



*years of*  
**IGNITING LEADERS OF  
TUMORROW**  
**M o m e n t U M**

20TH ANNIVERSARY SPECIAL EDITION

TECHNICAL  
UNIVERSITY  
OF MUNICH (TUM) Asia

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**TUM** Asia

Technical  
University  
of Munich



2022 | Edition 01



# IGNITING LEADERS





# OF **TUM**ORROW



# OUR MILESTONES

2002 - 2012

## 2003 ▶

Prof. Dr. Wolfgang A. Herrmann, President of TUM (1995 - 2019) at the inauguration ceremony of TUM Asia (formerly known as GIST - TUM Asia).



## 2003 ▶

Signing of the agreement of the joint Master's Programme in Industrial and Financial Mathematics between TUM and NUS.



## 2006 ▶ 3<sup>rd</sup>

Commencement Ceremony (Right to left) Dr. Markus Wächter, Managing Director, TUM Asia and graduate.



## 2007 ▲

A successful 4<sup>th</sup> graduation following the launch of our 3<sup>rd</sup> master's programme, the Master of Science in Microelectronics.

## 2002

TUM Asia (formerly known as GIST - TUM Asia) was established in Singapore, welcoming its first cohort of joint degree in Master of Science in Industrial Chemistry. ▼



## 2004

The pioneer cohort graduated with the 1<sup>st</sup> Commencement Ceremony held at The Fullerton Hotel. ▼



## 2005

2<sup>nd</sup> Commencement Ceremony held for Master of Science in Industrial Chemistry and Master of Science in Industrial & Financial Mathematics. ▼



## 2007 ▲

Dr. Folkmar Stoecker, former German Ambassador to Singapore, gave a speech at the 4<sup>th</sup> Graduation Ceremony Master of Science Industrial Chemistry and Integrated Circuit Design.



## 2011

In partnership with Singapore Institute of Technology (SIT), TUM Asia launched two Bachelor of Science programmes (Electrical Eng. & information Technology / Chemical Eng.) conferred by TUM. ▼



## ▲ 2008

TUM Asia (formerly known as GIST - TUM Asia) opens its new campus at Pixel building. TUM Asia was recognised as the second home of TUM and became the first offshore campus of TUM outside of Germany.



## ◀ 2012

Another milestone achieved as TUM Asia ushered in 146 students for its 10<sup>th</sup> intake of Master of Science students.

## 2012

TUM Asia celebrated its 10<sup>th</sup> anniversary, which was hosted by Prof. Dr. Wolfgang A. Herrmann, TUM President Emeritus. This same year also saw an unprecedented increase in student enrolment, welcoming more than 200 students in a single cohort. ▼



## ◀ 2010

A research contract was signed between TUM and Singapore National Research Foundation to set up TUM Create, the Centre for Electro-Mobility.



## ◀ 2009

Two master's programmes were added to TUM Asia's suite of programmes - Master of Science in Aerospace Engineering and Master of Science in Transport and Logistics conferred by TUM.

## ◀ 2008

A magnificent dusk overlooks the celebrations at TUM Asia's new campus at Pixel building.

# OUR MILESTONES

2013 - 2022

## 2014 ▶

TUM Asia graduated its 1000<sup>th</sup> student



## 2013

TUM CREATE unveiled the electric taxi prototype at the 43<sup>rd</sup> Tokyo Motor Show in 2013. This prototype showcased the results of the research and development carried out by the Singapore-based research institution. ▼



## 2015 ▶

In commemoration of 50 years of diplomatic relations between Singapore and Germany, TUM Asia launched a new TUM Asia - SG50 Scholarship.



TUM Asia marked the opening of its new campus at the SIT@SP Building on 24 April 2015. ▼



## 2016 ▶

Festo Didactic SE and TUM Asia inked partnership to upskill the workforce for Industry 4.0.



## 2016 ▶

“INDUSTRIE 4.0: Towards the Future of Manufacturing” Research Symposium was jointly organised by TUM Asia, Agency for Science, Technology and Research (A\*STAR) and the German Academic Exchange Service (DAAD).



## 2017 ▶

TUM Asia signed Memorandum of Understanding (MOU) with Nanyang Polytechnic to raise engineering standards.



## 2018 ▲

TUM celebrated 150 years of culture of excellence.



## ◀ 2022

The inaugural CILT-TUM Asia Logistics Leadership Dialogue Series kicked off with Mr Chee Hong Tat, Senior Minister of State for Transport gracing the opening session as the Guest-of-Honour.



## ◀ 2022

The year 2022 marked the return of in-person celebration of TUM Asia graduation ceremony after a two-year hiatus.



## ◀ 2021

TUM Asia signed a MOU with the Plastics Recycling Association Singapore (PRAS) to provide skills training and foster closer collaboration in the mechanical recycling of high-volume plastic wastes.



## ◀ 2020

SIT and TUM launched two new joint Bachelor of Engineering programmes with honours to offer students greater adaptability and strengthen their industry-readiness.



## ◀ 2019

Festo Singapore and TUM Asia further cultivated partnership to establish a Competence Centre for Digitalisation, Technologies and Innovation (CDTI).



## ◀ 2019

The Graduation Ceremony 2019 was held in The Star Performing Arts Centre with a record number of academic Professors, TUM Board of Management and TUM Senate members in attendance.



## ◀ 2018

TUM Asia launched the Specialist Diploma in Advanced Digital Manufacturing with its first cohort.

# EXECUTIVE EDUCATION COURSES INDUSTRY 4.0

APPLICATION TO THE 2022 INTAKE IS NOW OPEN

We invite you to further your engineering skills with executive education courses from the **Technical University of Munich (TUM) Asia**. Benefit from our industry-relevant executive education offerings, partnerships with the industry and funding support of **up to 90% SkillsFuture funding available**.



## OUR TOP INDUSTRY 4.0 COURSES

### Specialist Diploma in ADVANCED DIGITAL MANUFACTURING

*6 Modular Certificates, 280 contact hours*

- Gain an overview on the essentials of advanced manufacturing systems
- Obtain deep insight on effective organization of manufacturing processes
- Develop skills and experiences employed in designing IIOT systems
- Apply software development approaches for development of CP systems with integrated Industry 4.0 features

### LEARN Programme (Stage 1) ENGINEER YOUR SMART FACTORY BLUEPRINT

*3 Day Workshop, 24 contact hours, 6 hours pre-assessment*

- Understand and apply SIRI and the Prioritisation Matrix
- Understand core principles, frameworks and methodologies of i4.0
- Determine aspirational state of company guided by business objectives
- Generate actionable problem statements in Industry 4.0 focus areas
- TÜV SÜD solution taxonomy and Fraunhofer digital media technology

## CREATE YOUR COMPETITIVE EDGE FOR INDUSTRY 4.0

*Be ready for i4.0 job roles  
with the right skills!*

For more information or to find out more about the latest course schedule, please contact:

*TUM Asia, Office of Executive  
Development  
exd@tum-asia.edu.sg  
6777 7407 ext 138*



*Find out more at  
[www.tum-asia.edu.sg/exd](http://www.tum-asia.edu.sg/exd)*



## PRESIDENT EMERITUS AND DIRECTOR'S MESSAGE



Guten Tag! After two years of living in the deep throes of the pandemic, we are beginning to emerge from the worst of the COVID-19 crisis as we make slow but steady steps in opening the economy and resuming some semblance of normalcy. After a two-year hiatus, the cacophony of laughter and chatters echoed across the campus is truly a melody to behold. As the campus becomes a hive of activity with students returning to campuses for lessons and activities, the TUM Asia community has not been idle. After 11 times in Munich, the mobil. TUM 2022 arrived on our shores, bringing together the latest mobility research and innovation from all over the world. In the same vein, we collaborated with the Thai-German Graduate School of Engineering (TGGS) and the Vietnamese-German University (VGU) in a webinar where we gained a rare insight into the traffic conditions of heavily populated countries such as Singapore, Thailand, and Vietnam and the strategies in place to ensure safe and effective transport. Such transnational collaborations are needful in contextualising our theoretical knowledge and developing well-rounded perspectives necessary to pivot in an increasingly interconnected and complex world.

The year 2022 also saw graduands of the Class of 2020 and Class of 2021 receiving their scroll in person and walking the proverbial rite of passage from graduand to graduate, as their loved ones watched with deep emotions. Over the past two years, the unprecedented levels of disruption the pandemic has wrought on students have consequently reduced much of their lives confined within their computer screens. The effects of social isolation were acutely felt by our students and their loved ones. Despite this, they managed to press on and imbue as much student life as possible by organising small-scale activities, one-on-one sessions with Professors, and intimate peer-group discussions - a remarkable example of their mettle that truly embodies the true TUM spirit of tenacity and fortitude. 2022 happens to be the year TUM Asia turns 20! In this issue, we take a nostalgic look back through the years of milestones and achievements we have

made over the past 20 momentous years. Looking back when we first had the idea of chartering TUM Asia, it was a bold endeavour that no other university in Germany had embarked on. In the face of very real challenges and possible failure, we mustered all our resolve to push through the multiple collaborations with university partners and industry leaders to bring the TUM experience closer to people beyond Europe to drive the progress of innovation for people and society. There have been many tough moments, but 20 years on, we have grown from 20 students to more than 2,000 graduates and 600 students plying through different trades in various fields. We have built a legacy of remarkable triumphs, but we will never forget the tumultuous times we have been through navigating the uncharted waters of venturing abroad.

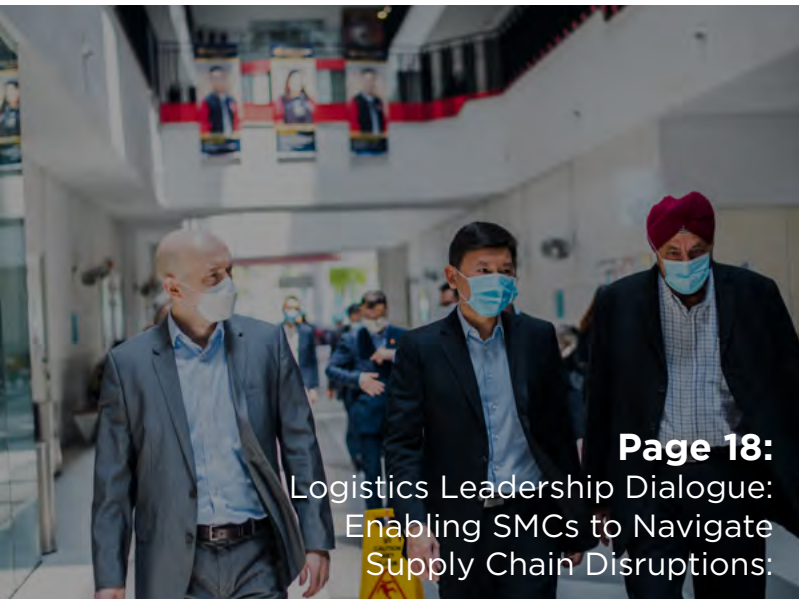
As the climate crisis tightens its grips, our eyes are on the rising stars of our TUM Asia community who are poised to change the future. In this issue, we saw people within our TUM Asia community from across the fields and around the globe who overcame the obstacles and emerged victorious against the tide of challenges and overwhelming odds. We hope these stories provide some inspiring guideposts of how you can achieve success amid the unknowns.

In addition to some of our TUM Asia alumni notables, we shine the spotlight on a fellow TUM alumnus, Dr. Suraj Nair, whose successful research output in revolutionising the air-cargo industry with artificial intelligence and robotics has founded SPEEDCARGO, propelling him into the world of start-ups. Thrust into an entirely different world and completely out of his comfort zone, Suraj remains undaunted in the face of challenges as he manoeuvres the extremely new terrain, double hatting as domain experts and generalists. With the firm belief that decision-making is not about making the right decisions but by making them right, he learned to anticipate problems and avoid them in time. The leadership displayed by young people like Suraj will be necessary to combat many of the world's crises today.

We hope you will be able to find courage and confidence in the stories we have prepared for you in this special edition and take the next step with a deeper sense of pride and fuller appreciation of the legacy of TUM Asia. As the architects of your future, we are confident you will be able to chart your pathway to success and navigate any uncharted waters as boldly as we do.

Prof. Dr. Wolfgang A. Herrmann  
President Emeritus, TUM  
Academic Director, TUM Asia

Dr. Markus Wächter  
Managing Director,  
TUM Asia



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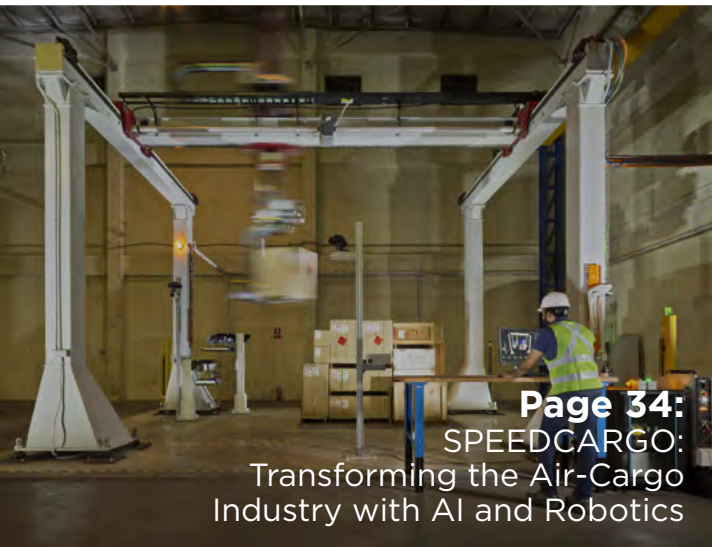
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Published on: June 2022

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## PLASTIC RECYCLING VIRTUAL WORKSHOP: SUSTAINING A BETTER WORLD

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As part of TUM Asia’s commitment to sustainability, the Plastic Recycling Virtual Workshop organised by TUM Asia kicked off successfully, which saw more than 50 participants from various capacities understanding more about the technologies revolving around plastic recycling. For the first time, the workshop is conducted for free to drive more awareness on plastic recycling, thus promoting a circular economy.

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For Day 1, our Technical University of Munich (TUM) Professor on Circular Economy Prof. Dr. Magnus Fröhling, started off with an introductory talk on the global plastic challenge and impacts. He spoke on the links between circular economy and recycling, underscoring the importance of producer responsibility on companies to reduce the plastic waste they produce, as well as the importance of public education in driving ground-up action to accelerate the broader sustainability transition.

Next, Prof. Dr.-Ing. Johannes Fottner, TUM Chair of Materials Handling, Material Flow and Logistics, and Mr Niclas-Alexander Mauss, TUM Programme Manager and Research Associate, shared on the topic “From Smart to Sustainable Manufacturing”. Prof. Fottner explained that the Industry 4.0 environment we are in today embraces data as a product that drives the circular economy. Indeed, this digital transformation has helped companies to realise large cost savings. Niclas further noted that sustainable companies have been seen to

**Prof. Fottner explained that the Industry 4.0 environment we are in today embraces data as a product that drives the circular economy. Indeed, this digital transformation has helped companies to realise large cost savings.**

## Smart Manufacturing and Industry 4.0 Economic Potential of Digital Transformation



Cost type	Effect	Economic potentials
Stock costs	<ul style="list-style-type: none"> <li>Reduction of safety stocks</li> <li>Avoid Bullwhip and Burbidge effect</li> </ul>	-30 to -40%
Manufacturing costs	<ul style="list-style-type: none"> <li>Improvement of Overall Equipment Effectiveness (OEE)</li> <li>Process control loops</li> <li>Improvement of vertical and horizontal personnel flexibility</li> <li>Use of smart wearables</li> </ul>	-10 to -30%
Logistics costs	<ul style="list-style-type: none"> <li>Increased degree of automation (milk run, order picking, ...)</li> <li>Smart wearables</li> </ul>	-10 to -30%
Complexity costs	<ul style="list-style-type: none"> <li>Extension of service margins</li> <li>Reduction of "troubleshooting"</li> <li>Prosumer model</li> </ul>	-60 to -70%
Quality costs	<ul style="list-style-type: none"> <li>Everything as a Service (XaaS)</li> <li>Near-realtime quality control loops</li> </ul>	-10 to -20%
Maintenance costs	<ul style="list-style-type: none"> <li>Optimization of stock and spare parts</li> <li>Condition-oriented maintenance (process/measured data)</li> <li>Dynamic prioritization</li> </ul>	-20 to -30%

Source: WZP SmartProduction 4.0, Baumhans, Thomas, Kogler, Jörg, Krenn, Günther, Schuch, Günther  
Chair of Materials Handling, Material Flow, Logistics | TUM School of Engineering and Design | Technical University of Munich

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outperform their competitors. Sustainability also leads to increased resource efficiency, resulting in cost and emission reductions and a directly positive ecological impact. Above all, sustainable business models improve our quality of life.

Next, Dr. Ronny Hanich from Fraunhofer-Institut für Chemische Technologie ICT spoke on "How to Identify the Common Types of Plastic". He first presented an alarming statistic that one full garbage truck's worth of plastic waste finds its way into our oceans every minute. The bulk of plastic demand arises from packaging and building and construction needs. Plastics are used greatly today as they are the cheaper alternative, with high grade plastics possessing the same properties as metal alloys at a fraction of the weight. Furthermore, plastics can be reinforced with other materials to make them stronger.

On Day 2, key industry pioneers contributing to efforts in plastics recycling shared their contributions and strategies to reducing plastic waste. Mr Marcel Rakowski, Executive Vice President Corporate Development of Reverse

Logistics Group, shared on "Recycling Processes and Mechanisms". Used packaging is first collected for recycling in different coloured recycling bins to facilitate sorting. Non-recyclable items are rejected and incinerated, and recyclables are then further sorted. Rakowski explained that some countries deploy a Deposit Refund Scheme (DRS) for plastic bottle recycling. Generally, under a DRS for beverage containers, producers would finance the take-back of the used beverage containers with refunds offered to consumers when they return their empty beverage containers to designated return points. The average recycling rate for countries without a DRS in place is 47 per cent versus 89 per cent for countries with a DRS. In fact, Singapore's National Environment Agency (NEA) is going to implement a Deposit Refund Scheme (DRS) for beverage containers by 2022 as well.

Ms Isabel Gomez from Cradle and Cradle (C2C), a non-governmental organisation powering the shift to a circular economy, then talked



**8 million tons of plastics enter the ocean every year on. That's the equivalent of setting five garbage bags full of trash on every foot of coastline around the world.**

about “A Circular Future for Plastics”. C2C advocates people becoming contributors to environmental protection rather than destroyers of our planet. C2C also advocates a biological cycle for products of consumption, in which used products are sent for composting. For products of usage, used products are returned for disassembly after use. The C2C Products Innovation Institute certifies products that are awarded the C2C certification.

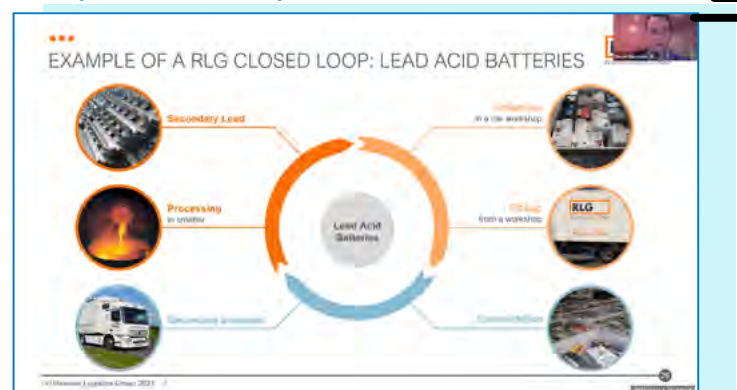
Mr Christian Schiller, Co-Founder and CEO of Cirplus stated that our world is drowning in plastics, with 8 million tons of plastics entering the ocean each year. The reason why is because virgin plastic is always cheaper than recycled plastic. Cirplus was created to lower the costs for procurement of recycled plastics, by leveraging its digital platform as a marketplace for purchase of recycled plastics, thereby driving down costs for recycled plastics acquisition, giving recycled plastics a potential second life instead of being trashed. Schiller further shared that Cirplus has rolled out a recycled plastics specification standard - DIN SPEC 91446 - to benchmark recyclable plastic to an industry-recognised standard.

Mr Martin Körner, Co-Founder and Chief of Sales/Business Development Officer of WeSort. AI explains how the company pioneers artificial intelligence to facilitate sorting of recyclables. WeSort uses deep learning to train neural networks to comb through waste to identify specific items for removal prior to recycling. For

example, the problem of lithium batteries in waste sorting plants potentially causing explosion and fire hazards can be neutralised through WeSort's artificial intelligence technology to enable effective detection of these batteries on the conveyor belt.

Indeed, the Plastic Recycling Virtual Workshop has deepened our knowledge on the issues of plastic consumption, waste reduction and effective recycling solutions. TUM Asia is honoured to be able to host this event and thankful to all presenters and participants alike for contributing to an interactive and engaging workshop.

- ▶ **Mr Marcel Rakowski, Executive Vice President Corporate Development of Reverse Logistics Group, elaborated how its company end-to-end recycling solutions for industrial and automotive batteries, enable a closed-loop material implementation path.**



SOURCE:  
<https://www.nationalgeographic.com/environment/article/plastic-pollution>

# ENSURING SAFE AND EFFECTIVE TRANSPORTATION SYSTEMS FOR DENSELY POPULATED CITIES



- ▶ In 2019, Bangkok was ranked one of the most congested cities globally by TomTom, Dutch multinational developer and creator of location technology and consumer electronics. The transport sector contributed a quarter of carbon emissions to Bangkok's overall carbon emissions, which is higher than the global average.

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Traffic congestion is a serious issue that plagues almost every country these days. A lot of effort goes into relieving traffic congestion, but with limited success mainly due to difficulties in striking a balance between supply and demand. The webinar conducted by TUM Asia in conjunction with the Thai-German Graduate School of Engineering (TGGs) and the Vietnamese-German University (VGu) shed light on the strategies adopted in heavily populated countries such as Singapore, Thailand, and Vietnam to combat this issue.

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First up, Dr. Andreas Rau from TUM Asia spoke on the topic of “Effective Transportation Systems for Congested Cities”. Walking us through the theme of urban transport and land-use evolution, Dr. Rau explained that there is no way to build our way out of traffic congestion due to generated traffic. Changes in land use may lead to changes in transportation services, leading to changes

in traffic demand and changes in mobility, with all these being feedback loops that connect and influence one another. Dr. Rau shared that researchers found that people spend an average of 10 to 15 per cent of their income on transport, and approximately 60 minutes per day on transport. Transport demand management comprises push and pull factors. Push factors restricting private traffic may include parking

SOURCE:  
<https://www.bangkokpost.com/opinion/opinion/1762349/understanding-bangkoks-traffic-woes>

► **Transport Demand management is one way in maximising the efficiency of the urban transport system using a wide range of measures, such as congestion pricing, (Electronic Road Pricing in Singapore), public transport improvement, promoting non-motorised transport, fuel taxation and parking management.**



space and zoning restrictions, permanent or time-of-day car bans, congestion management, speed reductions and road pricing. Pull factors promoting public transport include priority lanes for buses, high public transport service frequency, passenger friendly bus stops and surroundings, park-and-ride schemes, park connector and cycle friendly networks. Measures with simultaneous push and pull factors include redistribution of road lanes to serve exclusive bus or bicycle lanes, redistribution of traffic lights in favour of public transport, as well as public education and enforcement. Dr. Rau concluded his presentation by stating that since dense cities such as Singapore do not have sufficient land space for all to own a car, these cities must follow a public-transit-oriented development.

Next, Dr. Vu Anh Tuan from VGU shared on “Traffic Management for Motorcycle-Dominant Cities in Asia”. He explained that the broad reasons for motorcycle dominance in Southeast Asia are limited road supply, narrower roads that facilitate growth of the motorcycle population, and the slow growth and development of railway lines. Generally, motorcycle growth has increased to meet increased mobility demand, particularly for Taipei, Hanoi, Ho Chi Minh City, Jakarta and Bangkok. As road infrastructure

and public transport services are somewhat inadequate despite the improvements made to date, motorcycle ownership increased rapidly at lower income levels and may continue to do so even at higher income levels. Unless there is active governmental intervention, Dr. Vu contends that motorcycle ownership and use will remain high for a long time. As motorcycle travel is the most dangerous mode of traffic, less efficient than bus and rail in terms of energy use and emissions, and bearing the lowest efficiency in terms of passenger capacity, Dr. Vu suggests that the use of motorcycles could be encouraged as a feeder mode to reach park and ride stations at railway stations. This intermodal connectivity will thereby reduce overall motorcycle use on roads.

Following this, Assoc. Prof. Dr. Saiprasit Koetnyom from TGGs presented on improving motorcycles for safer and more efficient transportation in Thailand. He shared that deaths by two or three - wheeler vehicles stood at 74 per cent, according to World Health Organisation’s (WHO) global status report on road safety. The majority of motorcycle deaths in Thailand was analysed to be due to rollovers and losing control of the vehicle. In order to improve the safety of motorcycle usage, Assoc. Prof.



**Anti-lock braking systems should be installed as the standard braking system for safer vehicles, and motorcycle-safe barriers and dedicated motorcycle lanes should be rolled out to create a safer road environment for motorcycle users.**

**TGGS**

6) Safe road for motorcycle: Barrier

The motorcycle velocity 60 km/h and impacted a sigma post at 47 km/h

The motorcycle left the sled at 60 km/h and impacted the barrier at 54 km/h

Library	Primary impact	Secondary impact
lib01	107.7	
lib02	327.0	247.1
lib03	11.1	74.2
lib04	18.4	97.0
lib05	3342.0	12.25
lib06	0.5330	2.4125
lib07		
lib08	30.0	100.0
lib09	31.2	97.0
lib10	16.0	77.0
lib11	11.0	10.0
lib12	0.8130	0.525
lib13	0.8130	0.410

Source: F. A. Berg, P. Rusker, M. Gartner, J. König, R. Grzebieta, and R. Zou. "Motorcycle impacts into roadside barriers-Real-world accident studies, crash tests and simulations carried out in Germany and Australia." 2006

Saiprasit explained that there must be education of riders to learn the actuation of brake systems in motorcycles, Anti-lock braking systems should be installed as the standard braking system for safer vehicles, and motorcycle-safe barriers and dedicated motorcycle lanes should be rolled out to create a safer road environment for motorcycle users.

In summary, the virtual webinar was highly informative and enriching for all participants and we had an enjoyable and interactive session. We look forward to further collaborations with other universities on future exciting topics to broaden our knowledge in the trending fields of technology and transportation.



**Due to limited road supply, narrower roads, the motorcycle population has been growing to meet increased mobility demand, particularly for Taipei, Hanoi, Ho Chi Minh City, Jakarta and Bangkok.**

# LOGISTICS LEADERSHIP DIALOGUE: ENABLING SMCS TO NAVIGATE SUPPLY CHAIN DISRUPTIONS



- ▶ (From left to right: Mr Peer G. Rasmussen, Managing Director, Kuehne + Nagel; Mr Hans De Jonge, CEO, BEUMER Group Singapore Pte. Ltd; Dr. Andreas Rau, Faculty Head and Principal Investigator; Ms Karen Tan, Chief Information Officer, DHL Express Pte Ltd; Professor Peter Klaus, TUM Asia) The panellists shared some of the obstacles that participants must learn to overcome to reap the full benefits of digitalisation.

Technical University of Munich (TUM) Asia held the first-of-its-kind Logistics Leadership Dialogue Series with the Chartered Institute of Logistics and Transport (CILT) Singapore, bringing together seven top global leaders in supply chain management and logistics solutions, to spearhead discussions on the strategic challenges faced by local SMEs, while providing specialised know-how and strategies for participants to start successful initiatives amid mounting supply chain disruptions.

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*Targeted at the top management levels of SMEs and larger transport and supply chain organisations, the dialogue series were helmed by the top executives of global logistics leaders to share their experiences of their digitalisation journey while providing opportunities for participants to discuss critical issues and share expertise to bolster supply chain resilience collectively.*

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By combining real-world experiences with academic knowledge, this dialogue series featured a cadre of eminent supply chain professors such as Professor Peter Klaus of Technical University of Munich (TUM) Asia and Prof. Dr.-Ing. Johannes Fottner from TUM to share their research insights and knowledge in this field.

Senior Minister of State for Transport, Mr Chee Hong Tat, graced the opening session as Guest-of-Honour and gave a keynote address that highlighted the importance of digitalisation and the various initiatives the Singapore Government has taken in enabling companies to embark on their own digitalisation journey.

#### **Digitalisation challenges amid escalating supply chain shocks**

The 2020 SME Digital Transformation Study produced jointly by Microsoft Singapore, and the Association of Small and Medium Enterprises (ASME) revealed that despite over 80 per cent of local SMEs embracing digital transformation, 54 per cent reported delays in their digitalisation plans due to the COVID-19 pandemic. Despite higher adoption of digital transformation, only two in five SMEs perceive their efforts to be successful.

In addition to their digitalisation challenges, SMEs continue to be hard hit by ongoing supply chain shocks. The steady onslaught of disruptions in global supply chains has laid bare the fragilities of today's global supply chains and underscored the need for companies to bolster their supply chains to weather the volatilities. The Interos Annual Global Supply Chain Report revealed that the global supply chain disruptions in the last two years had cost large companies, on average, US\$184 million a year. In another survey with 400 C-suite executives at European and U.S. global companies conducted by GEP, 64 per cent reported revenue losses between 6 per cent and 20 per cent in 2020, amounting to a

total financial cost of US\$4 trillion due to supply chain disruptions.

#### **Bolstering the supply chain resilience**

Against this backdrop, the CILT-TUM Logistics Leadership Dialogue Series aimed to address the mounting challenges by providing the know-how to top management executives of SMEs in navigating this new dynamic presented by top global logistics leaders. Targeted at the top management levels of SMEs and larger transport and supply chain organisations, the dialogue series were helmed by the top executives of global logistics leaders to share their experiences of their digitalisation journey while providing opportunities for participants to discuss critical issues and share expertise to bolster supply chain resilience collectively. In addition, participants were given a rare inside look at companies' warehouse operations to provide a solid context for SMEs to replicate such successful strategies.

- ▶ **In the opening ceremony, Dr. Markus Wächter, Managing Director of TUM Asia highlighted the critical role supply chains play in the globalised world.**





- ▶ **Senior Minister of State for Transport, Mr Chee Hong Tat, graced the opening session of CILT-TUM Asia Logistics Leadership Dialogue session alongside distinguished guests of global logistics companies such as BEUMER Group Singapore, DB Schenker Singapore, DHL Express, Equalbase, Geodis, Kuehne + Nagel (Asia Pacific) Management, NESTE Asia Pacific Pte Ltd, Trustwave, and Transporeon Group Asia Pacific.**

The first module of the dialogue series on 1 April focused on the digitalisation challenges in the Singapore logistics industry.

**Dual vocational training system: combining real-world experiences with expert inputs**

The genesis of the CILT-TUM Asia Leadership Dialogue Series underpins the German educational concept of a “dual vocational training system”. By bringing together real-world experiences, dual expert inputs from academic professors and industry experts, and reinforcing learning through small peer group interaction, the dialogue series presented the best of both traditional teaching methodologies and the application of industry knowledge to equip the logistics professionals with fresh choices

and perspectives to recalibrate their business strategies to ones that are more resilient and flexible.

The modules curated by knowledge experts and top global logistics leaders provided real-world experiences and specialised know-how to navigate this new dynamic. These modules demonstrated how participants can glean invaluable insights into the initiatives presented by the top global logistics leaders that enabled logistics professionals to pivot as circumstances evolve.

The subsequent modules were held at the respective supporting companies’ logistics centres focusing on the digitalisation challenges and opportunities unique to their industry.

# LOGISTICS LEADERSHIP DIALOGUE: MODULE HIGHLIGHTS

## Module 1: Digitalising Singapore's Logistics Service Provider Industry

The first module of the logistics leadership dialogue series convened the leaders of the top global logistics companies in a panel discussion as they shared about the key opportunities and challenges of digitalisation for the transport and logistics sector in Singapore. Professor Peter Klaus gave an expert insight on the promises and challenges of digitalisation.



## Module 2: Digitalisation for the Global Air & Ocean Forwarding Industry

This module focused on the digitalisation challenges of the global forwarding industry and its digital solutions employed to address such challenges. Participants were given the opportunities to exchange their experiences with the hosts and strategise solutions to address the evolving challenges in digitalisation in the forwarding industry.



## Module 3: Digitalisation for Cargo Carrier Operations

This module focused on the digitalisation challenges of the container line and air cargo carrier industries. Participants were given the opportunity to share experiences of working with carriers and the digital solution approaches to address the unique scenarios.



## Module 4: Promises and Challenges of New Digital Technologies for Logistics and Supply Chain Operations

This module focused on the available and emerging new digitalisation technologies. There was an on-site demonstration of their advanced technology system to provide participants with a deep understanding of the potential and risks of the technologies employed.



## Module 5: Digitalisation for Contract Logistics and Other Warehousing Operations by Geodis

This module focused on how technology can be best integrated into warehousing, storage, and distribution services to streamline processes, bolster demand management, and upgrade forecasting abilities to seamlessly navigate unexpected challenges and situations like the e-commerce boom driven by the pandemic.



## Module 6: Petrochemical Logistics / Digital Security in the Supply Chain

This module focused on cybersecurity issues in relation to supply chain digitalisation. There was also an exchange of digitalisation experiences within the petrochemical industry in Singapore and how they overcame the challenges unique to their landscape. Lastly, Professor Peter Klaus concluded the Logistics Leadership Dialogue Series by sharing his insights and knowledge on the logistics industry.



## CELEBRATING IN PERSON: GRADUATION CEREMONY - CLASS OF 2020 AND 2021



The TUM Asia Graduation Ceremony was held on 7 March and 9 March 2022 for the Class of 2021 and Class of 2020 respectively. Our TUM Asia graduands of the various Bachelor of Science, Master of Science and Specialist Diploma programmes came together across both days to celebrate a highly important milestone – graduation – after a 2-year postponement, due to the COVID-19 pandemic. The celebration was a momentous success, with many of us gathered to commemorate the wonderful occasion.

The ceremony was divided into two sessions per day to limit the number of people gathering, so that everyone could distance themselves socially. During each session, Safe Management Measures (SMMs) were applied and observed to ensure that everyone could enjoy the day safely.

Our special guests of the Graduation Ceremony include Prof. Dr. Wolfgang A. Herrmann, President Emeritus, Technical University of Munich (TUM) and Academic Director of TUM Asia, Professor

John Thong, Deputy President (Academic) and Provost of Singapore Institute of Technology (SIT), representatives from the Embassy of the Federal Republic of Germany to Singapore, professors and representatives from TUM, as well as our partner universities, academic institutions and industry partners.

TUM President Emeritus, Prof. Dr. Wolfgang A. Herrmann, graced the Graduation Ceremony for the Class of 2021. In his incisive words, “the



- ▶ **After two years of pandemic, graduands are finally able to mark their rite of passage for graduation and begin their next phase of journey.**

fact that we can gather physically and safely today embodies the courage and perseverance of mankind, while underscoring the transformational role science and engineering can play in every facet of our lives. Equally significant, all of you have overcome countless difficulties and challenges throughout your studies, which culminates in your triumph and success as a graduate today.”

Dr. Markus Wächter, Managing Director of TUM Asia, delivered a congratulatory message to the graduating Class of 2020. He noted that despite the Covid-19 pandemic, he was immensely proud that our graduates have grown stronger and wiser through these tough times. Graduation is a victory for them, and he hoped that the graduates would continue to strive for the best in future. “The most powerful voice for us to create a better future with is the youth we educate and train. That is why we are now looking to you. Hopefully, you will help us make an impact because you have the knowledge and spirit to overcome all these if we work together.”

As our graduands returned to see familiar faces alike to celebrate the joyous and momentous event of graduation, spirits were high as they cheered one another on, each taking the metaphorical path from graduand to graduate as they went onstage to collect their graduation scroll. All also took the chance to snap memorable

- ▶ **Graduands were in high spirits reuniting with their friends, Professors and mentors they have not seen for a long time.**



“The fact that we can gather physically and safely today embodies the courage and perseverance of mankind, while underscoring the transformational role science and engineering can play in every facet of our lives.”



photographs with their friends and family after their individual ceremonies, which underscored their friendships and happiness at the jubilant occasion.

As all graduates of the Class of 2020 and 2021 emerge ready to take on the challenges of the future in their separate fields, we are sure that the advice of Prof. Hermann still echoes in our minds, “therefore, stay undaunted in

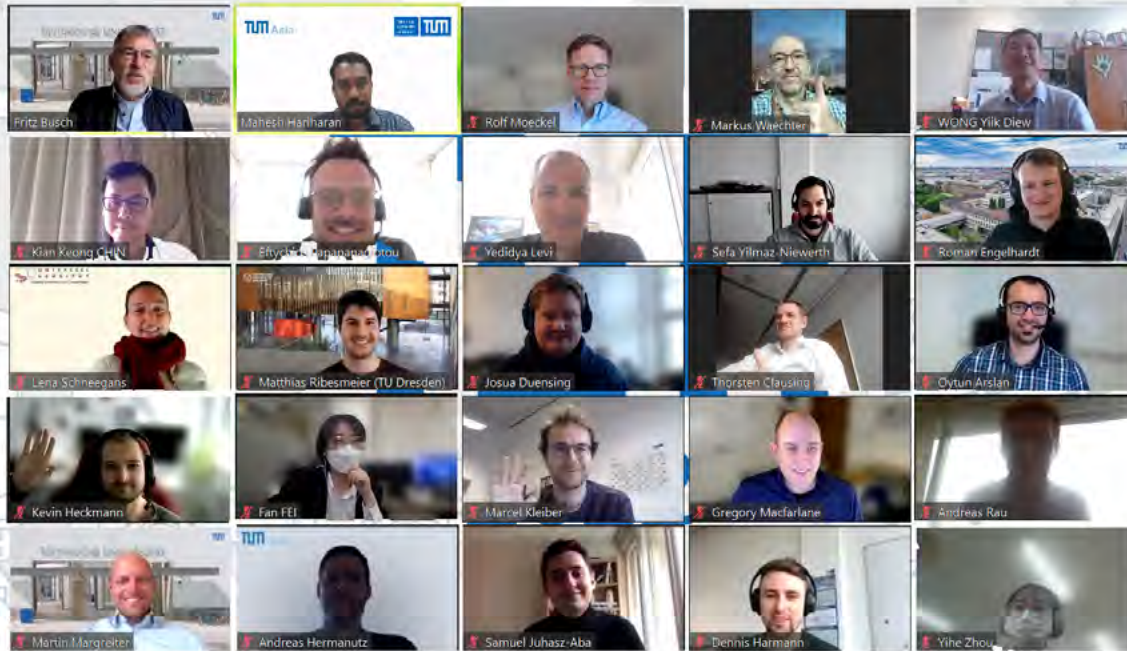
the face of challenges and obstacles, however insurmountable they may seem, for there is always light at the end of every tunnel.” Indeed, we are all enablers of tomorrow, each possessing the knowledge to ignite change, transform society, and shape the world we live in, so as to achieve a better, brighter, and more sustainable future.



► Masks could not hide the families’ smiles as they helped their loved ones wear the traditional academic dress to receive their scrolls on stage.



# MOBIL.TUM 2022: MOBILITY INNOVATIONS FOR GROWING MEGACITIES



- ▶ The 12<sup>th</sup> installment of the mobil.TUM conference was hosted by TUM Asia in Singapore in hybrid form with about 50 scientific papers presented in the conference.

The mobil.TUM 2022 – 12<sup>th</sup> International Scientific Conference on Mobility and Transport was hosted on 5 – 7 April 2022, by TUM Asia in Singapore in hybrid form, bringing together mobility research and innovation from all over the world while offering networking opportunities. The conference theme “Mobility Innovations for Growing Megacities” saw discussions on transit concepts, shared mobility systems, impacts of Intelligent Transportation Systems (ITS) technology, environmental impacts, modelling and simulation, travel behaviour and data analytics. Some highlights of the three-day conference are presented below.

Kicking off the conference was Prof. Barbara Lenz from Humboldt University, addressing

the topic of “The Impact of New Transport Technologies in Metropolitan Areas on Mobility Behaviour”. She also shared some opportunities of new technologies in the mobility sector that will increase the liveability of cities with less motorised traffic, less energy consumption, less pollution and noise, and more public space for people. She cautioned on the risks which included a widening mobility divide, resulting in increased inequality due to increased mobility cost, and a re-configuration of accessibility, as those who cannot adapt to digitalisation fall behind.

The second day of the conference saw the keynote address by Mr Mohamed Mezghani, Secretary General of the International Association of Public Transport (UITP), who introduced the audience



► In a study conducted by Zmud and Sener, 41 per cent of users stated that the reason for not using self-driving vehicles were due to lack of trust in the technology.

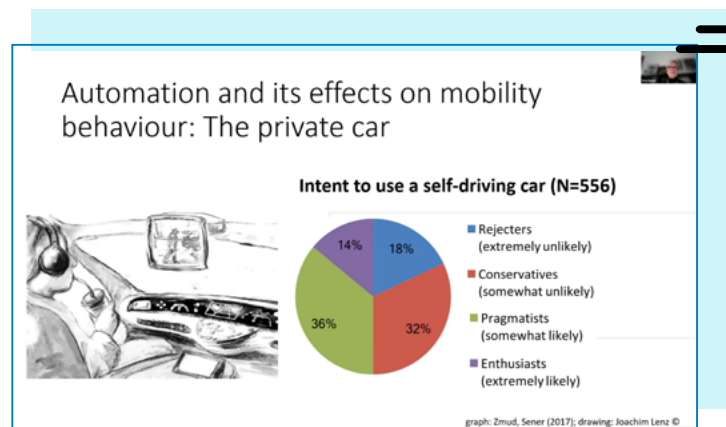
to the changing priorities of the public and urban transport sector. He shared about the impact of the COVID-19 pandemic on public transport. The pandemic exposed the essential nature of public transport, its vulnerability to the sanitation necessities caused by the outbreak, and the undervalued nature of public transport, as public transport is left to fend for itself with insufficient funding. Citing an infographic from American’s National Association of City Transportation Officials (NACTO), Mezghani argued that car lanes are the least efficient in the transport sector in terms of the per-hour movement of commuters. Mezghani also touched on the need for diversification of talent by progressively inviting more women to inform and shape the public transport sector by carving out their careers in this sector.

For the final day of the conference, Chief Engineer Dr. Chin Kian Keong gave a keynote speech titled “Mobility Challenges - Going Beyond Technologies”. He commenced by providing a summary of all the ITS technology currently available. This web of data collection technologies forms a dynamic, real-time picture of the ebb and flow of a population moving through their daily lives. ITS uses the sensors,

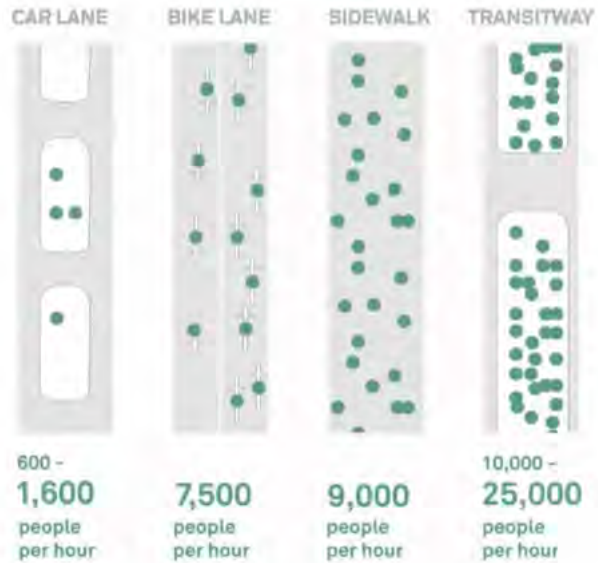
traffic and control systems, and data analytics, to maximise road network efficiency capacity, monitor and manage traffic flow, and make the roads safer.

In the conference, Dr. Chin concurred with Prof. Lenz that an improved land transport system can create a safer, healthier and more liveable environment, filled with vibrant community

► In another study by Zmud and Sener, only 14 per cent out of 556 respondents were enthusiastic about the use of a self-driving car.



## > CITIES FOR PEOPLE



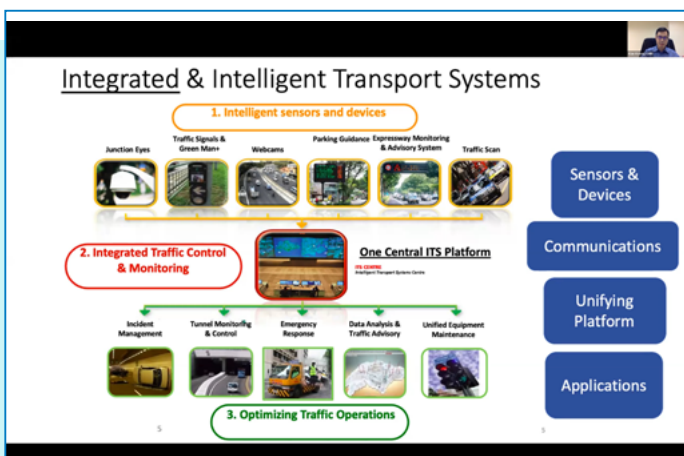
Source: NACTO

In a study by American's National Association of City Transportation Officials (NACTO), Mr Mohamed Mezhani reiterated that car lanes are the least efficient in the transport sector in terms of the per-hour movement of commuters.

spaces. Ultimately, ITS technology is necessary but must attain public acceptance and deliver enhancements to our general quality of life.

Indeed, the mobil.TUM conference can be described as an eye opener that enriches our

knowledge in the mobility and transportation sector. TUM Asia is honoured to be able to host this event and looks forward to future collaborations with research and industry alike.



*Using sensors, traffic and control systems, and data analytics, the Intelligent Transportation Systems (ITS) maximises road network efficiency capacity, monitor and manage traffic flow, and makes the roads safer.*



**Prof. Dr. Rer.Nat. Habil. Barbara Lenz**  
**Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)**

**Impact of New Transport Technologies in Metropolitan Areas on Mobility Behaviour – Opportunities and Risks**

Addressing the topic of the impact of new transport technologies in metropolitan areas on mobility behaviour, Prof. Lenz pointed out that more climate-friendly behaviour is needed with regard to transportation and mobility. She also spoke about the importance of public transport and shared vehicles to reduce environmental impact and also to simultaneously keep car ownership low. She touched on automation technology as well, quoting research from US researchers Zmud and Sener that the main reasons that deter people from using self-driving vehicles were a lack of trust in this technology, and the safety and cost concerns.



**Mr Mohamed Mezghani**  
**The International Association of Public Transport (UITP)**

**Moving Ahead with Transport**

Mr Mohamed Mezghani introduced the audience to the changing priorities of the public and urban transport sector. The beginning of 2022 saw the onset of one of the worst health and sanitation crises that the world has collectively dealt with. The crisis sparked many innovations and brought to the forefront the essentiality of clean air, open spaces, health, social inclusion, among other points. Mezghani then outlined priorities of the transport sector: the need to ensure the resilience of public transport since it is a public good; the need for decarbonisation of public transport, especially in the light of energy supply instability brought about by the current Russia-Ukraine crisis, the need for digitalisation of advanced systems for public transport to reinvent itself through road traffic management and ticketing apps, and the need for public transport to be redefined by introducing both mass public transport and shared private transport options.



**Dr. Chin Kian Keong**  
**Land Transport Authority**

**Mobility Challenges: Going beyond Transport**

Dr. Chin explained that it is important for all ITS systems to be connected to one another so that they are able to provide high quality data. The data gathered by ITS systems must be consistent, accurate, reliable (both spatially and temporally), and exchangeable. Future mobility technology solutions must be safe and secure, efficient, inclusive and equitable, financially and environmentally sustainable.

# SUSTAINABLE FOOD: REVITALISING THE TRADITIONAL FOOD SYSTEM WITH INNOVATION

The current global food system is inherently flawed: as many as two billion people are suffering from micronutrient deficiencies as there are of people who are overweight or obese. The world population is tipped to exceed 9.2 billion in 2050, thus overall food production has to be raised by some 70 per cent between. With more than 70 per cent of the water extracted from nature to support the food system, generating up to a third of human greenhouse gas emissions, the pressure our current food system places on our environment is already putting a visible strain on our climate. Conversations on improving our food system are ongoing but have largely revolved around agricultural or diet challenges and these are only parts of the fragmented global food system. To secure a sustainable food system, we need to use a more holistic lens that shed light on the entire value chain - not just production and consumption, but also food processing, packaging, transport, retail and food services.



**1/3 GREENHOUSE GAS EMISSIONS** are derived from global food systems.



**70%** of water is extracted from nature to support the food system.



**38%** of the total food waste (est. 1.6 billion tonnes as primary product equivalents) come from by-products produced from food industries.



**HALF HABITABLE LAND** are used for agriculture.



**94%** of mammal biomass are feedstock. Livestock outweigh wild mammals by 15-to-1.



**77%** of farming land are used for livestock, producing only 37% of total protein.



**18%** of food emissions come from supply chains.



**59.9 MILLION TONS OF CO<sub>2</sub> EMISSIONS** generated from the production of pulp and paper used for packaging.



**1/3 OF FOOD PRODUCED** for human consumption every year - (1.3 billion tonnes) - are wasted.



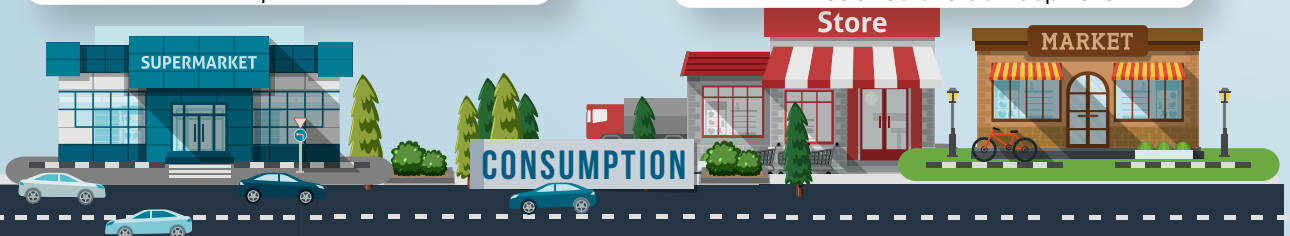
**8.3 POUNDS** of methane released into the atmosphere for every 100 pounds of food waste.



**1 IN 3 PEOPLE** in the world (2.37 billion) did not have access to adequate food in 2020.



**80 TIMES** the warming power of Methane over Carbon Dioxide in the first 20 years after it reaches the atmosphere.



# CONSUMPTION

The current global food systems face the challenge of producing enough food for a growing population. Compounded by extreme weathers due to climate change, the traditional agricultural model is no longer sustainable. The introduction of novel food has grown in popularity in response to the growing call for sustainable food production as advances in novel food production have demonstrated potential solutions to reduce environmental impacts of the food production and supply chains, while meeting the demands for food with beneficial effects on health.

# PRODUCTION

The traditional agriculture model is one of the biggest contributors to carbon emissions, leaving a set of collateral damage in its wake such as land degradation and deforestation, over-extraction of groundwater, emission of greenhouse gases, loss of biodiversity, and nitrate pollution of water bodies. Using technologies like Internet of Things (IoT), robotics, drones and artificial intelligence to perform essential tasks such as monitoring of water level, and irrigation efficiency, smart farming increases the quantity and quality of products while optimising resources and minimising environmental impact.



# DISTRIBUTION

The distribution of food to consumers is dependent on a number of different enablers such as producers, assemblers, importers, and transporters which require infrastructure, facilities and regulations to guide and govern their decisions. The lack of markets and inadequate transportation to markets have caused inequitable distribution of food, which in turn lead to food loss and waste. With the use of virtual inventories, supply chains can be streamlined by establishing an inventory across multiple locations and picking the most appropriate location to dispatch delivery accordingly. Drivers are able to improve delivery times, by managing schedules and routes more effectively. Through IOT devices, temperature and humidity can be measured, monitored, and remotely controlled so as to keep the produce from turning to waste.

# PROCESSING

The traditional food processing methods generate high levels of waste and by-products, which could cause a negative environmental impact and significant expenses. However, these bio-materials are a source of valuable nutrients such as proteins, lipids, starch and micronutrients. TUMCREATE is leading a research programme, Proteins4Singapore, that uses novel food process to secure a sustainable proteins supply in Singapore. Using additive manufacturing and novel reverse food engineering, by-products and wastes are converted into sustainable proteins that are palatable and aesthetically pleasing, thus minimising waste in food processing.

# PROTEINS4SINGAPORE: SECURING SUSTAINABLE PROTEIN SUPPLY THROUGH NOVEL REVERSE FOOD ENGINEERING AND ADDITIVE MANUFACTURING



- ▶ The two leading Principal Investigators (PI) Prof. Dr.-Ing Thomas Becker, Chair of Brewing and Beverage Technology, Technical University of Munich (TUM); and Prof. Peter Preiser, Associate Vice President (Biomedical and Life Sciences), Nanyang Technological University (NTU) Professor; will be heading the Proteins4Singapore research programme in Singapore.

TUMCREATE, a multidisciplinary research platform of the Technical University of Munich (TUM) at the Singapore campus, will lead the scientific research programme, Proteins4Singapore, to explore and secure sustainable sources of protein supply for food production in Singapore. This will potentially open new doors for commercialisation opportunities using novel reverse food engineering and additive manufacturing approaches. Harnessing world-class expertise in material science, process engineering and food chemistry from leading academic and research institutions - TUM, Nanyang Technological University (NTU), Singapore Institute of Technology (SIT) and Agency for Science, Technology and Research (A\*STAR) - the research programme propels forward a new generation of proteins that is nutritious and palatable.

SOURCE:

[https://www.fao.org/fileadmin/templates/wsfs/docs/expert\\_paper/How\\_to\\_Feed\\_the\\_World\\_in\\_2050.pdf](https://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf)

<https://www.todayonline.com/commentary/singapores-30-30-food-production-target-it-feasible>

<https://www.ourfoodfuture.gov.sg/30by30>

<https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html#:~:text=By%202030%2C%20the%20world%20is,located%20in%20Asia%20and%20Africa.>

The research will combine alternative protein sources, like micro-algae, protein-rich crops, or side-streams from aquaculture, on indoor farming concepts independent from arable land and climate change. These new protein sources will be integrated into innovative processing methods to facilitate a new generation of proteins.

Funded by National Research Foundation (NRF), the research also explores cutting-edge sustainable methods to derive protein sources from conventional side streams and revolutionise the way food is produced traditionally by creating food of highly defined textural, sensory and nutritional qualities. The first phase of its research will begin by employing vertical soybean and micro-algae farming to obtain a perfectly suited protein quality mix from various protein sources.

Launched today at CREATE tower, the Proteins4Singapore Kick-Off event saw 50 scientists of interdisciplinary research facilities convening in a series of networking and dialogue sessions to share their latest research findings and to foster closer collaborations in food research.

#### **Keeping pace with rising global population**

With the world's population tipped to exceed 9.2 billion in 2050, there is an urgent need to provide food to the growing population amid mounting challenges such as climate crisis, ongoing urbanisation, depletion of the agricultural landscape, unexpected and disruptive events such as the COVID-19 pandemic.

Singapore, with only one per cent of its land available for food production, relies heavily on global supply chains for food. In 2020, the nation only produces 10 per cent of its food locally while importing 90 per cent of local food consumption from 170 countries. The inherent vulnerability of

its food supply chain and the volatilities the food supply chain is subjected to have consequently urged the nation to push forward with its “30 by 30” plan of producing 30 per cent of Singapore's nutritional needs by 2030.

#### **Bridging food security gap amid challenges**

Against this backdrop, Proteins4Singapore will catalyse the scientific understanding of the relationship between proteins and their structural function and discover more about their aroma, taste and texture interactions. The completion of the research offers promising solutions to address one of the world's most complex challenges. In addition, the technologies emerging from this research will also provide new business opportunities in Singapore while strengthening its food supply. The United Nations projected that by 2030, there will be 43 megacities exceeding 10 million people, while 68 per cent of the 10 billion global population will live in urban areas. Thus, the unique position that Singapore is in will serve as a blueprint for globally relevant scenarios to supply nutritious food to a densely populated but land-limited urban population.

TUMCREATE's CEO, Professor Dr.-Ing. Ulf Schlichtmann said, “The Proteins4Singapore research programme holds great potential in unlocking clues and accelerating our understanding towards the formation and interactions of proteins while offering life-changing technologies to secure a sustainable





*“The Proteins4Singapore research programme holds great potential in unlocking clues and accelerating our understanding towards the formation and interactions of proteins while offering life-changing technologies to secure a sustainable protein supply, which will make a difference for people in Singapore and other megacities.”*

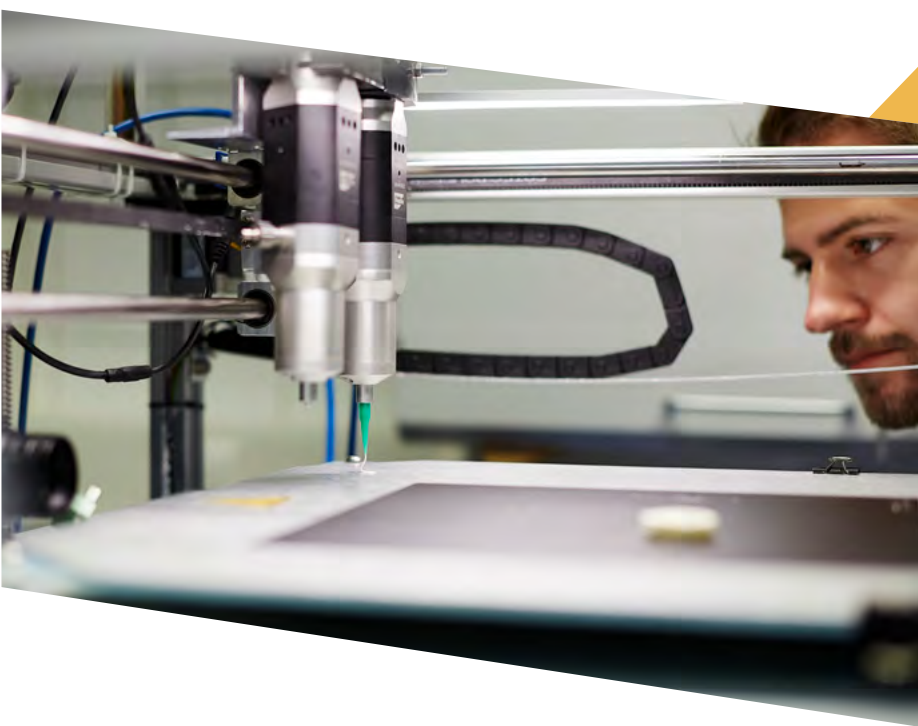
protein supply, which will make a difference for people in Singapore and other megacities. The deep collaboration fostered between the institutions straddling world-class expertise across a range of disciplines that TUMCREATE spearheads will pave the way towards a robust scientific research ecosystem essential to generate scientific breakthroughs to confront future challenges.”

**Facilitating a new generation of proteins**

At its core, the research will combine alternative protein sources like micro-algae, protein-rich crops, or side-streams from aquaculture, on indoor farming concepts independent from arable land and climate change. These new protein sources will be integrated into innovative processing methods to facilitate a new generation of proteins. One of them is the use of novel reverse food engineering. This technique breaks down and separates food products into individual components to produce food with pleasant textures and improved sensory

impressions - a critical step in creating nutritious and high-quality food products that has yet to be commercialised in the market.

Another is the use of integrative and innovative extrusion systems in combination with 3D printing techniques to lead to large-scale, as well as decentralised production capabilities for plant protein-based foods with highly controlled and defined sensory perception functions. The formation of realistic textures similar to conventionally textured food will greatly improve consumer perception of such novel food products. Drawing expertise from different disciplines in material science, process engineering and food chemistry, the research will focus on establishing links between protein functionality, proteins’ interactions with other ingredients, sensory qualities, and the inherent processing methods using fundamental and application-based analytic techniques.



**Another is the use of integrative and innovative extrusion systems in combination with 3D printing techniques to lead to large-scale, as well as decentralised production capabilities for plant protein-based foods with highly controlled and defined sensory perception functions.**

# SPEEDCARGO: TRANSFORMING THE AIR- CARGO INDUSTRY WITH A.I. AND ROBOTICS



*Automation exists in nearly every facet of our lives now, but not so much in the air cargo industry. Due to air cargo's high-mix and high-volume nature, cargo palletisation remains an arduous and laborious process done manually to better maximise every nook and cranny of capacity. Like piecing a jigsaw puzzle with pieces that do not fit, freight forwarders have to plan to optimise the capacity with a wide array of cargo that includes hazardous cargo, overlength cargo, heavy cargo, live animals, and perishables. Yet as the air-cargo industry continues to be beset by such operational challenges coupled with global challenges that threaten to rip global supply chains apart, freight forwarders are still mired in the old ways of working. SPEEDCARGO, a start-up borne out of TUMCREATE's initial prototype development, has developed products for digitisation, optimisation and automation of the air cargo handling process using computer vision, artificial intelligence (AI), advanced mathematics and robotic technologies.*



▲ With more than a decade at TUM and a PhD in Robotics and AI under his belt, Dr. Suraj Nair's research endeavours have taken him through an impressive number of robotics projects in the automotive, ICT, medical and aerospace sectors as well as several large-scale European robotics projects.

The brainchild behind SPEEDCARGO is Dr. Suraj Nair. With more than a decade at the Technical University of Munich (TUM) and a PhD in Robotics and AI under his belt, his research endeavours have taken him through an impressive number of robotics projects in the automotive, Infocomm Technology (ICT), medical and aerospace sectors as well as several large-scale European robotics projects. In 2015, his unyielding passion for robotics brought him to Singapore when an opportunity presented itself - an opportunity that could potentially transform the global air-cargo industry in which he would play a central role.

#### **The beginning of a research**

"The palletisation of cargo is very backward as everything is done manually. With computer vision, complex mathematics, AI and robotics, cargo palletisation can be digitised and optimised first, and eventually automated, which will address the non-standardised cargo shipment category with high variation in cargo shapes, dimensions, materials, and weight. Automation will increase productivity, work safety, and security, and upgrade job profiles needed within the aviation cargo industry. We managed to secure the funding from the Civil Aviation Authority of Singapore (CAAS) for technology development and National Research Foundation for productisation," Suraj shared.

Throughout the five years, Suraj and his team worked on the ground to gain an incisive understanding of the entire air-cargo operations from the ground handlers and airlines. Over the past five years, the earnest search for insights enabled them to know its operations inside out, culminating in digitisation and optimisation, as well as automation solutions that will reduce revenue leakage, improve productivity, maximise efficiency, optimise operations, and improve business performance.

"When we completed the project in 2018, we received many good reviews by industry players such as Singapore Airlines, Dubai National Air Travel Agency (dnata), Changi Airport Group, DHL, and SATS. The technologies have since evolved based on industry feedback. And SPEEDCARGO was born," Suraj said with satisfaction.

#### **The beginning of an enterprise**

Since the research project has taken off, Suraj has been plunged into a whirlwind of activities involved in securing investments from investors and buy-ins from clients. The successful research output has also dropped him into a new terrain that put his newly acquired entrepreneurial skills to the test.

"Start-ups are extremely difficult playing field. There is a reason why nine out of 10 start-ups fail and why 90 per cent of failed start-ups fail extremely fast. The hardest part of start-ups is not the technologies, but building the product market fit and developing the business around that," Suraj shared.

► SPEEDCARGO has developed products for each of these stages: digitisation, optimisation and automation using computer vision, AI, advanced mathematics and robotics technologies.



***“The hardest part of start-ups is not the technologies, but building the product market fit and developing the business around that.”***



Unlike well-established companies, start-ups lack customer databases, business contacts, staff and funding even while organisational structures are still underway. On top of such fundamental challenges, founders are required to double hat as domain experts and generalists to perform various tasks while making decisions on the fly.

“It is always about looking ahead. Good start-ups are the ones that know the problems to avoid by pivoting in time - this is the DNA of start-ups. I recall this incident where there was no stock for a specific specialised camera model in the market. We had to work closely with our partner to help create the possibility to source directly from the manufacturers where our partner had to prioritise us for getting stock. This was a strategic and lobbying exercise,” recounted Suraj.

When it comes to his business philosophy, he does not believe in making the right decisions but believes in making them right. Despite hailing from a technology background, Suraj has developed the sharp business acumen necessary to navigate this new terrain.

“We have to have an entrepreneurial mindset and do whatever that is thrown at us. The process of securing funding has taught me a lot about the ins and outs of managing a business. My time at TUM has certainly helped equip me with the necessary technology competencies. I am privileged to have worked with Prof. Dr.-Ing. habil. Alois Christian Knoll, a very commercially driven Professor. Because of the experiences and opportunities gained from working on various large-scale projects alongside him and the robust innovation ecosystem TUM provides, I established good business networks with people from different industries whom I could rely upon for solutions,” Suraj shared.

The road that lies ahead may be fraught with uncertainties and constant upheavals, but Suraj has grand plans for this up-and-rising-fast start-up.



## FACES OF TUM ASIA

In this section, we shine the spotlight on inspiring alumni and Professors who valiantly pursued their passion and found a firm foothold in their respective arenas.



## DR. RONNY SONDJAJA: THE CULTURE WHIZZ WHO LEADS BEYOND CHEMISTRY

Stepping into the doors of Evonik’s newly opened Research Hub, one would be greeted by the open-concept space tastefully decorated in warm tones interspersed with lush greenery, making one feel inevitably welcome. This is the work of a master at his best – inspiring co-innovation in a culturally synergistic organisation.

“The Research Hub is the first to be opened in Singapore by Evonik with the aim of co-creation and co-innovation to generate ground-breaking research in various domains – tissue engineering, advanced biomedical, additive manufacturing, and other sustainability-driven topics. Thus, when I set up the Research Hub, I intentionally redesigned it with creativity in mind and created spaces for researchers from different domains to collaborate and innovate, breaking away from the traditional mould of white labs. I want to build a diverse culture of innovation. Thus, I do not want to create an atmosphere with a hierarchical difference between managers and technicians. I believe in building a community of

scientists to trigger collaborations and inspire open discussion with one another,” said Ronny.

At 43, Dr. Ronny Sondjaja is already a well-established leader in the chemicals industry, adept at managing people from diverse backgrounds, nationalities, specialisations, and cultures. Ronny currently oversees more than a hundred researchers across several business lines in cities such as Mumbai and Shanghai. This rare leadership skill did not come naturally.

“The international exposure I have gained from my joint degrees from the Technical University of Munich (TUM) and the National University of Singapore (NUS) has taught me to navigate



- ▶ **Having graduated from TUM Asia in MSc in Industrial Chemistry in 2004, Dr. Ronny Sondjaja has since pursued a doctoral degree and progressively advanced in his career at Evonik, helming multiple leadership roles in different countries.**

the different cultural nuances in an international environment. One of the reasons I got the job from Evonik was due to my learning experiences in Germany, Singapore and USA. It equipped me in my first role as Product Development Manager for Evonik's Business Line Oil Additives in which its activities span across Germany, Singapore and the USA," said Ronny.

#### **Evonik: diversifying beyond chemistry**

As Evonik embarks on the next phase of its strategic transformation, the chemicals giant is increasingly diversifying its portfolio beyond chemistry to mainly in three growth divisions: Specialty Additives, Nutrition & Care, and Smart Materials. With a dizzying array of research activities spanning from chemicals, special additives, nutrition and care to automotive, the cultural and professional diversities within the team would undoubtedly obfuscate any organisational dynamics.

Beyond this complex web of cultures, professions and personalities, Ronny is instrumental in creating a synergy of innovative spirit out of diversity to take root in the culture of Evonik,

where co-creation and co-innovation are bound to happen.

"The diversity of the team is manifested. We are a speciality chemicals company that leads beyond chemistry, with a diverse technology portfolio, to bring next generation solutions for sustainability. With that motto, our team is made up of multi-diverse researchers, not only chemists but as well as engineers, biologists and even data scientists. There is also the diversity of ideas and perspectives of every individual while taking into consideration the working style. Because of the international exposure I gained during my studies, I have always liked the fact that I have developed an appreciation for multi-cultures and their nuances and the know-how to use the diversity to strengthen our co-innovation spirit and grow the team together. At TUM Asia, I was able to learn from Professors from both Germany and Singapore, who have uniquely distinct teaching styles. It became a training ground for me to be agile and adapt to their teaching styles," explained Ronny.

The merits of a joint degree - in which Ronny



► **Dr. Ronny Sondjaja continues to nurture students of TUM Asia through sponsorships and industrial visits to broaden their horizons.**

developed an appreciation and understanding of the twin perspectives and working styles of Germans and Asians - provided the soil for his career to flourish. Since receiving the offer to work as a Product Development Manager at Evonik, Ronny has progressively advanced in his career, helming multiple leadership roles in different countries. While this would require some to muster the courage to take the leap of faith to jump cities, Ronny - a globetrotter with a larger-than-life personality, simply tried to reorient himself to the various cities he finds himself stationed at.

Naturally, the challenges grew as his role expanded.

**Complementing differences to achieve synergy**

“If I look back at what I did at the very beginning of my career, the challenge was very much focused on the scope of work. The challenge then was creating a new product and successfully bringing it to the market. With the growth of my career development, the challenge is now different. Apart from taking care of the R&D team of the entire Asia, the greater challenge is how we can nurture the strong co-innovation spirit and strengthen our R&D presence with the focus on

developing next generation technology solutions to reach our ambitious sustainability target. I think it’s all about complementing the different mindsets to achieve the greatest output, and this is something that I enjoy doing tremendously,” quipped Ronny.

Since the opening of Evonik Asia’s Research Hub in Singapore, the research team has grown from 20 researchers to more than 90 employees coming from 14 countries of origin. The stellar performance record of Ronny as the Vice President and Head of Research at Evonik, Asia, epitomises the qualities of a leader required to tread the intricacies in an international environment effectively.

**Business mantra: Performance first, but with empathy**

“My mantra has always been performance first. We can’t win without performance. Whatever things we need to do, we have to do it with high-quality and high-performance output. At the same time, we need to exercise empathy by putting ourselves in somebody’s shoes. We want to address needs and solve problems, but it can’t solely be performance-oriented without truly



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DR. RONNY SONDJAJA • PIONEER GRADUATE OF MSC IN INDUSTRIAL CHEMISTRY IN 2004  
• VICE PRESIDENT - REGION ASIA • RESEARCH, DEVELOPMENT & INNOVATION •  
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*“My mantra has always been performance first. We can’t win without performance. Whatever things we need to do, we have to do it with high-quality and high-performance output. At the same time, we need to exercise empathy by putting ourselves in somebody’s shoes. We want to address needs and solve problems, but it can’t solely be performance-oriented without truly empathising with other people’s problems.”*

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empathising with other people’s problems,” Ronny shared.

With climate change taking a toll on different facets of life, Ronny understands the gravity of the role Evonik and the researchers play in creating a sustainable future. While that might entail a task as impossible as it seems, for Ronny, it creates endless opportunities to change the world for the better.

“Evonik envisions itself leading beyond chemistry with sustainability at its core. I believe this is something we have to grow further. The fact that we are aligning all fronts in this direction - by establishing our presence in different areas while reducing our carbon footprint - is a direction that aligns with what the world needs and resonates with my beliefs. I am glad to be part of the transformation,” Ronny shared.



***“The greater challenge is how we could nurture the strong co-innovation spirit and strengthen our R&D presence with the focus on developing next generation technology solution to reach our ambitious sustainability target.”***

# MS ANBUMALAR MANICKAM: MASTER JUGGLER OF MOTHERHOOD AND WORK



- ▶ Since graduated as the pioneer cohort in Master of Science in Microelectronics, Ms Anbumalar Manickam continue to stay in the semiconductor industry, working as a Programme Manager while enjoying the joys of motherhood.

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A passionate individual determined to make a promising career in the semiconductor industry while performing the balancing act of juggling between family and work, is Ms Anbumalar Manickam, or endearingly known as Malar, whom TUM Asia had the pleasure to find out more about her.

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Having graduated with a Bachelor's degree in Engineering, Ms Malar Manickam was clear about where she wanted to begin her career: the semiconductor industry. The question was whether to continue her education and which programme she should choose.

"I was battling between the choice of pursuing a PhD or a Master's. The Master of Science in Microelectronics conferred by Nanyang Technological University (NTU) and the Technical University of Munich (TUM) caught my eye as it encompasses the breadth and depth of the study in the field of semiconductors.. It gave me the opportunity to learn everything about the industry and bridge the gap in academic and industrial knowledge."

When she learned that she was awarded a scholarship by this programme, "hard work truly pays off. My attachment to Germany as a result of the scholarship proved to be an extremely eye-opening experience. I met several passionate individuals in this field and had the first encounter of working between a semiconductor industry."

Enamoured by the technologies and the pace of the semiconductor industry, Malar did not waste any time securing her first career as a research engineer at Agency for Science,

Technology and Research (A\*Star). Not long after, she was at the crossroads of her life, and this time, it was harder for her to choose.

"After working at A\*Star for two and a half years, I had the choice of pursuing a PhD which would invariably propel my career forward, or thrust myself into a challenging and fast paced environment of this industry. I chose to join Micron Technology," said Malar.

It was a decision that placed her right in the heart of the semiconductor action.

"Starting my career in A\*Star allowed me to understand the cleanroom environment and obtain hands-on experience on the process and steps involved to produce various devices. It was usually project-based and served as a learning opportunity as we were given time to understand before moving forward. However, in Micron Technology, it was a different ball game. I did research in the US, where Micron Technology is headquartered, in which we brought the new technologies to Singapore for mass production. The environment in Singapore was extremely fast paced as we needed to ensure that we had a good head start in the competitive market. Witnessing the technology that I had a part in researching coming to fruition was extremely heartening, and it was one of the best parts of my career,"



**"Hard work truly pays off. My attachment to Germany as a result of the scholarship proved to be an extremely eye opening experience. I met several passionate individuals in this field and had the first encounter of working in a semiconductor industry."**

**“I joined the training team because I wanted to pass down the knowledge I’ve learnt to the new hires. This is where the knowledge and experience I have amassed at TUM Asia came in handy. I was able to apply that knowledge and the experience I acquired through working in Micron, to share information with a personal touch.”**



said Malar.

Reminiscing the frenetic days, she recalled, “There was once where the results were completely off the charts. We were baffled by the results and it was a moment of immense pressure. I managed to shut myself off from every distraction, sit down and focus on the problem. Thankfully, we managed to address it and come up with a working solution,” explained Malar.

“Looking back, the challenges I have encountered taught me never to give up, however insurmountable the problem might be. At that moment, it might appear unsolvable but we just need to persevere past that to obtain a solution,” said Malar.

Beyond research engineering, Malar had the opportunity to nurture a new generation of semiconductor enablers as well as career switchers.

“I joined the training team because I wanted to pass down the knowledge I’ve learnt to the new hires. This is where the knowledge and experience I have amassed at TUM Asia came in handy. I was able to apply that knowledge and the experience I acquired through

working in Micron, to share information with a personal touch,” said Malar.

“It’s been more than a decade since I joined the semiconductor industry. The major change that I have seen or experienced was that, in the past, the engineers would have to personally see to the nuts and bolts of the processes. Today with automation, nearly all configurations can be tweaked via a computer interface. Personally, the exhilaration of working hands-on is something that I will always remember,” reminisced Malar.

Having experienced all levels of action – from research to training and now programme management, Malar is well positioned to take on the overseer’s role to direct and nurture others.

When asked about her future, “Research engineering can be very unpredictable but exciting, and I love the adrenaline rush. On the other hand, I always felt that the management’s role of nurturing the new generation of leaders is something that I enjoy doing and now that I am beginning to have a family, I think it is a perfect situation to embark on this,” said Malar.

## DR. ASWIN HARIDAS: DOCTOR OF STRUCTURES



- ▶ At TESTIA GmbH, Dr Aswin Haridas helms the role of a Non-Destructive Testing (NDT) Engineer specialising in Structural Health Monitoring (SHM), gathering and making sense of data from sensors attached to structures.

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If anyone pondered the possibilities of careers that an Aerospace Engineering degree could lead to, a medical doctor would not have been one of them. Oddly, with a Master of Science in Aerospace Engineering and a PhD in Optical Non-Destructive Testing under his belt, Dr. Aswin Haridas has become a doctor of sorts in the aerospace industry: monitoring the health of different aircraft structures.

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“I would call myself the doctor of structures,” quipped Aswin, a gregarious person with an infectious smile and a fiery passion to boot. Speaking favourably of the things he does at TESTIA GmbH, an Airbus company, there is no doubt that this is exactly his calling.

At TESTIA GmbH, Aswin helms the role of a Non-Destructive Testing (NDT) Engineer specialising in Structural Health Monitoring (SHM). Together with his team, Aswin and his team gather and make sense of the data collected from sensors attached to such infrastructure as wind turbines

and aircraft structures. From the data, they are able to monitor the structural health and come up with prognostic or diagnostic solutions accordingly. Being privy to the innermost workings of structures, they are able to determine if structural damage has occurred and precisely when and where the damage occurs.

Structural health monitoring (SHM) comes to the fore in the aerospace industry as new structural materials and aeronautical technologies become increasingly effective. To enhance aviation safety while optimising structural integrity, SHM is vital in monitoring external impacts and loads and



- ▶ Since attaining his Master of Science in Aerospace Engineering in 2015, Aswin proceeded to pursue an industrial Ph.D. with Nanyang technological University and Rolls Royce Singapore and has been working at TESTIA ever since.

detecting possible damage to structures.

In retrospect, it probably did not occur to Aswin that he would become part of the essential apparatus to keep aeroplanes from malfunctioning when he was at TUM Asia.

“I still remember it as if it had happened yesterday that Prof. Dr.-Ing Horst Baier said that there is no hangar in the sky to check if the aircraft malfunctioned. That sentiment stuck with me permanently,” recalled Aswin.

Unlike any other, this sentiment became a desire in him to transform the way the aerospace industry works. The epiphany did not come overnight, and like everyone else who was fresh out of college, he too was clueless about what he wanted to do.

“I had the option of heading to Europe or Singapore to pursue an Aerospace Engineering

degree. It was also 2012 when the world was smaller, and the internet connection was not as easily accessible. Thus, the prospect of residing in an entirely foreign land, worlds apart from my family, can be quite intimidating. Conversely, TUM Asia allowed me to experience two uniquely distinct cultures in an environment that wasn't too different from mine. Moreover, I was closer to home from Singapore.”

“If there was one thing I was certain about achieving from my master's degree, it was to gain a holistic understanding and appreciation of the various specialisations of aerospace engineering. And I was glad that I chose TUM Asia because the course gave me a comprehensive understanding of every aspect of aerospace engineering. It was as though I went into the course with a sketchy image of an empty aircraft. With every module completed, I was able to furnish this imaginary aircraft with a new part. By the end of the course, I had a full image of the aircraft complete with its



**In one of the Alumni Network events organised by TUM Asia, I met Prof. Dr.-Ing Horst Baier. We had a lively discussion about rockets and aeroplanes while reminiscing about the good times at TUM Asia. These conversations remain fresh in my mind and will continue to inspire my course of work.”**

nuts and bolts,” continued Dr. Aswin.

Beyond the technical knowledge he gained at TUM Asia, he learned something more precious than what books alone could teach.

“The best thing about my learning journey at TUM Asia was the opportunity to embrace and learn from people from different cultures and perspectives. There were platforms for us to openly exchange our ideas, which greatly broadened my perspectives. In one of the Alumni Network events organised by TUM Asia, I met Prof. Dr.-Ing Horst Baier. We had a lively discussion about rockets and aeroplanes while reminiscing about the good times at TUM Asia. These conversations remain fresh in my mind and will continue to inspire my course of work,” mused Aswin.

Fulfilling the maxim that life is incomplete without education, Aswin proceeded to pursue an industrial Ph.D. with Nanyang Technological

University and Rolls Royce Singapore. His impressive academic and professional pedigree enabled him to provide sound technical advice to decision makers, propelling his career to new heights. He has been working at TESTIA ever since.

“Aerospace engineering is still a very conservative industry. There are not a lot of sensors in the aircraft. Although we have damage monitoring to monitor structural damages and sensors to monitor the operational parameters such as humidity and temperature within the cabin, which gives us insights into the health of the cabin, monitoring is predominantly and much more prevalent within the cabin than outside of the cabin,” Aswin explained.

“There is a plethora of factors to consider before installing any sensors. For instance, if we were to install sensors on the wings of an aircraft, they must be appropriately placed so that they do not create any electric interference and be of suitable



materials, lest they cause any ignition. There is always a string of discussions with different stakeholders, possible scenarios to explore, and case studies to learn from to ensure the decision to place any sensors is carefully deliberated and extensively tested,” Aswin continued.

Because of the potential risks, the introduction of new sensors takes a long lead time of testing before it is approved. And Aswin plans to change that.

In his recent working endeavour, he intends to identify and develop NDT and SHM solutions not just for aerospace industries but also for automotive, civil and energy industries.

“Every structure requires monitoring, and the key question is, why do we need to monitor them? It is important to define the objective we want to achieve, and the goals we have in mind affect the types of sensors we use in the structures. What I am trying to achieve here is to speed up the process of sussing out the optimal set of sensors by using my knowledge of the other industries and apply the insights I

have gleaned back to the aerospace industry,” shared Aswin.

At this juncture, it is evident that Aswin is poised to check off all the requisites that mark the rite of passage towards success.

► **Memories relived: Dr. Aswin together with his classmates at TUM Asia.**





## DR. HEMADRI HARISH: THE WELL-CONNECTED LOGISTICS GURU



► *Mr Hemadri Harish, Pioneer Graduate, MSc in Transport and Logistics in 2012*

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Even after accumulating a wealth of work experiences in various capacities and a Master of Business Administration, Dr. Hemadri Harish chose to start from ground zero, pursuing a Master of Science in Transport & Logistics at the Technical University of Munich (TUM) Asia - where his calling truly begins.

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“I had secured an offer from the Technical University of Munich (TUM), but when I learned that TUM was opening a campus in Singapore, I thought, why not? So, I’ve changed my destination and came to Singapore,” quipped Harish.

With the relevant degree in hand, he managed to gain an inroad into the supply chain industry, securing an internship at DB Schenker. Since then, his affinity with the supply chain industry has only deepened.

“Somehow, I would always be connected to the supply chain industry no matter where I am. After my internship with DB Schenker, I went back to India and started working at a technology company as a Manager handling a lot of US and European customers, before starting my own

supply chain technology firm. In 2014. After selling the firm to investors, I joined a technology firm as part of core top management mooring to the supply chain business by building products and services relevant to the future growth of the industry. Even today, as I work as a Director - Digital Transformation in Chainsys Middle East focusing on the European, Middle Eastern and African regions, I am still very much attached to the industry,” explained Harish.

His resume of career adventures - working as an intern at DB Schenker, founding a start-up firm, and now helming the role of Director providing end-to-end technology solutions to supply chain companies of varying sizes - had been so rich that it established his status within the supply chain arena. He credits much of his success to the connections he has kept alive and the Professors

of TUM Asia who taught him beyond book knowledge.

“The Professors who taught us at TUM Asia are truly industry experts with a treasure trove of experiences. The lessons were one of the best things I experienced at TUM Asia. Till today, I am glad that we still keep in touch. These connections have brought about some unexpected rewards as well. Apart from providing me with career advice, the Professors had even referred me to businesses,” Harish shared.

Having travelled across the globe, taking on roles as diverse as the places he has been, Hemadri has a multitude of diverse experiences that could easily fill a book. Possessed of an acute sensitivity to every pulse of technological and business trends, Hemadri has a playbook on which he largely bases his actions: “keep things simple”.

With globalisation, increased product complexity and heightened customer demands taking supply chain businesses by storm, companies are leveraging technologies to transform their supply chain. Hemadri plays a central role in revitalising the supply chain companies by providing them with a set of differentiated technology solutions that hinges on the use of big data, cloud computing, Artificial Intelligence (AI), Robotic Process Automation (RPA) and the Internet of Things (IoT), to address some of the most pertinent problems that beleaguer companies today.

“There are so many technology solutions we have in today’s era. But we tend to forget that not everyone is savvy about the language. It can get complicated for them to understand all the functions of the technology solutions. So I believe in listening to understand clients’ needs and cutting through the noise to provide the most straightforward and simple solutions to alleviate

their problems. We project a realistic reduction so that they know what to expect from these technological solutions,” explained Harish.

It was not always a bed of roses as he learned to navigate through the complex web of the supply chain industry. But he has also come to a fuller appreciation of how failures are the mother of success.

“Throughout my career, I’ve met with setbacks, experienced the bitter taste of failure, and enjoyed the fruits of my labour. As a result, I have grown from these tribulations, and I have learnt to take setbacks with a pinch of salt. Rather than dwelling on misery, I learned to move on quickly and find solutions no matter how big the problems are,” said Harish.

Harish explained, “No doubt the supply chain has weathered some of the most tumultuous storms. But it has always evolved with time, with better and more technology solutions coming into play. It has stood the test of time, in which it evolved from its archaic days to what it is today. Thanks to the technologies that we have today - data analytics, machine learning, and AI - we can deliver insights to drive efficiencies and boost performances. I am privileged to be part of this transformation, providing such technological solutions to improve the supply chains of businesses.”

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**HEMADRI HARISH • DIRECTOR, DIGITAL TRANSFORMATION, EMEA REGION . CHAINSYS MIDDLE EAST**

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*“The Professors who taught us at TUM Asia are truly industry experts with a treasure trove of experiences. The lessons were one of the best things I experienced at TUM Asia. Till today, I am glad that we still keep in touch.”*

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## **PROF. FRITZ KÜHN: THE CHEMISTRY STALWART WHO DEDICATES HIMSELF TO A LIFETIME OF TEACHING**

Having worked on organometallic chemistry and catalysis all his professional life, Prof. Kühn dedicates his life to science through his research work in mapping the mechanistic behaviour and the practical and industrial uses of efficient catalysts with the examination of the sustainability and environmental impact of the catalytic processes of prime importance. Like many young scientists, he was drawn to teaching and worked towards Professorship.

“When I was young, I wanted to become a Professor. Although my parents were school teachers themselves, we had no clear idea how exactly a university Professor’s daily work schedule looks like,” chuckled Prof. Kühn.

Yet fast forward to today, Prof. Fritz Kühn has been a Professor at the Technical University of Munich (TUM) Asia since its first day in 2002.

“I think teaching at TUM Asia has been such a pleasant experience because students are very motivated. Besides, it has always been enlightening to hear about their learning experiences back in their home country,”

explained Prof. Kühn.

### **Success by overcoming adversity**

The journey to Professorship was never easy. A firm believer in growth through overcoming adversity, Prof. Kühn believes that life is not defined by moments of success but by challenges.

“I think my career journey is quite similar to how TUM Asia first began. When the idea was first mooted, it was completely unheard of in Germany to have an overseas university abroad. Because it was so unprecedented, there was no playbook for such an undertaking. Because of



► Professor Kühn together with his research group in early 2007 in which there were two TUM Asia students amongst his team.

that, I witnessed how Professor (Dr. Wolfgang A.) Herrmann, who was then the President of TUM, laboured towards the establishment of the institution, as he often travelled to Singapore personally in his capacity to forge ties and collaborations,” Prof Kühn recounted.

### **The beginning of an unknown venture**

In 2002, Prof. Herrmann, now President Emeritus of TUM, chartered the first overseas campus of TUM, embarking on an extraordinary and most unheard-of ventures in Germany. The sheer amount of red tape involved, and the different legal and administrative languages both countries operate on, were some of the challenges that Prof. Herrmann addressed in person during the first years of TUM Asia. Its rocky start also brought the point home that success is not built easily, but on the struggles and efforts of the people who are determined to succeed.

“Because it was so novel, there were also apprehensions to teach in a country and language that most are not the most familiar with,” Prof. Kühn shared.

Many were hesitant to take up the offer. For Prof. Kühn, it heralded an abundance of opportunities

to come.

“At that time, when TUM Asia was establishing its presence in Singapore, I had returned from postdoctoral work in the USA. I was quite comfortable delivering lectures in English. It was also interesting to come to a different cultural environment to engage with students from Asia as I had never been to Singapore before. It was a continual journey of personal growth for me,” explained Prof. Kühn.

Since then, Prof. Kühn embarked on an extraordinary career journey to various corners of the world – as a scientist in Lisbon in Portugal, teaching in Nanjing in China, Abu Dhabi, and Kazakhstan – and finally, returning to his hometown at TUM in Germany. His time at TUM Asia and TUM has certainly nurtured a vast number of chemists who have found their respective footholds in the arena. Throughout his tenure, Prof. Kühn has had more than 80 PhD students under his wing, with close to 10 of them being TUM Asia students working on various research projects.

Recognising that the students coming from different universities had varying knowledge exposures, Professors at TUM Asia tried to level



the course syllabi with their depth of knowledge by personalising the lessons.

“We had smaller cohorts then, and Professors flew and still fly from Germany regularly to meet with students in person, giving them opportunities to ask questions about the topic. We would also contextualise our teachings by sharing our experience working in the field. For instance, we would share why it is important to make a chemistry compound more expensive, or how different chemical compounds are introduced and handled, which helped deepen their understanding of the topic,” Prof. Kühn shared.

### **Bedrock of teaching: inspiring curiosity and creativity**

Having made teaching his life, Prof. Kühn deeply understands that learning is never solely about the topic. It is the mindset behind learning the subject – the desire to learn more and transform the knowledge into something infinitely better – that is the bedrock of learning.

“I think it is crucial always to stay curious and creative. Only then we would be able to address the complex challenges we are facing. It is great if students can understand what I have taught, but if my teachings do not inspire students to

take the knowledge beyond exams and tests, the knowledge will not serve its full purpose. When students take ownership of their education, they learn to take the initiative to dissect what they know and find out more about the areas they do not understand. This is also when they truly imbibe the knowledge they are imparted with to find new perspectives and harness the knowledge for new and more meaningful purposes,” explained Prof. Kühn.

### ► **Professor Kühn together with TUM Asia’s second cohort of MSc in Industrial Chemistry in 2005.**





# IGNITING LEADERS





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Published by:

Technical University of Munich Asia  
Office of Marketing Communications  
SIT@SP Building  
510 Dover Road #05-01  
Singapore 139660

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Tel: +65 6777 7407 | Email: [events@tum-asia.edu.sg](mailto:events@tum-asia.edu.sg)

Website: [www.tum-asia.edu.sg](http://www.tum-asia.edu.sg) | Facebook: [www.facebook.com/tumasia](http://www.facebook.com/tumasia)

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German Institute of Science & Technology - TUM Asia Pte Ltd  
CPE Reg. No. 200105229R (13.06.2017 - 12.06.2023)