الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا

NU Core Research Areas

& Groups

Table of Contents

International Maritime College Oman

INTERNATIONAL MARITIME COLLEGE OMAN

Core Research Area	1. Process Design and Computational Engineering
About the Research	**Focus** The Process Design and Computational Engineering (PDCE) group uses a range of analytical, computational and experimental techniques for the design, development and optimization of sustainable and zero/ultra low carbon processes and products. We work on fundamental as well as applied research. **Scope:** Our focus areas include design and synthesis of zero/ultra-low carbon processes, process modelling, simulation, intensification, energy integration, energy efficiency and process optimization studies. The research group is multidisciplinary, drawing inspirations from collaboration with experts from variety of fields including Process/Chemical Engineering, Chemistry, Material Engineering, Mathematics & Statistics, Computer Science/Engineering, and Physics. Our primary research interests currently fall into three: Process Design and Intensification of zero/ultra-low carbon processes, Applied Computational Modelling, and Artificial Intelligence in Process Industries. **Specific Research Priority of the Research Group** • Process modeling and Economic analysis of zero/ultra-low carbon processes • Design of hybrid renewable energy powered processes with zero waste discharge • Computational studies of low carbon footprint processes such as membrane-based separation • Computational studies of Nano-Fluidic Phenomena, Heat and Mass Transfer • Machine learning and data analytics in various fields • Rapid Prototyping using 3D Printing Technology • Artificial intelligence in the process industry • Process Intensification and Energy integration • Chemical conversion of CO2 and other green house gases, hydrogen production, water electrolysis and fuel cells • Design of smart membrane for controlled release • Process plant reliability studies • Mathematical modeling of global stability of virus dynamics • Process modeling of SmartWater Production from sea water • Process Modelling of energy efficient separation processes (membrane gas/vapor separation, organic solvents membrane distillation, and membrane crystallization). • Circular economy of seawater, plastic and food • Computer-aided/Digital Design and Manufacturing • Loss prevention in the process and maritime industry **Specific words reflecting research focus areas** Zero/Ultra-low carbon processes, Zero waste discharge, Artificial Intelligence, Big data analytics, Energy Integration and Efficiency, Nano-fluid, Process Intensification, Process Optimization, Computational Fluid Dynamics, Process Modelling and Simulation, Molecular Modeling, Process Retrofitting, Rapid Prototyping, 3D Printing, Digital Design and Manufacturing.

<table>
<tr><td>Alignment with Oman Vision 2040</td><td colspan="2">The main objective of this group is to develop zero/Ultra-low carbon processes for energy generation and utilization (hydrogen, natural gas and other renewable energy). Specifically, the group focuses on designing chemical processes and products that are environmentally friendly, flexible, and able to provide rapid response to changes in market demand. It also works to develop new process technologies that bring about order of magnitude reductions in plant/equipment size which consequently lead to enormous reductions in energy consumption, capital and running costs, enhanced sustainability, control, process flexibility, and safety. These are all inline with Oman vision of sustainability and becoming one of the major players in green energy (such as hydrogen).</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>People</td><td>Lead:
Dr Jimoh K. Adewole (Associate Professor of Chemical Engineering)
</td><td>Team:
1) Dr Amer Al Habsi
2) Dr Habeebllah Oladipo
3) Dr MD Jashim Uddin
4) Dr Yaqoob Al Rahbi
5) Dr Taofeek O. Alade
6) Ms Asma Said Khamis Al Kharusi
7) Ms Ahlam Mohammad Al Balushi
8) Mr Khalid Saif Mohammed Al Sa'idi
9) Mr Muhammad Javed
10) Ms Khaloud I. A. Al Ajmi
11) Mr AbdulKabir Muritala
12) Laboratory Instructors & Research Assistants</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Projects & achievement</td><td colspan="2">
• Print-Assisted Fabrication of Mixed-Matrix Membrane for Separation of CO2/Light Gas Mixture (awarded internal grants-2022/CRG07, Principal Investigator) 2022
• Novel Application of Aluminium and Steel Slags for Improved Carbon Mineralization: Novel Dielectric Mixing Model and Products Application in Construction Industries (awarded TRC grants- BFP/RGP/EI/21/171, Co-Principal Investigator) 2022
• Renewable Energy Generation from Sea Wave in Oman (awarded TRC grantsBFP/URG/EI/21/092, Principal Supervisor) 2022
• Carbon Capture and Storage Using Industrial Steel Slag: Application to Concrete and Building Construction (awarded grants-CRG0, Co-Investigator) 2022
• Process Simulation and Techno-Economic Analysis of Membrane Distillation as an Alternative to Reverse Osmosis in Seawater Treatment (awarded grants-CRG04, Principal Investigator) 2021
• Application of Machine Learning and Data Science in Early Detection of Students at Risk in Higher Education (awarded grants-CRG) 2021
• Comparative Studies of Solar Powered Membrane Distillation and Reverse Osmosis for Seawater Desalination: Experimental Studies and Process Modelling (The Research Council (awarded by TRC Grant- BFP/URG/EI/20/006, Principal Investigator) 2020
• Integrated Water Treatment Plant for Energy Generation and SmartWater
• Production (EOI submitted to Majis Industrial Services, Principal Investigator) 2020
• Development of a Novel Nano-composite membrane for separation of petrochemical gaseous (awarded grants-CRG0, Co-Investigator) 2021
• Experimental Investigation of Produced Water Treatment using 3D-Printed Mixed Matrix Membrane (awarded grants-CRG0, Co-Investigator) 2020.
• Natural Convection and Flow Dynamics of Nanofluid: Problems-Modelling and Application (awarded grants-) 2021.
</td></tr>
</table>

	• Reliability Analysis of Jindal Shadeed industry (awarded grants-) 2021.
Recently featured publications	The recently featured publications include: 1. Jimoh K. Adewole; Hilal M. Al Maawali; Tahereh Jafary; Amin Firouzi; Habeebllah Oladipo (2022), Membrane Distillation: A Review on Material Development for Seawater Desalination, Applications and Energy Requirements, Water Supply , https://doi.org/10.2166/ws.2022.337 2. Hilal M. Al Maawali, Jihan S. Al-Qartoubi, Maryam S. Al Maamari, Reem K. Al Balushi, Rud ayna A. Al Mazrui, Asma S. Al Kharusi, Jimoh K. Adewole (2021), Comparative Studies of Membrane Distillation and Reverse Osmosis for Seawater Desalination, Journal of Student Research, Volume 10 Issue 2 (2021) doi.org/10.47611/jsr.v10i2.1208 3. Kazeem Ayodeji Mohammed and Jimoh K. Adewole (2022), Compositional Analysis of Date Pit using Thermal Gravimetric Analysis, Waste and Biomass Valorization (DOI:10.1007/s12649-022-01780-3) 4. Kabiru B. Muritala and Jimoh K. Adewole (2022), Recent advances in the use of lignocellulosic biomass in microbial fuel cells for electricity generation, International Journal of Sustainable Energy, March 2022 (DOI:10.1080/14786451.2022.2043859) 5. M.J. Uddin, S.K. Rasel, Jimoh K. Adewole, Khamis S. Al Kalbani (2022), Finite element simulation on the convective double diffusive water-based copper oxide nanofluid flow in a square cavity having vertical wavy surfaces in presence of hydromagnetic field, Results in Engineering, Volume 13, March 2022. (DOI:10.1016/j.rineng.2022.100364) 6. Abiodun Abdulhameed Amus, Abdul Latif Ahmad (2021), Jimoh Kayode Adewole, Mechanism and Compatibility of Pretreated Lignocellulosic Biomass and Polymeric Mixed Matrix Membranes: A Review, Membranes, 10(12):370, DOI: 10.3390/membranes10120370 7. Habeebllah Oladipo, Ahmed Yusuf, Samar Al Jitan, and Giovanni Palmisano. "Overview and challenges of the photolytic and photocatalytic splitting of H2S." Catalysis Today 380 (2021): 125-137. https://doi.org/10.1016/j.cattod.2021.03.021 (IF: 6.766) 8. Habeebllah Oladipo, Ahmed Yusuf, Khalid Al-Ali, Giovanni Palmisano "Techno-Economic Evaluation of Photocatalytic H2S Splitting." Energy Technology (2021): 202100163. https://doi.org/10.1002/ente.202100163 (IF: 3.631) 9. M. J. Uddin, JawaherAl-Balushi, S.Mahatabuddin, M. M. Rahman: "Convective heat transport for copper oxide-water nanofluid in an isosceles triangular cavity with a rippled base wall in the presence of magnetic field". International Journal of Thermofluids, 16, 100195, (2022). 10. Latifa M. Balushi, M. J. Uddin, M. M. Rahman, Hakan F. Oztop, Ioan Pop : "Three-dimensional tilted hydromagnetic natural double-diffusive convection in a rectangular cuboid filled with nanofluids based on magnetic nanoparticles". Journal of Heat Transfer (JHT), 1-31, (2021). 11. M. J. Uddin, M. Arifuzzaman : "Convective flow of alumina–water nanofluid in a square vessel in presence of the exothermic chemical reaction and hydromagnetic field". Results in Engineering, 10, 100226, (2021). 12. M. J. Uddin, M. Mosfiqur Rahman : "Magnetohydrodynamic boundary layer flow of nanofluid with variable chemical reaction in a radiative vertical plate". Journal of Heat Transfer (JHT), 1-19, (2021).

	13. M. J. Uddin, M. Arifuzzaman, M. M. Rahman: "Thermo-Hydromagnetic performance of wateralumina nanofluid in a trapezoidal vessel". Journal of Thermophysics and Heat Transfer (JTHT), 36(1), 28-39, (2022). 14. Abiodun Abdulhameed Amusa, Abdul Latif Ahmad, Jimoh K. Adewole (2021), Study on Lignin-free Lignocellulosic Biomass and PSF-PEG Membrane Compatibility, BioResources 16 (1), 1063-1075 15. Jimoh K. Adewole, Taye S. Kazeem, Tajudeen A. Oyehan (2020), Tuning the Chemistry of Seawater with Activated Clay: An Application in SmartWater Enrichment for Enhanced Oil Recovery, J of Petroleum Exploratn & Production Technology, (DOI:10.1007/s13202-020-00943-z) 16. J. K. Adewole and M. O. Najimu (2020), Development of a green multifunctional additive for applications in water-based drilling fluids, International Journal of Energy and Water Resources, (DOI:10.1007/s42108-020-00078-1) 17. Mohd Yusuf Khan, Abuzar Khan, Jimoh K. Adewole, Mohd Naim, Shaik Inayath Basha, Md. Abdul Aziz (2020), Biomass derived carboxylated carbon nanosheets blended polyetherimide membranes for enhanced CO2/CH4 separation, Journal of Natural Gas Science and Engineering Vol 75, pp 103156 (DOI:10.1016/j.jngse.2020.103156) 18. Kabir B Muritala, Jimoh K Adewole (2019), Technical Challenges in Pharmaceuticals and cosmetics Industries in Nigeria: Role of Membrane Technology, Membrane Science and Technology Vol 9(1), pp 195 19. Jimoh K Adewole, Kabir B Muritala (2019), Some applications of natural polymeric materials in oilfield operations: a review, Journal of Petroleum Exploration and Production Technology, Volume 9, Issue 3, pp 2297–2307 20. Adewole J.K., Sultan A.S. (2019) Polymeric Membranes for Natural Gas Processing: Polymer Synthesis and Membrane Gas Transport Properties. In: Jafar Mazumder M., Sheardown H., Al-Ahmed A. (eds) Functional Polymers. Polymers and Polymeric Composites: A Reference Series. Springer, Cham, https://doi.org/10.1007/978-3-319-95987-0_26 21. Tahereh Jafary, Anteneh Mesfin Yeneneh, Jimoh Adewole, Asma Al Kharousi, Thirumalai Kumar, Dev Raj, Alok Kumar, Prerna Tripathi, A.S.K. Sinha, and Deepak Dwivedi (2022) Current advances, challenges, and prospects of CO2 capture, storage, and utilization In: Tushar Sharma, Krishna Raghav Chaturvedi, and Japan J. Trivedi (eds) Nanotechnology for CO2 Utilization in Oilfield Applications, Elsevier, https://doi.org/10.1016/B978-0-323-90540-4.00015-6 22. Jimoh K. Adewole, Naveed Khan, Asma S. Al Kharusi, Muhammad Javed, Habeebllah B. Oladipo, Muhammad Zahir Khan, Riaz Ahmad (2022), Redefining the Upper Bound Curve for Process Intensification in Natural Gas Processing, 2022 AIChE Spring Meeting in San Antonio, TX, April 10 – 14 2022. 23. Hoor 'Abdallah Badar Al Sawafi and Jimoh K. Adewole (2021), On Demand Seawater Desalination System with Zero Discharge: Conceptual Design and Process Modelling, 3rd Sustainable Waste Management Conference & 3rd Solar Energy Systems Conference, August 4-6, 2021, " organized by the American Institute of Chemical Engineers. 24. Jimoh K. Adewole, Asma S. Al Kharusi, (2020), Process Intensification in Seawater Desalination Process: Comparative Studies of Membrane

	Distillation and Reverse Osmosis, MEDRC. Omani Young Water Researchers Award 2020, Submitted July 2020, Muscat, Oman. 25. Jimoh K. Adewole, Rahma H. S. Al-Maharouky, Musa O. Najimu, Abbas S. Hakeem, Idris Bakare, Ahmad Adewunmi (2019), Blend of Pre-Treated Lignocellulosic Biomass and Bentonite As Water-Based Drilling Fluid: Preparation, Characterization and Testing, 8th International Congress on Sustainability Science & Engineering (ICOSSE 19), Kuala Lumpur, Malaysia, 1-3 JULY 2019 26. Rahma H. S. Al-Maharouky, Jimoh K. Adewole, Musa O. Najimu (2019), Effect of Partially Liquefied Date Pit Particles on the Performance of Water-Based Drilling Fluids, 9th National Symposium on Engineering Final Year Projects, University of Nizwa, 1st May 2019 27. Jimoh K. Adewole (2018), Membrane-Based Controlled Release: A Useful Tool in Oilfield Operations- A Review, AIChE Annual Meeting in David L. Lawrence Convention Center, Pittsburgh, PA, USA. October 28 - November 2, 2018. 28. Jimoh K. Adewole, Najimu O. Musa, Ahmad A. Adewunmi (2018), The Effects of Hydrolyzed Lignocellulose Materials on the Performance of Water-Based Drilling Fluids, AIChE Annual Meeting in David L. Lawrence Convention Center, Pittsburgh, PA, USA. October 28 - November 2, 2018. 29. S. A. Ghaleb, A. M. Elaiw, M. Alnegga, Emad Ghandourah, T. O. Alade, Global stability of virus dynamics of an adaptive immune response with two routes of infection and latency, International Journal of Dynamics and Control, https://doi.org/10.1007/s40435-022-01034-z, 2022.	
Resources /lab facilities	The Process Design and Computational Engineering (PDCE) research group employs a range of analytical, computational and experimental techniques for the design of sustainable and zero/ultra low carbon processes and products. We are equipped with a variety of equipment and tools which include: • Membrane Technology lab • Membrane distillation unit • Membrane emulsification unit • Membrane Filtration unit • Membrane Gas Separation Unit • Pyrolytic Reactor • UltraSonicator • Solar Energy Generation Unit • Vacuum Oven • Open Source Computer Lab • Process Simulation facilities and software including AspenONE, MATLAB, Avogadro, OpenFoam, and ANSYS)	 Membrane Distillation Unit  Solar Energy Generation Unit  Membrane Gas Separation Unit

		 Pyrolytic Reactor  Equipment for size Reduction and Refractometer  Membrane filtration and Membrane Emulsification Units  Vacuum Oven and Hydrocarbon Cooler

News & events/training	The PDCE group engaged in variety of scholarly activities and professional training courses for industries, 1. Process Modeling using Aspen HYSYS, 2018 till date 2. Python Programming Tutorial, 2019 3. Symbolic Programming using MATLAB/Octave, 2020 4. Workshop on the use of LaTeX, 2021 5. Aspen Custom Modeler 6. Process Evaluation using Aspen Process Economic Analyzer, 2018 till date 7. Process Modeling using Aspen Plus 8. Workshop on Computational Fluid Dynamics (CFD) using ANSYS and OpenFoam

Core Research Area	2. Technology applications, sustainability in logistics and supply chain management group	
About the Research	**Focus:** Technology applications, green logistics and agrifood supply chain, sustainability in logistics, Port infrastructure, quality and logistics performance, Global challenges &Humanitarian logistics. **Scope:** Logistics, supply chain, port management, humanitarian logistics	
Alignment with Oman Vision 2040	As it is clearly indicated in the vision, Oman aspires to be one of the top logistics hubs in the region, the research group conducts a research in identifying challenges, provide policy recommendation that will enable for the execution of the vision.	
People	**Lead: Dr. Abebe Ejigu Alemu (Associate Professor)** IMCO	**Team:** 13) Dr. Bekir Sahin 14) Prof. Abdelghani 15) Dr. Adela P. Balasa 16) Mr. Khalid 17) Mrs. Najat 18) Mrs. Hind 19) Mrs. Shaimaa 20) Dr. Faiza
Projects & achievement	• Omani Logistics Gateways Capacity and Potential Demand: Gaps and Misalignment (Dr. Bekir Sahin-PI) • Impact of cyclone Shaheen on supply chains of daily essential goods: Exploring vulnerability and resilience strategies for Oman for future disasters (Dr. Samsul Isalm-PI) • Supply chain sustainability: Determinants of green supply chain implementation in the local manufacturing chains in Oman (Mr. Rashid-to be replaced by Dr. Abebe Ejigu Alemu)	
Recently featured publications	**1.** **Abdelghani Benayoune**, Zouhaier Slimi, & **Abebe Ejigu Alemu** (2022). A Study of Teachers' Experiences and Perceptions of Research-Teaching Nexus in HEI (Higher Education Institutions, *Journal of Educational and Social Research*, 12 (4). **(Scopus)** **2.** **Abebe Ejigu Alemu,** Abdelsalam Adam Hamid Aba, Noorul Shaiful Fitri Abdul Rahman, **Adela P. Balasa & Najat Juma Al Maqbali**(2022). Small and Medium Logistics Enterprises Resilience during COVID19 in the Sultanate of Oman, Academy of Entrepreneurship Journal, 28(4):1-14. **(Scopus)** **3.** **Abebe Ejigu Alemu & Adela P. Balasa (2022).** Success factors for small and medium enterprises in Oman, Open Journal of Business and Management, 10 (4). **4.** YE Nazligul, D Yazir**, B Sahin (2022).** Selection of Desalination System for Commercial Vessels by Implementing Improved Intuitionistic Fuzzy TOPSIS Method, *Mathematical Problems in Engineering.* **5.** D Yazir, **B Sahin**, M Alkac (2022). Selection of an Inert Gas System for the Transportation of Direct Reduced Iron,, Method, *Mathematical Problems in Engineering* **6.** Birara Bezie Asratie, **Abebe Ejigu Alemu**, Demis Getahun (2022). Does Emotional Intelligence, Moderate Leadership-Commitment nexus in Organizations?	

	Evidence from the Banking Sector in Ethiopia, Innovations, Number 68: 647-659. **(Scopus)** **7.** Birara Bezie Asratie, **Abebe Ejigu Alemu**, Demis Getahun (2022). Emotional Intelligence and Organizational Commitment in the Banking Industry in Ethiopia, Number 68: 634-646. **(Scopus)** **8.** **Amira Saif Hamood Al Rashdi**, **Abebe Ejigu Alemu**, Noorul Shaiful Fitri Abdul Rahman (2022). Uncertainties and risk on SMEs sustainability in Oman: a logistics perspective, *International Journal of Business Society*, 6(1):541-551. **9.** Sintayehu Asefa, **Abebe Ejigu Alemu**, Gemech Nemera (2021). A structural equation analysis of export marketing adaptation strategies on export performance: evidence from textile and garment exporting enterprises in Ethiopia, Innovations, no. 67. **(Scopus)** **10.** Sintayehu Asefa, **Abebe Ejigu, Alemu**, Gemechu Nemera (2021). The structural relationship between internationalization barriers and export performance: evidence from textile and garment enterprises in Ethiopia, Innovations, no. 66. **(Scopus)** **11.** Abdulsalam Adam Hamid, Emad aldeen Essa Eshag, **Abebe Ejigu Alemu** and Umut Mehmet Yuruyen (2021-in press). The effect of transaction attributes on logistics performance: an empirical study on Sudanese food and beverage companies, International Journal of Supply and Operations Management. Volume 9, Issue 3, pp. 264-280 **(Scopus)** **12.** Noorul Shaiful Fitri Abdul Rahman, Sara Aadel Mohammed Al-Balushi, Abdulsalam Adam Hamid, **Khalid Salim Al-Kalbani** and **Abebe Ejigu Alemu** (2021-in press). Logistics Sector Development Integration with Oman Logistics Vision 2040: Analyzing using Porter's Value Chain Theory. Academy of Strategic Management Journal. **(Scopus)** **13.** **Abebe Ejigu Alemu**, Abdelsalam Adam Hamid, Noorul Shaiful Fitri Abdul Rahman, Yahya Salim Said Al Wadhahi (2021). Research-Teaching Nexus to Logistics Competence and Skills: An Exploratory Study on Logistics sector from the perspective of Managers in Oman, Psychology and Education, 58(5): 4706-4720. **(Scopus)** **Confernce** • Effect of Covid19 on operations of SM Logistics Enterprises in Oman, 4th Research and Innovation Conference in Maritime, Logistics and Engineering Technology Promoting Higher Education and Research for Sustainability, International Maritime College of Oman, 29 March 2022.

Resources /lab facilities	• Statistical software	

News & events/training	The group engaged in many scholarly activities and conducted professional training courses for industries. Some activities include: 9. Schedule free entrepreneurship training to the surrounding community involved and intended to do business. 10. Plan to establish center of excellence in logistics. 11. Conducted professional courses for various industries in Sohar port employees.

<table>
<tr><th>Core Research Area</th><th colspan="2">3. Advanced Fuels Technology & Systems</th></tr>
<tr><td colspan="3"></td></tr>
<tr><td>About the Research</td><td colspan="2">Focus: Advanced Alternative Fuels from Waste Feedstock, Nano-Additive Catalyst, Fuel Properties Enhancement, Non-Hazardous Additives, Ignition Delay, Spray combustion modeling, and Spray Atomization/Diagnostics.

Scope: Spray Atomization/Diagnostics, Leidenfrost Effects of Fuels, Thermal & Solar Desalination, Hot/Cold EGR, Fuels Fumigation, Low-Temperature Combustion, Catalytic combustion, green desalination, and Simulation & Combustion Modeling.

The objective of the above research laboratory is to provide a challenging environment to researchers to comprehend very important concepts in fuel processing technology, combustion science and also to afford the ability to carry out research in the area of power generation on using advanced fuels in Sultanate of Oman. This laboratory will play a critical role in the following research domains in Sultanate of Oman as listed below:

Advanced Alternative fuels from waste feedstock available in Oman
Emission Control Techniques
Spray combustion modeling, Spray Atomization/Diagnostics
Prediction of physical significance of ignition delay of fuels
Enhancement of fuel properties on adding some potential additives
Investigation of fuel properties on adding new potential additives/chemicals
Fuel economy, fuel composition, and fuel emission effects on diesel engine power plants available in Oman.
Utilization of Waste heat from engine for potential benefits (like thermal & solar desalination), etc.

The laboratory will be used for both research and instructional purposes for both UG/PG/Ph.D. scholars in the area of Mechanical, Automobile, Chemical and Process Engineering streams.

Our key research covers:
Parametric evaluation of advanced alternative fuels, Fuel Spray modeling cum diagnostics, Prediction of Ignition delay, Waste heat management, Green Desaliantion and fuel Optimization techniques.</td></tr>
<tr><td>Alignment with Oman Vision 2040</td><td colspan="2">The above lab fulfills one of the pillars of the Oman Vision 2040 (i.e., Preserving Environmental Sustainability) owing to the research linked to desalination, advanced fuels generation, ecological protection on using waste feedstocks available in Oman.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>People</td><td>Lead:
Prof. Dr. J. Sadhik Basha, IMCO
</td><td>Team:
21) Dr. Faizal Al Marzuqi
22) Dr. Tahereh
23) Mr. Ranjith
24) Mr. Jahenzeb
25) Laboratory Instructors & Research Assistants</td></tr>
<tr><td colspan="3"></td></tr>
</table>

Projects & achievement	• Assessment of Performance & Emission Attributes of a Diesel Engine Generator Fueled with Additive Blended Fuels TRC – FURAP (2018-2019) (completed) • An Experimental Feasibility Study on Thermal Desalination and Emission Reduction of a Diesel Engine Fueled with MWCNT Blended Emulsion Fuels, URG, MoHERI (2020-2021) (completed) • An Effective Utilization of Exhaust Gases From DICI Engine to Produce Potable Water (From Seawater) Coupled with Solar Distillation System, CRG, IMCO (2021-2022) (completed) • Synthesis of Plastic Oil and Its Utilization in a Compression Ignition Engine to Investigate Emission, Combustion and Performance Attributes. RG, MoHERI (2021-2023) (in progress) • An Experimental Probe to Ascertain the Ignition Delay of Fuels on Employing Hot-Plate Evaporation Setup, GRG, MoHERI (2022-2023) (Submitted) • A research article titled "Thermal Desalination Technique on Utilizing the Waste Heat Exhaust Gases from a Diesel Engine" was presented @ MEDRC (Middle East Desalination Research Centre), 2021, and it has been awarded FIRST PRIZE in Oman. • Omani Young Water Researchers Award Dec 2021 in Undergraduate Category, Second Place, Title: "Sustainable Desalination and Bioelectricity Generation Using Green Technology of Microbial Desalination Cell"
Recently featured publications	The recently featured publications include: 1. J. Sadhik Basha et al., Investigation of ternary blends of Animal fat biodiesel-Diethyl Ether-Diesel fuel on CMFIS-CI engine characteristics. Journal of Fuel, 2022 (Impact Factor – 8.1) https://doi.org/10.1016/j.fuel.2022.126200. 2. J. Sadhik Basha et al., Applications of Nano-Additives in Internal Combustion Engines: A Critical Review. Journal of Thermal Analysis & Calorimetry, 2022 (Impact Factor – 5.1) https://doi.org/10.1007/s10973-022-11199-6 3. J. Sadhik Basha et al., A case study on the electrical energy auditing and saving techniques in an educational institution (IMCO, Sohar, Oman), Journal of Case Studies in Thermal Engineering, 2022, (Impact Factor – 6) https://doi.org/10.1016/j.csite.2022.101820 4. J. Sadhik Basha et al., Potential of Utilization of Renewable Energy Technologies in Gulf Countries. J. of Sustainability 2021 (Impact Factor – 4) https://doi.org/10.3390/su131810261 5. J. Sadhik Basha et al., Clean combustion and emissions strategy using reactivity controlled compression ignition (RCCI) mode engine powered with CNG-Karanja biodiesel, J. of Taiwan Inst. of Chemical Engrs., 2021, (Impact Factor – 6.9) https://www.sciencedirect.com/science/article/abs/pii/S1876107021002315 6. J. Sadhik Basha et al., An emission control strategy in a low capacity single cylinder compression ignition engine powered with DEE blended fuels, J. of Materials science for Energy Technologies, 2020, 770-779 https://doi.org/10.1016/j.mset.2020.09.004 7. J. Sadhik Basha, Impact of Carbon Nanotubes & Di-Ethyl Ether as additives with biodiesel emulsion fuels – An Experimental Investigation, J. Energy Institute, 2018, 289-303 (Impact Factor – 6.3) https://doi.org/10.1016/j.joei.2016.11.006 8. J. Sadhik Basha, Preparation of water-biodiesel emulsion fuels with CNT & Alumina nano-additives and their impact on the diesel engine operation, SAE Technical Paper 2015-01-0904, 2015. (Impact Factor – 2.0) https://doi.org/10.4271/2015-01-0904 9. J. Sadhik Basha, An experimental analysis of a diesel engine using alumina nanoparticles blended diesel fuel, SAE Technical Paper 2014-01-1391, 2014 (Impact Factor – 2.0) https://doi.org/10.4271/2014-01-1391

10. J. Sadhik Basha & Montaha Al Balushi. Performance and Emission Features of a Light Duty Diesel Engine Generator Powered with Water-Diesel Emulsions, European Journal of Engineering Science and Technology, 2019, 2 (4), 72-78. https://www.dpublication.com/ejest/volume-2_issue-4-2019/
11. J. Sadhik Basha & Montaha Al Balushi. The Influence of Water and DEE as Additives with Diesel Fuel in a Light Duty Diesel Engine Generator-An Experimental Investigation, Journal of Engineering Science and Technology, 2020, 1 (2), 54-61. http://ojs.wiserpub.com/index.php/EST/issue/view/46
12. A book entitled "Opportunities and Challenges in Climate-Friendly Clean Water and Energy Technologies" is to be published in IGI–Global Publishers, USA, 2023, https://www.igi-global.com/book/opportunities-challenges-climate-friendly-clean/307032
13. A chapter entitled "An Experimental Analysis in a DICI Engine Powered with MWCNT Blended Emulsions" is published in Springer Nature Publications, 2022. ISBN 978-981-19-3467-4, https://link.springer.com/chapter/10.1007/978-981-19-3467-4_30
14. A book entitled "Recent Technologies for Enhancing Performance and Reducing Emissions in Diesel Engines" is published in IGI–Global Publishers, USA, 2020, ISBN13: 9781799825395, DOI: 10.4018/978-1-7998-2539-5
15. A chapter entitled "Applications of functionalized carbon based nanomaterials" is published in Taylor & Francis - CRC Press Publishers, 2015, ISBN 9781482253948, Chapter No. 23, pp.573-587.
16. A chapter entitled "Impact of Nano-additive blended biodiesel fuels in Diesel Engines" is published in Springer Publications, 2017, ISBN 9783319454597, Chap. No. 14, pp.325-339. https://doi.org/10.1007/978-3-319-45459-7_14
17. A research article titled "An cost-effective analysis of desalination on using waste heat gases and solar energy" was presented & awarded Best Presentation @ National University of Science & Technology, 2nd Annual Research Day, October 3, Muscat, 2022.
18. A research article titled "Simultaneous Benefits of Performance, Emission Reduction, and Desalination on using a Diesel Engine Fueled with MWCNT blended Diesel Fuels" was accepted & presented @ GPCA Competition, September 26-27, Dubai, UAE, 2022.
19. A research article titled "Breaking the Wall of Costly Desalination by Waste Heat & Solar Energy" was accepted and presented @ Falling Walls Lab Oman, 2022.
20. A research article titled "Breaking the Wall of Desalination by Engine's Waste- Heat" was accepted and presented @ Falling Walls Lab Oman, 2021.
21. A research article titled "Thermal Desalination Technique on Utilizing the Waste Heat Exhaust Gases from a Diesel Engine" was presented @ MEDRC (Middle East Desalination Research Centre), 2021, and it has been awarded FIRST PRIZE in Oman. (https://www.medrc.org/medrc-announces-winners-of-the-omani-young-water-researchers-award-and-the-eco-school-prize-2021/).
22. A research article titled "An Experimental Analysis in a DICI Engine Powered with MWCNT Blended Emulsions" was presented at the "International Conference on Energy & Materials Technologies", Chennai, Aug. 20–21, 2021.
23. A research article titled "The Influence of Water and DEE as Additives with Diesel Fuel in a Diesel Engine Generator - An Experimental Investigation" was presented at the "2nd International Conference on Computer, Automation, Engineering and Technology-CAET, Turkey, August 3-4, 2019.
24. A research article titled "Performance and Emission Features of a Light Duty Diesel Engine Generator Powered with Water-Diesel Emulsions" was presented at the "6th International Conference on Innovation in Science and Technology", London, July 26–28, 2019.

<table>
<tr>
<td></td>
<td colspan="2">

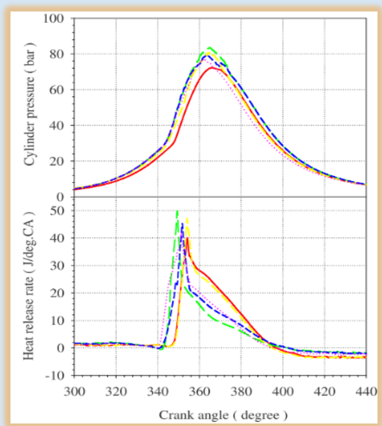
25. A technical Paper titled "Effects of Hexanol & Methyl Acetate as Additives with Diesel Fuel in a Diesel Engine Generator" was presented at "The Second Student's Research Conference, Sultan Qaboos University, Muscat, April 16-19, 2019.
26. A research paper entitled "Effects of Alumina Nano-additive and Carbon Nanotubes as additives with diesel fuel in a diesel engine - A critical review" is accepted for an oral presentation to be held at Saudi ARAMCO, Riyadh, Saudi Arabia - SAS-CI 9th Annual Meeting on April 28-29, 2019.
27. A research paper entitled "A critical review on combustion characteristics of a diesel engine on using various additive blended diesel and biodiesel fuels" was presented for an oral presentation held at Saudi ARAMCO, Riyadh, Saudi Arabia - SAS-CI 8th Annual Meeting on May 1-2, 2018.
28. A Technical Paper titled "Effects of Hexanol & Methyl Acetate as Additives with Diesel Fuel in a Diesel Engine Generator" was presented at the "Second Student's Research Conference", Sultan Qaboos University (SQU), Muscat, Apr. 16-19, 2019.

</td>
</tr>
<tr>
<td colspan="3"></td>
</tr>
<tr>
<td>Resources /lab facilities</td>
<td>

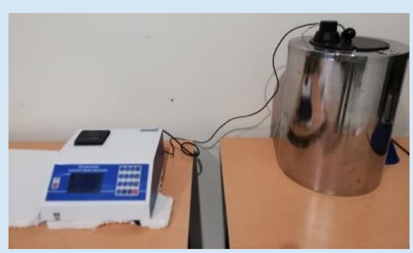
Our research work mainly focuses on investigation of combustion, emission and performance traits of advanced alternative fuels for power generation. The above research lab has following instruments/equipment:

- Computerized CI Engine setup to investigate combustion traits
- Semi-Automatic Bomb Calorimeter (as per ASTM std.)
- Carbon Residue Test Apparatus (as per ASTM std.)
- Petroleum Distillation Setup (as per ASTM std.)
- Digital Saybolt Viscometer (as per ASTM std.)
- Pensky Martens Flash Point & Fire Point Apparatus (as per ASTM std.)
- KANE Auto-5 Gas Analyzer
- KANE Smoke Opacitymeter
- Digital Overhead Mechanical Stirrer (2400 RPM)

</td>
<td>



Computerized Data Acquisition System Assisted Diesel Engine with Eddy Current Dynamometer Setup (Combustion, Emission, and Performance Investigations)

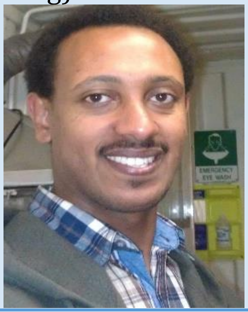


</td>
</tr>
</table>

		Semi-Automatic Bomb Calorimeter   NOx, CO, HC, CO_2 Gas Analyzer Smoke Opacity meter   Digital Saybolt Viscometer Carbon Residue Test Apparatus  Fuel Distillation Unit Setup

		 Pensky Martens Flash & Fire

News & events/training	The group engaged in many scholarly activities and conducted professional training courses for the UG students. A graduate trainee is currently undergoing a technical internship in the above research labarotory.

<table>
<tr><th>Core Research Area</th><th colspan="2">4. Bioprocess and Catalysis</th></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Research focus area</td><td colspan="2">This research cluster aims at addressing pollution, water, climate change and sustainability related challenges using various bioprocess and catalysis techniques. The research focus areas include noble and affordable bioprocess and catalytic technologies for the removal of nutrient, heavy metals, persistent organic pollutant and pharmaceutical waste. various pretreatment technologies, including microwave, ultrasonic, oxidation and other advanced pretreatment techniques for enhanced water and waste water treatment. Biolelectrochemical systems for water and wastewater treatment, electricity generation and biosensors for parametric monitoring applications. Bio-hydrogen and Biogas production from waste biomass including Algae. Improving competitiveness of climate response technologies, innovative solid and hazardous waste treatment technologies, environmental and bioprocess technologies for air, soil and water pollution control and mitigation and treatment of industrial and vehicular toxic gases and particulate emissions mitigation, waste to energy and waste to product technologies for various industry sectors, cleaner production and sustainable development, Rheological flow behavior analysis for various environmental applications, corrosion inhibition using microbial systems, environmental system analysis (ESA), Modelling and artificial intelligence for analysis of environmental and biological processes, life cycle assessment and life cycle costing (LCA and LCC), environmental management, industrial safety and risk management.</td></tr>
<tr><td>Alignment with Oman Vision 2040</td><td colspan="2">The Research group focuses on addressing water, environment and energy related challenges in Oman using various innovative bioprocesses, bioelectrochemical and catalytic materials, methods and technologies.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>People</td><td>Lead:
Dr. Anteneh Mesfin Yeneneh
(Assoc. Prof. Chemical Engineering)
</td><td>Team:
26) Dr Tahereh Ahmad Jafari
27) Dr Muna Al Hinai
28) Dr Faisal Al Mahrouqi
29) Mr Thirumalai Kumar
30) Ms Asma Al Kharousi</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Projects & achievement</td><td colspan="2">
<table>
<tr><td>Fabrication of low-cost microbial fuel cell for wastewater treatment and bioenergy production</td><td>IMCO Internal Grant</td><td>Tahereh Jafary (PI)
Jimoh K. Adewole
Anteneh M. Yeneneh</td><td>2020</td><td>2,000</td></tr>
</table>
</td></tr>
</table>

	Microwave-oxidation and Microwave-alkali pre-treatment of oily industrial and municipal wastewater for enhanced aerobic and anaerobic degradation	IMCO Internal Grant	Anteneh M. Yeneneh Jimoh Adewole Ahoud Al Hamadani Abdul Shakoor	2020	1800
	Synthesis of Chitosan from Sea Waste in Sohar	IMCO Internal Grant	Muna AlAjmi (PI) Tahereh Jafari Anteneh Mesfin Ahoud AlHamadani (Co-PIs)	2021	1,000
	A Comprehensive Study on Valorization of Spent Coffee Grounds into Activated Carbon in Oman; A Step Towards Pilot-scale Implementation	MOHERI	Tahereh Jafary (PI) Manar Al Attar Reem Al Masani AbdulRahman Al Marzuqi	2021	1,500
	Removal of Toxic Heavy Metals from Industrial Wastewater by Activated Waste Tire	IMCO Internal Grant	Ahoud AlHamadani (PI) Tahereh Jafari Muna AlAjmi, Anteneh Mesfin (Co-PIs)	2021	1,000
	Removal of Heavy Metals and toxic organics Using Thermally and Chemically Modified Lignocellulosic biomass and clay	IMCO Internal Grant	Anteneh Mesfin (PI) Tahereh Jafari Thirumalai Kumar Muna AlAjmi, Ahoud AlHamadani (Co-PIs)	2022	1,000
	Simultaneous green hydrogen generation, decentralized wastewater treatment and desalination in a novel reactor design of microbial electrolysis desalination system	IMCO Internal Grant	Tahereh Jafary (PI) Muna AlHinai Anteneh M. Yeneneh Muna AlAjmi, Ahoud AlHamadani (Co-PIs)	2022	1,300

Recently featured publications	Al Balushi, A., Al Maqbali, F., Al Saidi, H. ., Al Maaini, I. ., **Mesfin, A. Y.** ., Sharifzadeh, B. ., Al Ajmi, M. ., & **Jafary, T.** (2022). Effect of External load and Salt Concentration on the Performance of Microbial Desalination Cell . International Journal of Integrated Engineering, 14(2), 106–114. Bhadouria, A. S., Kumar, A., Raja, D., Verma, A., Singh, S., Tripathi, P. **Yeneneh*, A. M.** (2022). Corrosion mitigation in oil reservoirs during CO2 injection using nanomaterials *Nanotechnology for CO2 Utilization in Oilfield Applications* (pp. 127-146): Elsevier. **Jafary, T., Yeneneh, A.**, Daud, W., Al Attar, M., Al Masani, R., & Rupani, P. (2022). Taxonomic classification of sulphate-reducing bacteria communities attached to biocathode in hydrogen-producing

microbial electrolysis cell. *International Journal of Environmental Science and Technology, 19*(8), 7297-7306.

Jafary, T., Yeneneh, A. M., Adewole, J., Kharousi, A. A., Kumar, T., Raj, D., . . . Dwivedi, D. (2022). Current advances, challenges, and prospects of CO2 capture, storage, and utilization *Nanotechnology for CO2 Utilization in Oilfield Applications* (pp. 184-210): Elsevier.

AL-AJMI, M., AL-HAMDANI, **A., YENENEH, A. M., & JAFARY, T.** (2022). *Removal of Oil from Contaminated Wastewater Using Thermo-Chemically Modified Lignocellulosic Biomas.* Paper presented at the Materials Science Forum.

Al Balushi, A., Al Maqbali, F., Al Saidi, H., Al Maaini, I., **Mesfin, A. Y.,** Sharifzadeh, B.**, . . . Jafary, T**. (2022). Effect of External load and Salt Concentration on the Performance of Microbial Desalination Cell. *International Journal of Integrated Engineering, 14*(2), 106-114.

Yeneneh, A., Adewole, J., Eugene, H., Firouzi, A., & Khan, M. Z. (2021). *Investigation On Biosorption Of Lead By Acid And Surfactant Modified Rice Husk And Sugarcane Bagasse.* Paper presented at the 17th Leading Edge Technology Conference 2021, Reno, USA.

Rahman, S., Al-Mamun, A., **Jafary, T**., Alhimali, H., & Baawain, M. S. (2021). Effect of internal and external resistances on desalination in microbial desalination cell. Water Science and Technology.

Alwahaibi, B., **Jafary, T.,** Al-Mamun, A., Baawain, M. S., Aghbashlo, M., Tabatabaei, M., & Stefanakis, A. I. (2021). Operational modifications of a full-scale experimental vertical flow constructed wetland with effluent recirculation to optimize total nitrogen removal. Journal of Cleaner Production, 126558

Rahman, S., **Jafary, T.**, Al-Mamun, A., Baawain, M. S., Choudhury, M. R., Alhaimali, H., ... & Tabatabaei, M. (2021). Towards Upscaling Microbial Desalination Cell Technology: A Comprehensive Review on Current Challenges and Future Prospects. Journal of Cleaner Production, 125597.

Jafary, T., Al-Mamun, A., Alhimali, H., Baawain, M.S., Rahman, M.S., Rahman, S., Dhar, B.R., Aghbashlo, M. and Tabatabaei, M.,. Enhanced power generation and desalination rate in a novel quadruple microbial desalination cell with a single desalination chamber. Renewable and Sustainable Energy Reviews, 127 (2020), p.109855.

Jafary, T., Al-Mamun, A., Alhimali, H., Baawain, S. Rahman, S., Tarpeh W.A.,Dhar, B.R., Kim, B.H. Novel two-chamber tubular microbial desalination cell for bioelectricity production, wastewater treatment and desalination with a focus on self-generated pH control (2020). Desalination.

Al Maqbali, T. M. A., Alessai, K. s., Al hinai, A. H. S., Al Maktoumi, **A. M., Yeneneh, A., & Adewole, J**. (2020). *Anaerobic Biodegradation of Used Motor Oil for Safe Disposal.* Paper presented at the AiChE Annual Meeting 2020, USA.

Biswas, S., Sen, T. K., **Yeneneh, A. M**., & Meikap, B. C. (2019). Synthesis and characterization of a novel Ca-alginate-biochar composite as efficient zinc (Zn2+) adsorbent: thermodynamics, process design, mass transfer and isotherm modeling. *Separation Science and Technology, 54*(7), 1106-1124.

	Hong, E., **Yeneneh, A. M.**, Sen, T. K., Ang, H. M., & Kayaalp, A. (2018). ANFIS based Modelling of dewatering performance and polymer dose optimization in a wastewater treatment plant. *Journal of Environmental Chemical Engineering, 6*(2), 1957-1968. Hong, E., **Yeneneh, A. M.**, Sen, T. K., Ang, H. M., & Kayaalp, A. (2018). A comprehensive review on rheological studies of sludge from various sections of municipal wastewater treatment plants for enhancement of process performance. *Advances in colloid and interface science, 257*, 19-30. **Yeneneh, A., Al-Aamri, D., Adewole, J.**, Firouzi, A., Al Ajmi, M., & Noor Alam, A. (2020). *Application of Innovative Low-Cost Bio-Flocculants for Enhanced Wastewater Treatment.* Paper presented at the AiChE Annual Meeting 2020, USA.	
Resources /lab facilities	List of various equipment and facilities in the Bioprocess , Rheology and Catalysis research labs - Double Beam UV-VIS Spectrophotometer - Flame Photometer - Solar intensity meter - UV intensity meter - Moisture Analyzer - Rotational viscometer stepless speed change - Votex - Potentiostat - DC supply (Multiple Channel) - Peristaltic pump (multichannel) - Hydrothermal Reactor - Ultrasonicator (Sonic Cell) - Multi-parameter Analyzer - Turbidity Meter - pH/COND/DO/Salinity meter - COD/ammonia Nitrogen/Total Phosphorous analyzer - Bio Incubators - Furnace - Vacuum filter - Centrifuge	
News & events/training		

1. Abu Dhabi University Research Competition, Engineering Category, 2022, First Place, Title: “Fabrication of a MFC-based biosensor for COD monitoring in wastewater treatment plant”
2. Abu Dhabi University Research Competition, Innovation category, 2022, Third Place, Title: “Breaking the wall of costly desalination and brine hazards”.
3. National University Research Competition, 2022, First Place, Title: “Fabrication of a MFC-based biosensor for COD monitoring in wastewater treatment plant”

6. Omani Young Water Researchers Award Dec 2021 in Undergraduate Category, Second Place, Title: "Sustainable Desalination and Bioelectricity Generation Using Green Technology of Microbial Desalination Cell"
7. National Research Award, MOHERI, Oman, Environmental and Biological Resources field, 2021, Title: ''Operational modifications of a full-scale experimental vertical flow constructed wetland with effluent recirculation to optimize total nitrogen removal''
8. Falling Walls Lab Oman competition, First Place (selected as the representative of Oman), 2021, Title: "BREAKING THE WALL OF COSTLY DESALINATION"
9. Performance Enhancement of Municipal Wastewater Treatment and Sludge Dewaterability Using Innovative Ultrasonic-oxidation Technique (Oman Chamber of Commerce Innovaton Award) 2019.

10. Performance Enhancement Of Municipal Wastewater Treatment Sludge Dewaterability Using Ultrasonic Oxidation Technique (Gulf Petrochemicals & Chemicals Association) 2019.

Core Research Area	5. Maritime and Engineering Education for Sustainability
About the Research	**Focus**: MEES is a multidisciplinary research group whose mission is to investigate the future of higher education and explore innovative approaches to implementing and teaching for a sustainable future in the maritime and engineering programs offered by IMCO. **Scope:** The reseah group investigates issues related to education and sustainability in the field of maritime and engineering higher education, and explores the effect of digitalization on education and training in Maritime, logistics and engineering education and training.
Alignment with Oman Vision 2040	The research group activities are aligned with the Strategic Direction of Oman vision 2040 whose focus is Education, Lifelong Learning, and Scientific Research that is based on sustainable development, the creation of a knowledge-based economy as well as capacity building and equiping students with 21st century skills and competencies to contribute to a sustainable future and meet the requirements of rapidly changing business environment and unpredictable local and international labour markets.
People	**Lead:** Prof. Dr. Abdelghani Benayoune  Email: a.benayoune@imco.edu.om **Team:** 31) Dr. Jimoh K. Adewole 32) Dr.Tahereh Ahmad Jafari 33) Dr. Capt. Arife Tugsan Colak 34) Mr. Zouhair Slimi 35) Mr. Khalid Al Khalbani
Projects & achievement	• Digitalization Impact on Business & Training: The Case of Logistics Companies in Oman (Sponsore by MoHERI, Call 2021) • The impact of technology on jobs, training and education. (IMCO, 2019-2020) • The future of labour market in the energy sector: Challenges and opportunities. (Sponsored by OPAL, OQ and OXY.2019) • Skills Development and Employment Creation Strategy for the Logistics Sector (ASYAD 2018)
Recently featured publications	1. Benayoune. A. (2022). Factors Influencing Industry 4.0 Implementation in Oil and Gas Sector: Empirical Study From a Developing Economy. Academy of Strategic Management Journal 21 (2), 1-28. 2. Benayoune. A. (2021) Future Skills in Industry 4.0 Era: Empirical Evidence from Oil and Gas Companies. Academy Strategic Management Journal 21 (6), 1-14. 3. Benayoune, A., Hamid, A., N Rahman, Kalbani, K., and Slimi, Z. (2022). Logistics 4.0 Skills Requirements: Evidence from a Developing Country. Canadian Journal of Business and Information Studies 4 (2), 24-36. 4. Benayoune, A. (2019). How Might Technology Impact Future Jobs and Skills in The Oil & Gas Industry. Oil and Gas Conference. Muscat.

	5. Benayoune. A. (2018). Towards Effective Human Capital Development for the Logistics Industry. International Journal of Trade, Economics and Finance 9 (4), 153-158. **Consultancy reports** • Benayoune, A. The future of labour market in the energy sector: Challenges and opportunities". OPAL-IMCO Report, December, 2020. • A. Benayoune and P. Nikolaou. Skills Development and Employment Creation Strategy for the Logistics Sector. Submited to Asyad. 2018. **Confernces** • Benayoune, A. 2022. Competency-based Learning: Bridging the Knowing doing-Gap. 4th RIC, Oman, 29 March 2022. • Benayoune, A. 2022. Factors Influencing Industry 4.0 Implementation: Evidence from Oil and Gas Firms. Digital Oil & Gas Conference. 21-23 March 2022. • Benayoune, A. 2021. Enablers and inhibitors of Industry 4.0: The Case of Oman. 3rd RIC, Oman, 24 March 2021. • Inhibitors and Abdelghani Benayoune, 2019. How Might Technology Impact Future Jobs and Skills in The Oil & Gas Industry. Oil and Gas Conference, Muscat, Oman, 21-22 Oct 2019. • Benayoune, A. 2019. The impact of Technology on Jobs and skills in the oil and gas sectors. East Med Maritime Conference, Beirut, Lebanon 19-20 June 2019.
Resources /lab facilities	• Statistical software
News & events/training	The group has conducted various professional training courses for industries and many other scholarly activities. Some activities include: 12. Professional training for professionals from Oman Shipping, Steinweg LC C, Oiltanking LCC etc. (2016-present) 13. Particpating in conducting Research and Innovation Conference series (2018, 2019, 2021, 2022) 14. Conducing Maritime and Logistics Education, Training and Practices in the GCC Symposium series (2016 and 2017)