i>Empowering Change: ABW's Open-Source Analytics Solutions Driving SDG Impact Globally</i>
	Parvathy K Krishnakumari
	Chief Technology Officer and Lead Data Scientist, Analytics for a Better World Institute
1710 - 1720	Closing Ceremonies

# *Opening Ceremonies*

## *Keynote Speech*

0830 – 0925

### **The Philippines in the Face of Climate Change: Towards Sustainability and Resilience**

#### **ABSTRACT**

In the face of a changing climate, environmental sustainability and resilience are critical issues that demand urgent attention and action from governments and organizations worldwide. The scientific evidence is unequivocal, as the Intergovernmental Panel on Climate Change (IPCC) has said. While solutions are present, any further delay in coordinated action would miss a limited and quickly closing window to assure a liveable future.

Because of its physical characteristics as an archipelagic state and location within the Pacific Ring of Fire, the Philippines is prone to calamities such as earthquakes, typhoons, floods, and drought, among others. Climate change has exacerbated these vulnerabilities by increasing the frequency and severity of natural catastrophes, creating substantial setbacks in the country's socioeconomic growth and development. Furthermore, the simultaneous problem of climate change and biodiversity loss puts communities and ecosystems at risk.

Understanding the state of play of the climate crisis, as well as the solutions and actions that need to be undertaken, can move us forward toward sustainability and resilience while leaving no one behind. Multistakeholder involvement, partnerships, innovative mechanisms, and transformative approaches are needed to double down on the challenges we face in a climate-defined future.

The session will explore the state of the climate, current trends and issues, the global and national responses undertaken, and the role of science and innovation in decision-making. Further, the session will tackle the country's sustainability framework through the national climate change and adaptation, and development plans and the comprehensive roadmap toward reducing our country's ecological footprint through the use of renewable energy and energy efficiency in view of the Philippines' Nationally Determined Contribution (NDC) and alignment with goals of the Paris Agreement and the Sustainable Development Goals (SDGs).



***Atty. Angela (Gia) Consuelo S. Ibay***  
SPEAKER

With over twenty years of experience working on climate change, energy, and environment issues, Atty Ibay presently heads the Climate Change and Energy Programme of the World Wide Fund for Nature (WWF) Philippines and concurrently serves as Earth Hour Philippines' National Director, working for the organization for the past twelve and a half years on renewable energy and the clean energy transition, sustainable cities, and climate resilience. She chaired the National Renewable Energy Board's sub-committee on Public Relations and IEC for five years. Last March 2022, she was elected to the Board of Directors of the Climate Action Network (CAN) International, the world's largest climate network made up of over 1,500 civil society organisations in over 130 countries, fighting the climate crisis.

Her expertise includes environmental law and policy, climate change, climate finance, pollution, hazardous waste, renewable energy legislation and policy. The first Climate Change Attaché of the British Embassy Manila, she has worked at the Manila Observatory, the Department of Environment and Natural Resources and Environmental Management Bureau, serving also as legal counsel for the Pollution Adjudication Board and Mines Adjudication Board. She has peer-reviewed, co-written papers on environmental issues and has been a Philippine delegation



member to the United Nations Framework Convention of Climate Change (UNFCCC) Conference of Parties (COP). For the upcoming COP28 in Dubai, UAE, as a member of the Philippine delegation, Atty. Ibay will serve as a Technical Adviser to the DENR.

Holding a Bachelor of Arts degree in Economics from the Ateneo de Manila University and a Juris Doctor degree from the University of the Philippines College of Law, Atty. Ibay has received training from the Beahrs Environmental Leadership Program, University of California, Berkeley, U.S.A., and the Renewables Academy (RENAC), Berlin, Germany.

## *Plenary Talks*

0925 – 1020

### **From Fuzzy to Neutrosophic Sets: Mathematical Programming Approaches Considering Data Uncertainty in Emerging Technologies for Sustainability**

#### **A B S T R A C T**

Sustainability requires considering the economic, social, and environmental aspects of activities and technologies for development. One of the major global problems in sustainable development is the climate change impact of economic activities such as energy generation and transportation. The need to reduce greenhouse gas emissions in the future give rise to the emergence of new technologies such as

negative emissions technologies, carbon capture and storage, and energy storage. These technologies provide benefits to generate clean energy and low-carbon footprint products, how uncertainties are present in these technologies especially on how these technologies can be deployed in large scale. In this presentation, the development of mathematical programming tools for planning and decision-making considering uncertainties in emerging technologies for sustainable development will be discussed. Accounting for different types of uncertainty such as vagueness, imprecision, ambiguity, inconsistency, and complexity is done by modelling it as fuzzy sets. This technique is then extended to neutrosophic sets – a generalization of the fuzzy sets. The modelling approaches of uncertainty in emerging technologies for climate change mitigation are presented.

***John Frederick D. Tapia***

SPEAKER



**John Frederick D. Tapia** is an Associate Professor in the Chemical Engineering Department of De La Salle University- Manila, Philippines. He is a graduate of PhD in Chemical Engineering at De La Salle University- Manila and was a postdoctoral research associate for 1.5 years in University of Bath. As an early-career researcher, his research interests include process systems engineering (PSE) of low-carbon energy systems and biomass value chains, focusing mainly on developing mathematical tools that consider data uncertainty.

He was awarded as the 2022 National Academy of Science and Technology - Outstanding Young Scientist (NAST-OYS) in the field of chemical engineering. Currently, he published 43 Scopus-indexed articles on this topic, including pioneering research in the application of neutrosophic sets in process synthesis and in data envelopment analysis. His current h-index is 14. He is part of the editorial board of the Neutrosophic Sets and Systems, and Neutrosophic Sets with Applications, and part of Neutrosophic Science International Association (NSIA) as country representative. He also presented at numerous international conferences.

## Engineering Ethics into GenAI

### A B S T R A C T

We briefly discuss Generative AI and the ethical issues that surround it, then break it down from a data and engineering standpoint.

*Dominic Ligot*

*SPEAKER*



Data analyst, researcher, software developer, entrepreneur and technologist, Dominic Ligot is an advocate for data literacy, AI ethics, data ethics and social impact from data. His current work focuses on human rights, public health, food security, political risk and fighting disinformation and infodemics through the use of computational social science, social listening, remote sensing, artificial intelligence and data engineering.

ing.

Founder of CirroLytix, a social impact AI company, and Data Ethics PH, an online community focused on social issues such as data privacy, data security, AI-driven discrimination, data liabilities, data ownership rights, and data poverty. Three-time global winner of the NASA and ESA International Space Apps Challenges, his team's award winning dengue surveillance application, AEDES, has been backed by the Group on Earth Observations (GEO), the Digital Public Goods Alliance (DPGA) and the UNICEF Innovation Fund.

Co-authored the Masters in Applied Business Analytics degree of the University of Asia and the Pacific, and led the development of the nationwide data science education program Project SPARTA. Co-founded the Analytics Association of the Philippines (AAP) and is a Board of Trustees member of the Philippine Center for Investigative Journalism (PCIJ).

Passionate about using big data and AI to make a positive difference in the world and creating a better future for society as it transitions through the Fourth Industrial Revolution.

# *Closing Session*

1620 – 1710

## Empowering Change: ABW's Open-Source Analytics Solutions Driving SDG Impact Globally

### ABSTRACT

Analytics for a Better World Institute (ABW) synergizes the capabilities of Non-profits, academia, and businesses to contribute to the UN Sustainable Development Goals (SDGs) through analytics. We've established a vast network involving research institutes and companies, all aligned with our central mission: utilizing analytics to contribute to the SDGs. Our efforts span across knowledge dissemination, anchored by the ABW Academy and open-source resources; practical implementation of analytics solutions; and innovative research, bolstered by an academic journal and seminars. In my talk, I'll delve into pivotal open-source tools developed by ABW that harnesses the power of **Optimization**, aiding use case deployments in more than five countries worldwide.



*Parvathy K Krishnakumari*  
SPEAKER

Parvathy K Krishnakumari is the Chief Technology Officer and Lead Data Scientist at Analytics for a Better World Institute. In addition, she also consults on a series of data science projects for the World Bank and United Nations Development Programme. She holds a Professional Doctorate in Engineering (Eng.D) specialising in Data Science from Eindhoven University of Technology in the Netherlands.

# Paper Sessions

Schedule, Titles, and Authors

Session	Time	Title
1	1135 to 1155	<p><b>Paper in Focus: OR Modeling for Logistics</b></p> <p><b>Truck Loading Models for Multi-depot Distribution Network</b>  <i>Angelo C. Ani, Gabriel John L. de Leon, and Simon Anthony Lorenzo</i></p>
2	1300 to 1400	<p><b>OR for Nation Building</b></p> <p><b>Business Decision Support Systems for Disaster Response and Recovery</b>  <i>Rachel G. Aurelio</i></p> <p><b>Optimization of Agricultural Land Allocation for Banana Species using Linear Programming</b>  <i>Xinai V. Batiller, Jeanette Therese D. Javier, Anna Michaela R. Maghirang, Robert Kerwin C. Billones</i></p> <p><b>Interference Modeling and Performance Analysis of Wireless Communication Systems for Emergency Response*</b>  <i>Carlo N. Romero</i></p>



3	1400 to 1500	<p style="text-align: center;"><b>Transportation and Queuing</b></p> <p><b>System Design and Improvement of Vehicle Service Shop Lay-out Using FlexSim Software</b>  <i>Gene Paulo B. Agena, Paul Kim Ivan R. Ramirez, Frances Bless J. Villafania, Gabriel John L. de Leon, Angelo C. Ani</i></p> <p><b>Analyzing Car Queues due to Traffic Signal Delays Along Katipunan Avenue, Quezon City</b>  <i>Christell Doria, Anjanette Cayabyab, and Jude Buot</i></p> <p><b>Improving Transit Service Quality Through Efficient Jeepney Scheduling: A Simulation Study of the Uplb-Uprhs-Jubileeville Route*</b>  <i>Miguel Darwin Lapitan, Vince Denver Gomez, John Quiel Marcial, Gabriel John L. de Leon, Angelo C. Ani</i></p>
4	1500 to 1600	<p style="text-align: center;"><b>Inventory and Production Planning</b></p> <p><b>Application of Linear Programming to Optimize Swine Feed Formulation</b>  <i>Reign Marie A. Bersamina, Robert Kerwin Billones, and Renann Baldovino</i></p> <p><b>LIFT: Revamping the Supply Department of a Regimental Academy in the Philippines*</b>  <i>Geraldine G. Nerona, Jorina R. Bohol, Kyla Nicole R. Decena, Jonathan N. Jose, Anjelika N. De Guzman, John Carlo R. Rodriguez, Kate Shyra M. Abiado, Mark Christian O. Aquino, Sandra Nicole L. Antolin, Nicole Ivy G. Kalaw, and Anne Claire N. Paulino</i></p> <p><b>Reducing Stockouts Of Milk Products In A University Merchandise Store*</b>  <i>Jann Lester Ace Caspe, Gian Paolo Guiao, Kim Adrian Ibon, Gabriel John L. de Leon, and Angelo C. Ani</i></p>

# *Paper Presentations*

## Paper in Focus: OR Modeling for Logistics

### ABSTRACTS

11:35—11:55

#### **Truck Loading Models for Multi-depot Distribution Network**

*Angelo C. Ani, Gabriel John L. de Leon, and Simon Anthony Lorenzo*

Logistics planners of companies overseeing a network of distribution centers perform a highly repetitive task of preparing truck schedules and truck loading plans. Taking into consideration a high number of SKUs and several operational realities ranging from varying truck and warehouse capacities, target inventories, and delivery lead times, the said task requires a substantial amount of the planner's time. As the considered scenario includes truck delivery costs as one component of the objective function, the model also intends to prolong the time before a truck needs to return to the same distribution center. This emphasizes the need to balance the SKUs loaded to the truck since deficit in some SKUs, despite excess in others, will necessitate truck delivery more frequently. In this study, mathematical programs were developed to automate the planning process to achieve near-optimal results. Specifically, one mixed integer linear programming model assumes myopic analysis that considers only the need of the day, while the other model extends to a longer planning horizon. The models, including appropriate user interfaces, were implemented in an optimization software. Test instances were run, and results of the models, in terms of performance and speed, were compared.

## OR for Nation Building

13:00 — 13:20

### Business Decision Support Systems for Disaster Response and Recovery

*Rachel G. Aurelio*

The Philippines has had to deal with natural and man-made catastrophes that have lost several lives, businesses, and properties. The DOST-PAGASA regularly sets names in alphabetical order for tropical cyclones so we are aware of how many typhoons already arrived. Because of its scale and magnitude, the government and private companies attempt to mitigate the impact of these events through the Disaster Preparedness Program. To manage these efforts, information technology has a big role to play. The increasingly important component of this technology is the Business Decision Support System (BDSS) which describes its role in Business Resiliency as it provides contextual analysis of a variety of hazards that may cause business interruption and even work stoppage that will directly affect our socio-economic status. The BDSS will analyze vast amounts of data to assist in decision making. With this information, it will produce reports that may project profit and loss. Using quantitative studies, structured interviews with the insurance providers who covered the risks, and reviewing private documents such as claims handled by the Loss Adjusters, we can determine those cases that are declared as total losses and those that can be recoverable that will help the organizations easily back to business.

13:20 —13:40

## **Optimization of Agricultural Land Allocation for Banana Species using Linear Programming**

*Xinai V. Batiller, Jeanette Therese D. Javier, Anna Michaela R. Maghirang,  
and Robert Kerwin C. Billones*

Banana production in the Philippines contributes to approximately 56 billion Philippine pesos in exports last 2021, making it the top agricultural export of the country. On the island of Mindanao, 84% of bananas were produced in 2018 (and 99% of the Cavendish varieties) with Davao as the top producer of the product. Revenue optimization for farms is greatly influenced by effective farm planning and resource allocation, thus the need for a model to allocate land in the most optimal way possible. This paper explores the use of a linear programming single-production model to create an optimal land allocation for three different species of banana crops (Cavendish, Lakatan, Saba) and maximize profit. Variable factors included in the maximization problem will be based on land, labor, and capital. Results show that 57.3278 hectares of Cavendish, 11.4656 hectares of Lakatan, and 34.3967 hectares of Saba will be allocated to achieve a maximum value of 306.0159 pesos.

13:40 —14:00

## **Interference Modeling and Performance Analysis of Wireless Communication Systems for Emergency Response\***

*Carlo N. Romero*

Wireless communication systems are essential for effective coordination and information exchange in emergency response scenarios. However, these systems can be easily disrupted by interference from other wireless networks, co-channel interfer-

ence, and external factors. This study investigates the impact of interference on the performance of wireless communication systems in emergency response environments. The study uses mathematical modeling techniques using MATLAB Software to characterize and measure the impact of interference on system performance. It also evaluates the effectiveness of interference mitigation techniques such as power control, frequency allocation, and adaptive modulation schemes. The study's findings determine the performance of wireless communication systems in emergency response scenarios. The results contribute to the development of an effective and reliable wireless communication solutions that can withstand interference challenges and enhance communication capabilities for emergency responders. The study's findings can also inform the design, deployment, and optimization of wireless systems to ensure efficient and resilient communication during critical emergency situations.

## Transportation and Queueing

14:00 — 14:20

### **System Design and Improvement of Vehicle Service Shop Layout Using FlexSim Software**

*Gene Paulo B. Agena, Paul Kim Ivan R. Ramirez, Frances Bless J. Villafania, Gabriel John L. de Leon, and Angelo C. Ani*

A company operating a midsized automotive service station employs processes for its four services—tire tread vulcanization, tire change, tire rotation, and air replenishment—which are riddled with wasteful movement and thus faces high customer balking. The study aims to improve these bottlenecks and increase operational profitability by reconfiguring the current system layout into alternatives and statistically comparing output parameters, whose values are measured by using FlexSim simulation software. Deterministic and stochastic input parameters, as well as lay-



out dimensions and element distances, are first measured through on-site observations. The base and alternative cases are modelled in the software and run in the Experimenter for 500 replicates, resulting in the same number of data points for specified output parameters. Alternative 2 is found to be superior to Alternative 1 overall, as it yields better values for total operator travel distance, system throughput, and customer balking. Economically, this alternative yields 13.00% cost reduction compared to current, resulting in Php 61,764.82 worth of annual savings and thus warrants recommendation to the company.

14:20 — 14:40

## **Analyzing Car Queues due to Traffic Signal Delays Along Katipunan Avenue, Quezon City**

*Christell Doria, Anjanette Cayabyab, and Jude Buot*

School runs have been evidenced to have casual links to urban traffic congestion, especially in areas with unreliable public transportation as it encourages reliance on private vehicles for school transportation. This is manifested in Katipunan Avenue in Quezon City as a number of schools are situated within the area. This traffic woe does not only affect the quality of life of the students and residents within the area but also contributes to the country's losses brought about by transportation delays. Traffic-related studies conducted in the area mostly focused on origin-destination patterns (Franco et. al, 2012), redundancy analysis (Chan & Teknomo, 2015), and ideal flow analysis (Teknomo et. al, 2019). This paper aims to examine the potential of traffic signal optimization to mitigate congestion along Katipunan Avenue. A mathematical model is used to determine the number of cars queuing at intersections due to signal delays.

14:40 — 15:00

## **Improving Transit Service Quality Through Efficient Jeepney Scheduling: A Simulation Study of the Uplb-Uprhs-Jubileeville Route\***

*Miguel Darwin Lapitan, Vince Denver Gomez, John Quiel Marcial,  
Gabriel John L. de Leon, and Angelo C. Ani*

Efficient public transportation plays an important role in urban and rural travel. Public transportation is a viable alternative for people to travel long distances without owning a private vehicle. Patronage of this can have long-term effects on society such as traffic congestion reduction and environmental sustainability promotion. This study improved the transit service quality of public utility vehicles such as jeepneys by optimizing vehicle scheduling through a computer simulation, using the Flexim software. In the studied stations, passengers wait in queue as jeepneys often depart earlier than scheduled due to unexpected demand. After validating the base model, it was revealed, using thirty (30) replicates, that the average waiting time in queue in both stations is around 30 mins while the average length of queue is around 15. To improve the studied KPIs in both stations, this study proposed two alternatives. Alternative 1 utilizes scheduling with multiple headways that includes the passengers' peak and lean periods. Conversely, Alternative 2 utilizes the capacity of jeepneys by having departure only once the jeep is full. After statistical tests, it was revealed that by implementing alternative 1, the considered performance indicators would significantly improve by around 50%.

## **Inventory and Production Planning**

15:00 — 15:20

## **Application of Linear Programming to Optimize Swine Feed Formulation**

*Reign Marie A. Bersamina, Robert Kerwin Billones, and Renann Baldovino*

The production of swine plays a significant part in the sustainability of the nation's food supply because it accounts for around sixty percent of the Filipino popula-

tion's entire consumption of animal meat. Pigs have daily dietary requirements to sustain bodily processes and production, including growth and/or milk production. This paper presents the linear programming model of an animal diet formulation for pre-starter swines weighing 8-22 kilograms. Ten types of swine feed ingredients are reviewed in order to obtain the minimum feed cost while ensuring that the basic nutritional requirements for the swines are met. The objective function to obtain the minimum total cost is defined as the sum of the quantity of ingredient in the formulation multiplied by its price per kilogram. Constraints of the function include the nutrition requirements of pre-starter swines, maximum inclusion rate, and non-negativity. A constraint to ensure that the output would only equal to 1 kg is also included. The results show that the recommended formulation of swine feed are as follows: 36g of Sapal, 392.4g of Kamoteng Kahoy, 451.5g of Ipil-ipil, and 120.1g of Madre de Agua. This feed formulation totals to a low cost of PHP 11.62 per kilogram. This method may be used for other applications of animal feed optimization.

15:20 —15:40

## **LIFT: Revamping the Supply Department of a Regimental Academy in the Philippines\***

*Geraldine G. Nerona, Jorina R. Bohol, Kyla Nicole R. Decena, Jonathan N. Jose, Anjelika N. De Guzman, John Carlo R. Rodriguez, Kate Shyra M. Abiado, Mark Christian O. Aquino, Sandra Nicole L. Antolin, Nicole Ivy G. Kalaw, and Anne Claire N. Paulino*

The focus of Project LIFT (Layout, Inventory, Five-S, Technology) is a holistic problem-solving approach that incorporates OR approaches to revamp the supply department of the Philippine Military Academy (PMA), the largest regimental academy for aspiring soldiers of the Armed Forces of the Philippines. Initial assessments revealed a low layout functionality, low 5S compliance, and inadequate inventory management, resulting in storage, workflow, and ordering problems. Case study and descriptive-comparative methods were used in data analysis before and after implementation. Systematic Layout Planning (SLP) and FSN (Fast-Slow-Non) analysis were used to determine the optimal sizes and assignment of the relative sections

for each group of items to improve the supply department's functionality. 5S methodology (Sort, Set, Shine, Standardize, Sustain) was used to declutter the supply room and create clean, organized, and safe workspaces. MS-Excel VBA Technology was used to create a user-friendly inventory software that can store and track inventory data, make real-time reports, and signal when an item needs to be reordered. The solutions implemented significantly improved the supply room's functionality, 5S practice, and inventory management system, thereby increasing the efficiency of operations in the supply department.

15:40 —16:00

### **Reducing Stockouts of Milk Products in a University Merchandise Store\***

*Jann Lester Ace Caspe, Gian Paolo Guiao, Kim Adrian Ibon,  
Gabriel John L. de Leon, and Angelo C. Ani*

Stockouts have a major impact on retailers, primarily resulting in lost sales. Some of the milk products being offered at the University's merchandise store experience frequent stockouts due to unsatisfied demand. In this study, simulation was used to imitate the current conditions of the shop, aiming to identify the optimal inventory management strategy that effectively minimizes stockouts of milk products. The shop currently follows an inventory policy where orders are placed based on the refrigerator's capacity. If there are any remaining units in the inventory by the end of an operating day, the subsequent order is maximized to utilize the available space, taking into consideration product availability for the following day. The data used in the model was the transactions involving the milk products. A histogram was used to determine the distribution of the inter-arrival times of the customers and the proportion of weekly demand was derived from the raw data. The study proposed two alternatives wherein the first alternative utilized the proportion acquired and adjusted the inventory policy while the second alternative used the first alternative's solution with an additional capacity. The first and second alternatives resulted in a 44% and 50% decrease in lost sales, respectively.

# *Author Index*

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Angelo C. Ani is an assistant professor of industrial engineering from the University of the Philippines Los Baños. He is a member of the "Circle of Operations Research Enthusiasts" -- the OR group of the said department.

*Jann Lester Ace E. Caspe*

Jann Lester Ace E. Caspe is a senior BS Industrial Engineering student at the University of the Philippines Los Baños (UPLB). With his curiosity about real-life problems and passion for analyzing systems for efficiency, methods under operations research have been interesting for him. Collaborating with his peers, he conducted a comprehensive simulation analysis, delving into the occurrences of stockouts of Milk Products in a University Merchandise Store, focusing on the inventory policy in place.

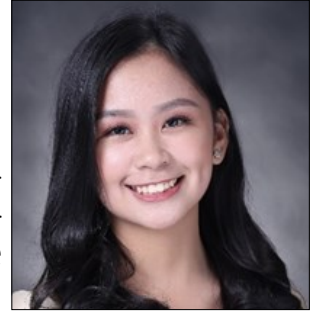


*Gabriel John L. de Leon*

Gabriel John L. de Leon is currently working as an assistant professor at the Department of Industrial Engineering - UPLB, and a member of the Circle of Operations Research Enthusiasts (CORE). He graduated BS Industrial Engineering from the said university as the Outstanding Student Leader recognized with academic excellence, leadership, and service awards. Prior to completing his Master of Science in Industrial Engineering from De La Salle University - Manila, he worked as a Demand Management Planner at San Miguel Purefoods Company. His research interests are focused on mathematical modeling, vehicle routing, digitalization and platform usability, and simulation, among others.

### *Christell Doria*

Christell Doria is a senior student at Ateneo de Manila University, majoring in Applied Mathematics with Specialization in Mathematical Finance. Her academic journey has been marked by a passion for mathematical modeling and actuarial science, which she has further honed during her valuable experience as a research intern at Ateneo Research Institute of Science and Engineering, and as an actuarial intern at Milliman San Francisco. Christell is dedicated to harnessing the power of mathematics to solve real-world problems and gain a deeper understanding of the world around us.



### *Miguel Darwin DC. Lapitan*

Miguel Darwin DC. Lapitan is a passionate and dedicated college student currently pursuing a bachelor's degree in Industrial Engineering at University of the Philippines Los Baños. It is his interest to apply mathematical models and analytical techniques to solve complex real-world problems within the realm of operations research. Driven by a desire to make a positive impact in the field, Miguel, together with his fellow students, engaged in a research project about jeepney transit service improvement using simulation under the guidance of experienced faculty members.

### *Geraldine G. Nerona*

Geraldine G. Nerona is a Professor and Extension Program Coordinator of Industrial Engineering at Saint Louis University, Baguio City, Philippines. She has a Bachelor's Degree in Industrial Engineering and a Master's Degree in Education, Magna Cum Laude, and was a board topnotcher for the Licensure Examination for Teachers in 2002 (4th Place). She specializes in Operations Management, Operations Research, Engineering Economics, Statistics, and Mathematics. Her published works include Industrial Engineering, Engineering Education, and Operations Research studies.



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Shella is the Data Analytics & Operations Research Manager of the Data and Analytics Group at San Miguel Corporation.. She has a BS degree in Industrial Engineering (minor in Mechanical Engineering) from De La Salle University. She has completed the Leadership and Management Development Program in Ateneo de Manila University with Academic Citation, completed the Basic Management Program in the Asian Institute of Management with Superior Performance, and taught at the De La Salle University.

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Jed is the Executive Director for the School of Management of NU Asia Pacific College, after serving as the Marketing Director and Head of its Master in Management program. He is also the VP Business Development of Great People Learning Laboratories, an educational technology company. He has a BS in Management Engineering and Master in Business Administration degrees from the Ateneo de Manila University, and is a candidate for a Doctor in Business Administration degree at De La Salle University. He is a member of the board of directors of Next-Gen University Alliance of the Philippines, the council of schools and universities in the Philippines that adopted the SAP technology.



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Iris is a professor of the UP Department of Industrial Engineering and Operations Research. She is the holder of the Fortunato T. dela Peña Professorial Chair for Productivity Engineering, leads the Production Systems Culture of Manufacturing & Operations Management Research Group, and co-heads the Supply Chain Analytics Research Laboratory. For more than 20 years, she has been helping the academe, government agencies and industries of food, personal care, healthcare, and utilities improve their production and service operations and supply chain management.

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Jacky is a workplace-based professor at the Ateneo Graduate School of Business, handling Applied Mathematics, Business Statistics, Management Decision Models, Operations Management and Lean Six Sigma courses. He was guest professor at Taiz University, Delft (an affiliate of Delft University of Technology, Netherlands), where he taught OR. A freelance consultant on Business Process Improvement, Operations Research, Quality Engineering and Lean Six Sigma, he is a registered ASEAN Engineer of the ASEAN Federation of Engineering Organizations (AFEO).



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Dennis is a former Chair and faculty of Industrial Engineering at De La Salle for more than 20 years and currently the Managing Director of Technopoly, a management consulting firm. He is a six sigma master black belt and a certified lego serious play facilitator. He holds a BS in Industrial Management Engineering and an MS in Industrial Engineering both from DLSU Manila.

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Dennis is an Assistant Professor in the Industrial Engineering Department of De La Salle University. He is a former Associate Dean of DLSU Gokongwei College of Engineering. He obtained his Bachelor of Science degree in Industrial Engineering Minor in Chemical Engineering from De La Salle University and his Master of Science degree in Industrial Engineering from the same university. His areas of interest include Supply Chain Management, Facilities Planning, Mathematical Modelling, and Optimization. He is presently pursuing his Doctor of Philosophy degree in Industrial Engineering in De La Salle University.



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Alex is a Director within Bain & Company's Advanced Analytics Group in Manila specializing in the use of optimization and machine learning / data science techniques for supply chain and service operations applications. Prior to Bain, Alex worked as a Solution Architect for Supply Chain as well as Data Science solutions for Hewlett Packard in Singapore. Alex has a Ph.D. in Industrial & Systems Engineering (Operations Research) from the University of Florida and holds industry certifications from ASCM (APICS Certified Supply Chain Professional) and INFORMS (Certified Analytics Professional).

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Francis is the Global Senior Head of Web Scraping Solutions, and Asia Pacific Quality and Data Science Director at GfK/NielsenIQ. He has more than 25 years of experience in various companies including Coca-Cola and Zuellig Pharma doing operations research, market research, data science and analytics. He has a BS degree in Industrial Engineering from De La Salle University-Manila, and a MS degree in Industrial Engineering from Purdue University. He completed his Advanced Management and Leadership Programme (OAMLP) at Oxford University in 2022. He is currently taking his Doctorate in Business Administration (DBA) at Business School Lausanne (BSL). He is the International Federation of Operational Research Societies (IFORS) Vice-President representing Asia Pacific. He is also the immediate Past President of the Association of Asia Pacific Operational Research Societies (APORS), and the Operations Research Society of the Philippines (ORSP).



*Rex R. Robielos*

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Rex is the Senior Manager of Operations Research Engineering at Analog Devices General Trias. He was previously the Dean of the School of Industrial Engineering and Engineering Management at Mapua University. He has a BS in Applied Mathematics from the University of the Philippines Los Baños, and a Diploma and MS in Industrial Engineering from the University of the Philippines Diliman. He received his Ph.D in Industrial Management at National Taiwan University of Science and Technology in Taiwan. Currently, he is a Director of Human Factors and Ergonomics Society of the Philippines.





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Nestley, a certified Professional Industrial Engineer, is currently the Director of Office for Programs and Standards in Adamson University. She obtained her BS in Industrial Engineering from Adamson University and her Master's degree in IE from UP Diliman. She had also been affiliated with PAASCU, CHED, and Philippine Technological Council (PTC) as an assessor and accreditor. Nestley received the title of ASEAN Engineer last December 2012 during the 30th Conference of the ASEAN Federation of Engineering Organizations (CAFEO) held in Phnom Penh, Cambodia

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Malu has been a lecturer of Operations Research at the John Gokongwei School of Management, Ateneo de Manila for over ten years. She has also taught OR and applied math at the University of Asia & the Pacific, and mathematics at UP Diliman. She previously worked in Dallas as a supply chain analyst, implementor, and trainer, consulting in different U.S. and Asia Pacific cities. She obtained her Ph.D. in Industrial Engineering from Purdue University where she specialized in nonlinear programming, network optimization, and complexity. Her dissertation in nonlinear optimization, entitled "Experiments with Nonlinear Discriminants in the Analysis of Fine Needle Aspirates," won First Place in the 1999 Pritsker Doctoral Dissertation Award from the U.S. Institute of Industrial Engineers (IIE), which recognizes the best dissertations in the US in the field of industrial engineering. She finished MS Applied Mathematics major in Operations Research at UP Diliman, and BS Mathematics at the Ateneo de Manila University



*Elise A. del Rosario*  
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Elise is Past President of the International Federation of Operational Research Societies (IFORS) and a founding member of the ORSP. Upon retirement from San Miguel Corporation as Vice President in charge of Operations Research, Elise went into consulting – mostly pro-bono work with the Philippine government – through the ORSP Committee for Public Service. Currently, she is the CFO of her family's One Small Step Forward Foundation, dedicated to uplifting Philippine public elementary school education. On the OR side, she still actively speaks at local and international conferences and acts as editor for various scientific publications. She obtained her BS degree in IE from UP, her Master's degree in IE & Mgt from Asian Institute of Technology, Bangkok and was an International Research Fellow at the Stanford Research Institute, USA. She is an IFORS Fellow

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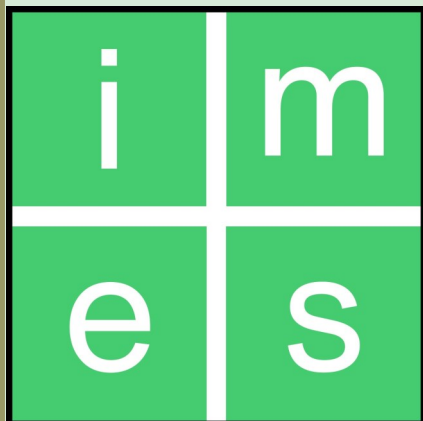
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