

# Final Report

## Bernoulli Goes Abroad 2016

*'Thailand, Engineering with a Smile'*

## A Study Trip Exploring Thailand

First edition: November 2016

Copies: 75

Press: Chris Russell Groningen

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## Preface

Frank van Mastrigt

Congratulations for getting a hold of one of the limited copies available of this travel report. You are one of a very select group of people that will be taken on a tour through Thailand. Not a physical tour, of course, but a very visual mental tour inspired by all the participants of the study trip.

We were very fortunate to make a fantastic trip to Thailand, where we thoroughly explored the professional, educational, and cultural life. New contacts were made, friendships were shaped, new experiences were challenged, and a mutual understanding of different cultures was provoked.

All in very good spirits and on a high level of sophistication, suitable to the study association G.T.D. Bernoulli. What started out as carefully exploring the potential for organizing a foreign study trip, turned to an even bigger success than everyone had dreamt of. Who would have thought that a trip to South-East Asia would be within reach for this first edition of 'Bernoulli Goes Abroad'? We are more than happy to strive to make Bernoulli Goes Abroad a biyearly event, in which students are prepared for an ever more international career!



# Bernoulli

Gronings Technologen Dispuut





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# A Foreign Study Trip

Study association G.T.D. Bernoulli has organized a lot of different study trips to foreign countries over the years. Countries like England, Italy, Portugal, Czechoslovakia, Germany, Chile, Spain and more countries were explored both professionally and culturally. During the past years, however, no proper study trip was organized. This was mainly because of the difficulty encountered and amount of time required to make the trip a huge success. The study trip was slowly becoming something of the past... until... summer 2015, when the association decided it was time for change!

Word was spread within the association and a five headed committee was readily installed. Next there was a whole range of tasks that had to be performed, ranging from organizing case studies at companies, discussing the possibility to get 5 ECTS for the case with the board of examiners, selecting students for the case studies to selecting an appropriate destination and making a global travel programme. Furthermore, Bernoulli Goes Abroad was chosen as a representative and easily abbreviated name: BGA. The latter was frequently mocked within Bernoulli by referring to GBA? Or: 'Goes Bernoulli Abroad'?

Luckily, these tasks were quickly fulfilled and during the following months the selected participants put a lot of effort executing case studies for several companies, while the committee was busy with the organization. Ten months of hard work were rewarded on Saturday the 25th of June: 18 students and professor Picchioni departed with KLM KL0875 to Bangkok. Besides this departure time and flight number, the participants did not know anything about the program and the itinerary of the study trip. The only thing the committee promised it would be an unforgettable experience... judge yourself!





# From Our Supervisor

Francesco Picchioni

Dear reader,

I am guessing what you are thinking right now: “Oh yes, here comes the lucky professor who spent some days in Thailand with a group of students telling me in a very formal way how the trip was interesting and about its educative value”. Yes indeed, the trip was nice and it had an educative value. I let the younger people trying to elaborate on this. On my side, I would like in these few lines to take another approach ... namely what is that I did learn from this. In other words: what is it that a 45 years old professor can learn by sharing a trip with a “bunch” of 20-25 years old students. Please bear with me and you will be rewarded.



## Organizational skills

After this trip there is no doubt whatsoever in my mind that the organizational skills of a typical Dutch student is beyond any conceivable standard for a 45 years old Italian. Planes (KLM) are on time, buses are waiting at the right place, they leave at the scheduled time and arrive also, depending on traffic, more or less on time and in any case no later than planned.

All in all, quite boring if not, luckily for me, for the typical unpredictability of the wonderful continent of Asia. Typical examples: a bus is on time but actually the other one is missing altogether, while in other occasions the driver (typically not somebody trained in the Netherlands) has difficulties finding the correct building. How does a Dutch student organizing the trip coping with this? Well, typically a first disappointment is replaced by immediate and highly efficient action: calling taxis for the first example and then switching on the navigation on the mobile in the second. As an Italian, the first disappointing reaction is priceless...

**Take away message:** If Dutch students are organizing, do not worry about a thing and enjoy it!

## Sparing the old man

The structure of the trip was quite clear: when the professor is present (first week) only visit to Universities and companies. After he goes back to Groningen still some formal visits but also: walking in jungles, enjoying beaches, having some fun, etc... This is ok, fully understandable (*carpe diem*) and very considerate for an older man who still have to give some of the students grades in courses and theses. You really never know what happens to your course or thesis if the teacher/supervisor gets lost in the jungle.

**Take away message:** Go swimming three times a week (instead of two) to learn coping with the physical stress of the jungle next time!

## Courses evaluations.

At the RuG, courses evaluations have been and still are the object of several discussions: programme committees, deputy directors, students... all involved in trying to get students evaluations to the level in which they are actually useful. After this trip, it is clear to me that all of this is a waste of time and not efficient. Alternative proposal: put 20+ students on a plane, spend a week with them in an exotic country and you will hear everything there is to know (in a very blunt and direct way) first about your colleagues' courses and then about yours. Fast, efficient and really enjoyable.

**Take away message:** make a deal with KLM to do courses evaluations in a far away country!

## Buying cigarettes and eating pizza

If you are out of cigarettes in Thailand and ask a student to fetch them for you because you have to work and have not time to go out of the hotel in the evening, make sure the student is acquainted with the most common brands suitable (image is everything!) for a 45 years old Italian man. If you do not specify, you might get menthol ones, typically smoked by old ladies. The same applies if you go with the all group to a pizzeria: make sure that the student choosing the place is acquainted with the minimum requirements. No sweet things on the top, tomato sauce of decent quality and a bottom not thicker than 1 cm.

**Take away message:** Use your status of professor to impose your authority and decide what to smoke and what to eat.



# From Our Supervisor

## "Spicy is sexy"

Spicy curry pastes are delicious and a common occurrence in Thailand. If you go to a cooking school with 20+ students and actually have to prepare them yourself, it is even more enjoyable. However, for Dutch standards, it can be that they are too spicy even if "spicy is sexy" seems to be the chef motto. Forget about the occasional hero (and there was one), who can take a lot of it and enjoy the expression on the faces of the rest when the capsaicin (I told you there was an educative value...please check this out if you do not know!) get into their tongues.

*Take away message: The Italian cuisine prepares you for almost everything!*

All in all, as you see an educative and most enjoyable trip also for the undersigned. I could go on and on. Regrettably the space allocated to me is finished and, after all, "what happens in Thailand stays in Thailand". Many thanks to all people who spent time in putting the trip together: really enjoyed it!

Groningen 3/11/2016

*Frans  
Jichien*



# Participants



Arjan ter Horst  
(21, MSc)



Arne Hommes  
(27, PhD)



Bas Disselhorst  
(22, MSc)



Folkert Keij  
(22, MSc)



Frank Hogewoning  
(24, MSc)



Frank van Mastrigt  
(27, PhD)



# Participants



Henk Botma  
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Hero Goldhoorn  
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Ibrahim Chaabane  
(24, MSc)



Loes van der Net  
(23, MSc)



Martijn Hazenberg  
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Martine Schouten Hoogendijk  
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Jasper van den Sigtenhorst  
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Jesper Zwart  
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Johnny Tran  
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Thiadrik Kramer  
(22, BSc)



# Thailand

*'The Land of Smile'*

Thailand, formerly known as Siam, is a country in South-East Asia, bordered by Myanmar, Laos, Cambodia and Malaysia. It has an area of 500.000 km2 and 67 million inhabitants and Bangkok is the political, commercial and industrial capital of the country.

It is the only South-East Asian country which has escaped colonial rule, leading to a wonderful country containing buddhist religion including around 75-95% ethnically Thai population. The country has a lot to offer; from Buddhist temples to exotic wildlife and spectacular islands. Also the fascinating history and unique culture including Thai food and massage makes it a very versatile and unique destination for a study trip.

Thailand is called 'The Land of Smile', not only because visitors love the beautiful country and historical riches, but also because of the friendly people and fascinating culture. It is a kingdom, featuring Buddhist temples, exotic wildlife and spectacular islands. With all its unique features and nice weather, BGA determined Thailand to be a wonderful must-see.



# Travel Programme

Date	Morning	Afternoon	Night
25 June		Departure from the Netherlands	Aircraft
26 June	Arrival in Bangkok	City tour Bangkok	Bangkok
27 June	Kasetsart University	AkzoNobel Paints	Bangkok
28 June	Thammasat University	Dutch Embassy/Orange Asian	Bangkok
29 June	Visit Ayutthaya	Visit Ayutthaya	Night train to Chiang Mai
30 June	Arrival Chiang Mai	Thai Cooking Class	Chiang Mai
1 July	Chiang Mai University	Lanna Products	Chiang Mai
2 July	Cultural expedition	Cultural expedition	Jungle
3 July	Cultural expedition	Cultural expedition	Jungle
4 July	Cultural expedition	Cultural expedition	Chiang Mai
5 July	Flight to Pattaya	City tour Pattaya	Pattaya
6 July	PQ Industries	SCG Chemicals	Pattaya
7 July	ATV Tour	Free time	Pattaya
8 July	Bus to ferry	Ferry to Koh Chang	Koh Chang
9 July	Free time	Free time	Koh Chang
10 July	Free time	Tree Top Adventure Park	Koh Chang
11 July	Bus to Bangkok	Arrival in Bangkok	Bangkok
12 July	DyeCoo (YEH Group)	DyeCoo (YEH Group)	Bangkok
13 July	Departure to the Netherlands		



# Outline of the Itinerary

During the 19-days trip, Thailand was discovered in its widest sense. Excursions to companies and universities were organized in order to gain insight and knowledge in the working atmospheres in Thailand and the differences between the Dutch and Thai educational programs.

Different cities across this beautiful country in the South-East of Asia were visited and communication and integration with the local people was accomplished by various social and cultural activities, making our visit to this inspiring country an unforgettable experience.

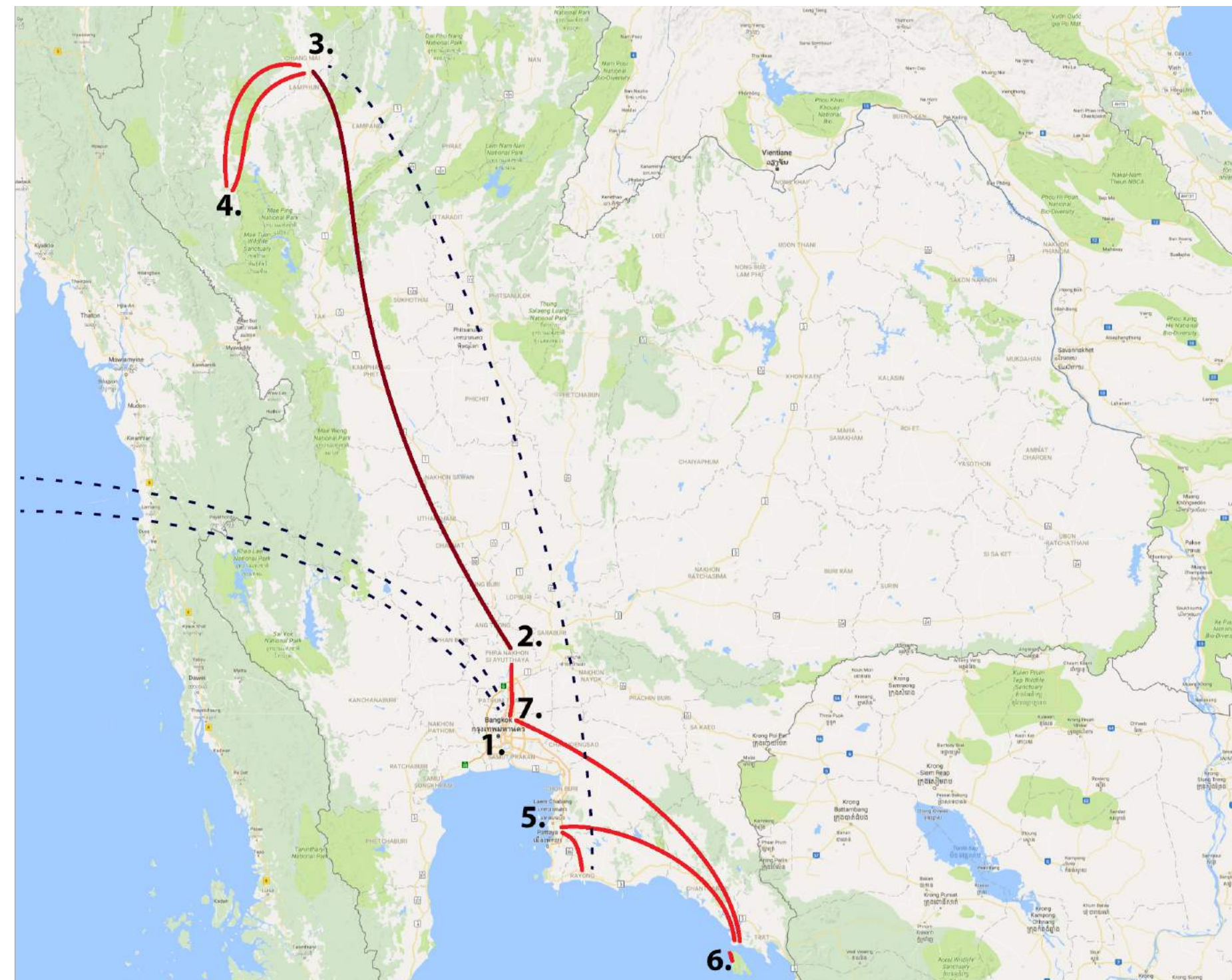
In collaboration with the different universities and companies an interesting and diverse travel itinerary was compiled.

With the travel itinerary depicted on the right, it was possible to schedule the majority of the company and university visits at the beginning of the trip. Bernoull Goes Abroad was very fortunate that professor Picchioni was willing to join the first week of the study trip and could thus be present at most of these visits.

After three busy and formal days in metropole Bangkok [1], the old city Ayutthaya [2] just north of Bangkok was visited for one day. From here the night train took Bernoulli from Ayutthaya to the north of Thailand; Chiang Mai [3]. In this place a company and university were visited and also a three day jungle tour was organized in the beautiful jungle in the north of Thailand [4].

The luxurious hotels so far were in large contrast with the living conditions in these jungle villages. After surviving in these small jungle villages, the group flew to Pattaya [5] for another three days.

The industry in the neighbourhood of Pattaya was visited, besides some leisure activities. Three taxis and the boat took us to one of Thailand's most beautiful islands; Koh Chang [6]. After having spent some days on the island, the final location of the trip of course is Bangkok [7] again where some more activities were planned.







# DAY REPORTS

## BANGKOK



# Let's Get Started

Day 1, Saturday the 25<sup>th</sup> of June 2016

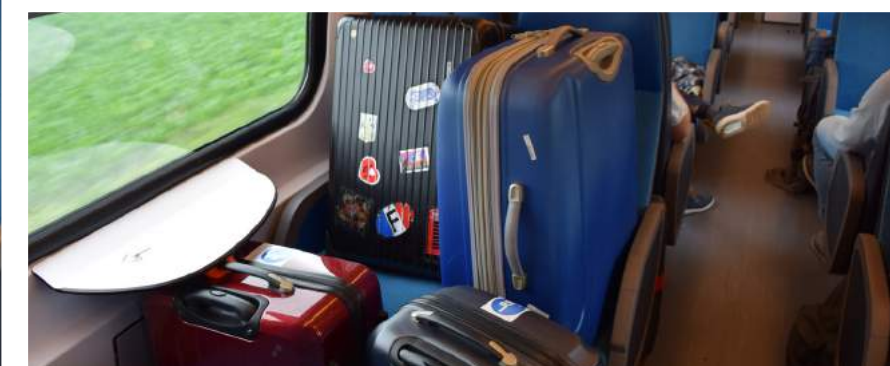
Thiadrik Kramer

The 25th of June, the day so many of us were looking forward to. After months of waiting for this day – the day of departure and the destination was the only thing known to us. It was a great relief to finally get to know what was in front of us.

The first task was to be on Schiphol airport on time. Some traveled by car and some by train. Although the plane departed at a very reasonable time, some managed to oversleep and miss the train. In the end everybody arrived at the airport on time. After going through all security proceedings there was some time to kill in the tax free zone.



Our flight departed at 17:45. The plane was ready to take us to Suvarnabhumi airport. On the plane, after everybody took their seats, the first of many surprises was showed. In our hands was put the first of many envelopes which contained the travel program for the next few days. The program told us we were going to have a few days in Bangkok. The booklet took us through glimpses of the next few days. The rest of the trip was still a secret. When the plane departed, much time had to be killed. Some choose to entertain them with the multimedia system, others enjoyed a book, and many tried to get some sleep. There even was the possibility of learning some Thai in the airplane which some of the members did. The day ends flying at 900 km/h, 12 km above the ground of the Middle East.





# Racing Through Bangkok

Day 2, Sunday the 26<sup>th</sup> of June 2016

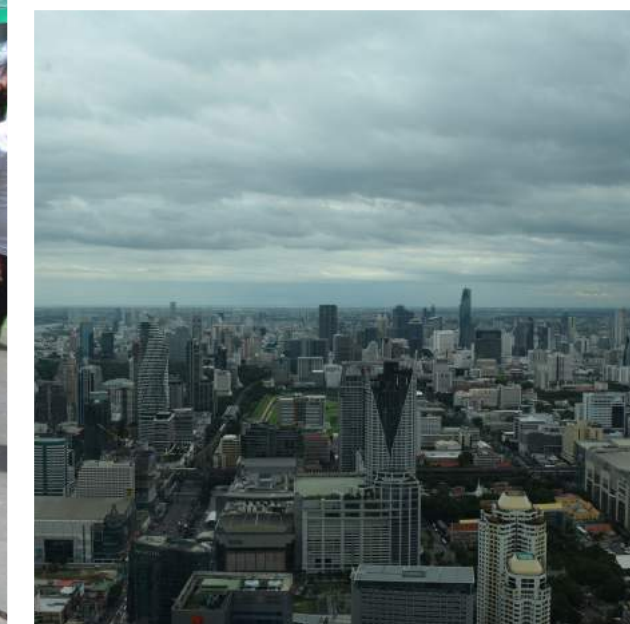
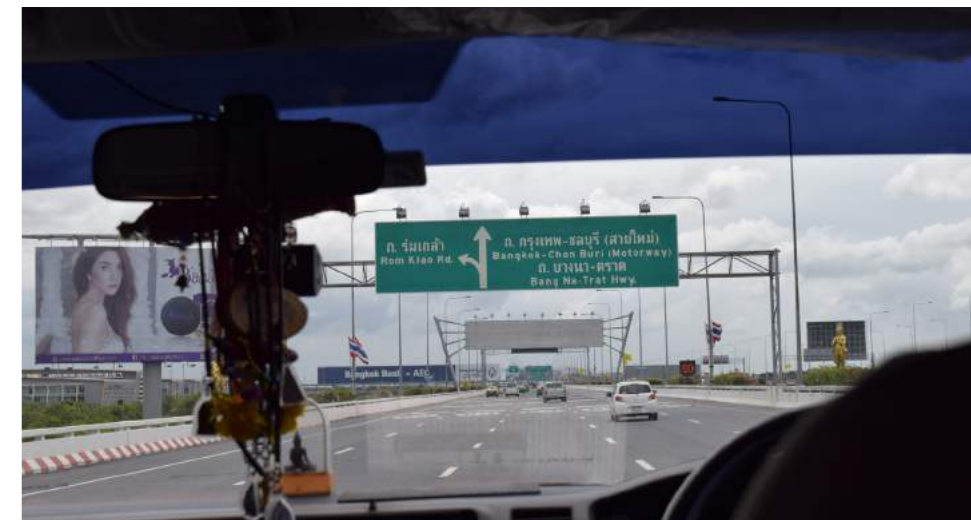
Henk Botma

After a long flight from Amsterdam we arrived in Bangkok. Some were a bit happier to be in Bangkok than others, that was mostly due to the amount of sleep some participants had on the aircraft.

During the flight everyone got the first program booklet from the organisation. All participants were put in groups based on the colour of the page number. The organisation brought all the bags to the hotel and the groups got different locations to go to. At these locations every group got an assignment to perform in Bangkok. When the assignment was completed everyone assembled at the Koh San road. After looking for the restaurant for half an hour and having lunch all groups got their new assignments and raced through Bangkok to complete

them before dusk. The assignments took everyone to the grand palace, the sky tower and on the boats over the river back to the hotel. After a long day everyone took a relaxing swim in the rooftop pool and saw the sun sink over the western end of Bangkok. The diner took place in the hotel restaurant and the beer towers provided a

well-deserved drink for everyone. After this good meal all participants settled in their rooms for a long rest.





# What a Difference!

Day 3, Monday the 27<sup>th</sup> of June 2016

Frank van Mastrigt

Today, a visit to the department of Chemical Engineering of the Kasetsart University was part of the programme. With 67.000 students, it is the largest university in Thailand.

After an introduction to the university by the dean and two presentations about the University of Groningen, it was time to head to the labs. Interestingly, many labs required to take off shoes before entering. On top of that, labs could best be described as a shared space, accommodating desks right next to experimental setups. Be careful, one might easily mistake that Vanilla Light Frappuccino for a beaker with aqua regia. Research was found to be very diverse, including microreactors for the production of biodiesel, synthesis of methanol from CO<sub>2</sub>, and large distillation setups.

After a quick and non-spicy lunch at the university, the group headed to the AkzoNobel facility at Chaeng Wattana Road. At this plant, both water and solvent borne paints are produced, packaged and vigorously checked for quality. G.T.D. Bernoulli was received by a huge delegation of AkzoNobel. In several presentations, the

business was introduced, along with the line of products. Safety was discussed in much detail, after which process diagrams of the different production lines were shown. Time to wear safety shoes. Strangely, when considering being in Asia, many of the pairs of shoes turned out to be oversized. During the tour, participants were asked to look out for potential



improvements, as well as things that were already appearing to go very well. After the tour through both the R&D laboratory and the production facility, all positive feedback and potential improvements were mentioned and discussed in some more detail. Furthermore, all feedback was ordered based on several categories (e.g. people, equipment, cost saving). This highly interactive session was very interesting for the participants and showed the level of education and insight that was expected by the local AkzoNobel team. Moreover, the importance of safety at this facility was found to be striking, especially for Asian standards. Clearly, a lot of effort has been put into making employees aware of the risks and installing fool proof equipment (Poka-yoke). After a quick dive into the pool and

dinner at the hotel, it was time to investigate the backpackers' area of Bangkok: Khao San Road. Several hours and many drinks on the street later, even the last standing man had to throw in the towel, cut his losses and grab some hours of sleep before attending to the programme of tomorrow.





# Lonely at the Top

Day 4, Tuesday the 28<sup>th</sup> of June 2016

Bas Disselhorst

On the 28<sup>th</sup> of June another university was visited. While some of the members came in contact with a 'changover' for the first time, the group traveled to the Thammasat University. It is the second oldest university of Thailand, known for the many Thai politicians who studied there. In total the Thammasat University has about 34.000 students, which makes it about the same size as the University of Groningen.

The visit started at the faculty of engineering at the main campus with a guided tour along some of the lab rooms followed by a question and answer session. After that a tour was given along the research group. A nice fact: some of the PhD students had their own room besides their lab in order to sleep at the university. Finally, a tour along the campus was given and the

group had lunch together with the Thai students. For most of the students this was the spiciest meal they had during the study trip. Luckily, as we would learn later on, more spicy means more sexy.

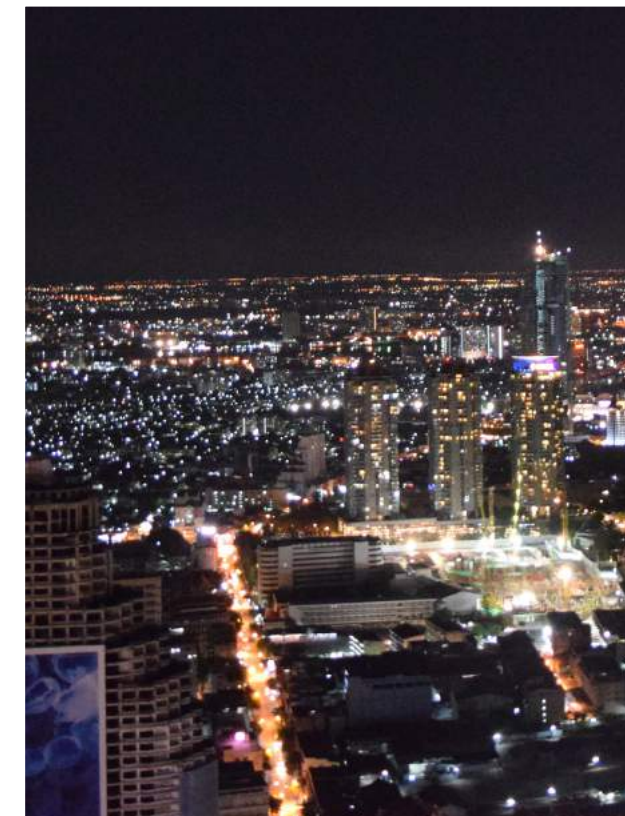
After the Thammasat University, the Dutch embassy was visited. The embassy terrain was situated in the middle of Bangkok and included the embassy building and the house of the ambassador. This embassy is responsible for Thailand, Myanmar, Cambodia and Laos. After a short introduction the ambassador told about the history of Thailand and why the country is located in this strategic position. He also told something about the political and economic developments in Thailand and what the embassy actually does. Afterwards, we had a lecture from the first secretary

of the economical department about the current economic situation of Thailand and how the embassy could work on improving the contacts between Dutch and Thai companies. The lectures were really interesting and it was interesting to get to know about some of the remarkable political differences between Thailand and the Netherlands. Afterwards a presentation on Orange ASEAN, a collaboration initiated by the Dutch Government with the private sector and non-governmental partners, was attended too. Orange ASEAN focuses on sustainable solutions for both societal and environmental issues in Southeast Asia. At the time of our visit, a group of young professionals and students from Orange ASEAN and the Netherlands were working on 'The Orange Factory', an extensive three week project in



which 30 participants work together in teams developing business cases for real-life issues. The visit was finalized by making a group picture in the beautiful garden of the embassy.

After the two intensive visits during the day it was time for some relaxation in the evening. After having dinner at an Italian restaurant, the group went to the Skybar of Bangkok. This is an open air rooftop bar at a height of 250 meter. While enjoying a €12.50 beer, one can see a mesmerizing view of Bangkok. It was a very special experience to be at the Skybar of Bangkok. It seemed like a never-ending city and looking over it felt like being lonely at the top.





# Phra Nakhon Si Ayutthaya

Day 5, Wednesday the 29<sup>th</sup> of June 2016

Arne Hommes

After a successful closing evening in Bangkok, it was time to move on to the second destination of the trip: Phra Nakhon Si Ayutthaya, which was the capital of the country until it was razed in 1767. The ruins of the city are recognized as a UNESCO World Heritage Site and are a popular tourist destination because of its old palaces, temples and other sights.

The way towards this location was not entirely prosperous for everyone. While some did not mind to overpay the always sympathetic Thai cab driver, others thought they were smart by using the Uber app to prevent being scammed. However, even this does not give full guarantee as an Isuzu Nux is considered as a limousine by some of the locals, resulting in a long pit stop at Priest Hospital. Fortunately, everybody

managed to arrive in Ayutthaya in time. Due to the limited time present in the old city, a tour was arranged consisting of visits to several Buddhist temples and a boat ride around the island on which the main points of interest were located. The tour was done in tuk tuks, rapidly racing from one location to another. Many impressive sights were visited such as: Wat Phra Si Sanphet, Wat Phra Mongkol Bopit, Buddha in tree (Wat Mahathat) and many others. In the meantime, the Thai language skills of the group improved with 'rapid steps'. After the basic 'Sawadee krab', some of the travellers even managed to make a short dialogue: "Ayutthaya? Wat Mahathat?"

A special orange boat was waiting to navigate the group around the island. Looking at the reactions of some visitors

of the city, it seemed that a group of tall Dutchmen in an orange boat is considered a more enjoyable attraction than the incredible temples Ayutthaya has to offer. Another remarkable thing was that the whole waterbody surrounding the island was almost entirely covered with plants, leading to a number of unplanned engine failures. This tiring day with much sightseeing ended with a heavy storm at dinner, during which a temporary power failure occurred and an occasional plate of curry flew around the terrace.

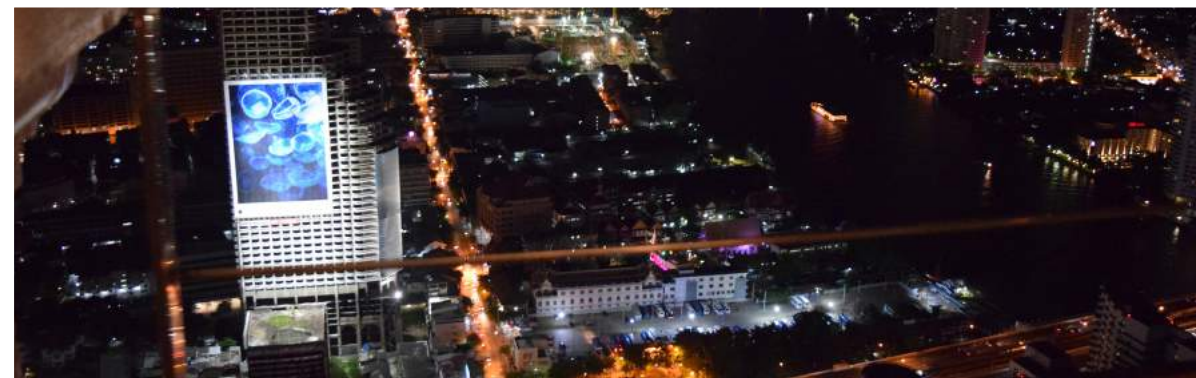
The last experience in Ayutthaya, since the next destination was Chiang Mai, travelling overnight by train. Unfortunately, no beer was served on the train, but luckily every 5 minutes there was the opportunity to purchase fresh orange juice. After some long



conversations the group made way to their wiggly beds as the journey continued northwards to Chiang Mai.













A wide waterfall cascading over dark rocks in a lush green forest, with a tree in the foreground.

# DAY REPORTS

## CHIANG MAI



# More Spicy More Sexy

Day 6, Wednesday the 30<sup>th</sup> of June 2016

Remon Schuring

After an 11-hour train journey the group arrived in Chiang Mai at nine o'clock in the morning. At the train station it was not difficult to get a taxi, judging from the large group of taxi drivers harassing the group. Three 'Songthaews' were required to continue the journey to the second hotel, BED Nimman Hotel.

After the check-in everybody got some free time till 15:45. The greater part of the group used their free time to relax at the swimming pool in order to recharge from the tiring train journey. However, also a small part of the group was brave enough to climb the 309 steps counting Doi Suthep temple. Once they arrived at the top, they were rewarded with an amazing view. When everybody was back at the Hotel, it was time to be

picked up for a Thai cooking class. Fortunately, the cooking class was not at the end of the study trip, since a few group members became really fed up with the Thai food at the end. During the cooking class, participants could determine themselves how spicy they wanted their food. This was a good thing since a few group members were complaining that the food in Thailand was not according to their liking of spiciness. During the class each person had to choose 4 dishes from 5 different categories. E.g. the spring rolls, cashew nut with chicken, red curry and the fried banana. Two master chefs were appointed, that had to do most of the work. The latter was definitely not an easy job, since they had to keep up the pace. All can remember the lovely small sized Thai teacher called Pièr screaming: FASTER, FASTER, FASTER!

Fortunately, it went all very well and the food was 'mmm, very nice'. However, there was one naughty bean who went out of the basket. After the cooking class transport back to the hotel was arranged and the participants prepared themselves for a first night out in Chiang Mai. Since the programme of the next day was to start early morning, the group decided not to go to the famous backpackers' nightlife district, but to a more local pub. Unfortunately, the pub was not prepared for such a large group of Dutch students, since after 16 3-Liter cans, there was no more draft beer available. That night also facilitated integration with the local Thai people in the bar, resulting in interesting interactions with locals. Games were taught to the locals, as well as the infamous strawpedo.



The group learned the Thai word for chugging drinks: Mod Keaw. A word that from this point on was to be used many times during the journey. Later at night, some of the participants started searching for a little late night snack. Unfortunately, Subway had run out of bread and only Thai street food was available. This opened the possibility to enjoy a red curry for the second time that day. This curry, however, was much spicier than all the curries that had been served in restaurants. It is probably true what some people say: Thai cooks in restaurants prepare the food less spicy for western people. The day is best ended with a nice quote the group come across: "I've never believed I'm the best but I will try to be the best for you".





# Thai Wasabi

Day 7, Thursday the 1<sup>st</sup> of July 2016

Jasper van den Sigtenhorst

The first of July was polo shirt day, the only day the group was allowed to wear polo shirts as dress code. After breakfast at the hotel, the group was driven to the Chiang Mai University in vans. Due to a lot of one way traffic at the University, it took some time to find the Faculty of Science.

Once arrived the group was warmly welcomed in the conference room. While enjoying instant coffee, tea, or water, the Dean of the Faculty of Science named Assoc. Prof. Dr. Sampan Singharajwarapan gave an introductory talk about the Chiang Mai University. Thereafter, Prof Picchioni did the same for the University of Groningen and study association G.T.D. Bernoulli. The Thai staff was surprised by the weather conditions in the Netherlands. Subsequently, a

guided tour along several research facilities was given. At the first research facility polyesters were made. The lab was new and very modern. Everyone had to take off their shoes to keep the lab clean and it became clear who was wearing the most awesome socks. The next labs could be described as standard Thai labs. In one of those labs, corn waste was fermented into alcohol as biofuel. Tasting was not allowed, however the smell of alcohol was identified by several students. Bio-oil as biofuel from pyrolysis is another research project at the Chiang Mai University which was discussed during the guided tour. After this interesting morning, it was time for lunch. The Chiang Mai University prepared a lunch for the whole group as well as the Thai staff who gave the guided tour. The lunch consisted of some delicious

Thai dishes, which made it a great end of the morning. Unfortunately, Prof Picchioni had to catch a flight to Bangkok for his return flight to the Netherlands. Fortunately, the Chiang Mai University was so kind to arrange transportation by van. The rest of the group was driven to the company Lanna Products. Lanna Products is a joint venture between Thai investors and a Japanese company. Wasabi is one of their main products. After a brief introduction, the plant tour started. A part of the required wasabi is cultivated at their plant in a condition regulated room. Other resources such as mustard seed are imported. In the process of Lanna Products mustard seed is extracted. The produced waste is fermented into biogas, which consequently is used as energy for their distillation unit. It was interesting

to see the plant of Lanna Products and their sustainability efforts. At the end, everyone received a tube of wasabi paste as present. Conversely, Dutch 'stroopwafels' were given to them. Once at the hotel, the swimming pool was the place to be. In the evening, dinner was at an Italian restaurant called Why Not? It was an appreciated alternative after all the Thai dishes.





# Many Boom Boom, No Babies

Day 8, Friday the 2<sup>nd</sup> of July 2016

Ibrahim Chaabane

July 2<sup>nd</sup> started with a bus trip of 80 km from Chiang Mai. Several hairpin turns led to the starting point of today's trip. Starting point of today's trip was Amphoe (district) Mae Wang. Amphoe Mae Wang is located in the central part of the Chiang Mai province in the northern of Thailand.

Two locals picked us up after being dropped at a dead end, and the trip was continued by foot. Hours of walking on 'slippely' sandy roads in a Mae Wang's tropical forest surrounded by mountains. Hours of walking surviving wild animals and height differences. Imagine those 18 Dutchies, who are used to flat asphalted roads, sweating and suffering for hours and hours. Imagine those Dutchies walking on inaccessible roads, moving from hill to hill. For what you might ask? Well,

for impressive waterfalls, wild rivers and the scenic landscape. Even a typical lunch was served, eaten out of an banana leaf, enjoying the sound and the view of a wild waterfall.

Swimming at places men would never visit again, eating insects and rare vegetables were all part of today's trip. Not to forget the heavy rainfall which kept us sheltering for a while. Hours and hours passed before reaching a small village. Not a typical village like we know it in the Netherlands. A village even without internet or television. A village even without electricity, but with lovely locals, which seemed to do everything they could do to make it as comfortable as possible for those 18 Dutchies.

After sunset and a delicious meal some deserved drinks were consumed. Even

the guide Tongh joined and started to talk about his personal life after a few drinks. Tongh's jokes let many of us laugh. Tongh, who has a lot of uncles and aunts, explained us that recently the pill was introduced in this village. The introduction of the pill led to an huge amount of 'Boom Boom' without having babies. Or in Tong's words: "Many Boom Boom, no Babies'!





# One Bridge Too Far

Day 9, Saturday the 3<sup>rd</sup> of July 2016

Loes van der Net

Around 5 o'clock in the morning some of the Bernoullians were woken up by a living alarm clock; some roosters were walking underneath the cabin in the small idyllic jungle village. Some more hours were spent on moist blankets and high density mattresses in mosquito nets until everybody was alive.

After breakfast the residual part of the Bernoulli group departed for a next jungle hike across the beautiful nature and rice fields. The group was even allowed to help the local people planting some rice. One Asian guy showed the group not to jump into the rice fields directly, because of the risk of a shoulder dislocation. At the waterfall the group took a break for having lunch and some even took a shower there. According to the guide 'trekking is no shopping', so the hike

was continued across very small (wet) paths, under supervision of the guide and his son, who comfortably walked in front of the group on his slippers. On arrival in the late afternoon, the group had to cross the river on two lying wooden trees to reach the next village. This time a wooden cabin with an 18 person bedroom on the first floor and a nice view at the river was booked for the group. There was the possibility to take a shower in the river or to have a nice cold beer in the middle of this beautiful jungle village, accompanied by some dogs. Souvenirs could be bought from a nice woman who was making shawls all by herself. The guide wanted to show the village' elephants, so the group followed the guide one by one, again across the river. However, this strong bridge was unfortunately not resistant against the jumps of

the masculine Australian beach boy and the bridge broke into two parts. At this moment, two Bernoullians and their phones got a free shower in the river. Without any entrance to and from the village, the rest of the group had to pass through the river to continue the walk to the elephants. Because of the swimming party of the phone, no personal photos of the wonderful elephant experience were added to this report. The group was allowed to feed the elephants with a lot of large cucumbers and the elephants could not get enough of it. After the feeding, the elephants were grabbed by their ears and taken to the water where they were intensively washed by the guides. During the day the other guide travelled some of the Bernoullians back to Chiang Mai for which he got some



1000s of baht, equal to a lot of whiskey bottles. This happy guide prepared a nice dinner for the remaining group upon arrival at the village and everybody enjoyed a nice meal in their newly bought 'elephant print' trousers. After dinner some more inspiring jungle stories were told by the guides, giving the participants of the trip some feed for nice dreams for the night.





# Connecting People

Day 10, Sunday the 4<sup>th</sup> of July 2016

Jesper Zwart

On this last day in the jungle the group of Bernoullians once again woke up early in the morning from our second luxury 'hotel' in the home village of our tour guide. After a well-deserved breakfast with the local guides the group was highly motivated to start the different and exclusive programme of this day.

On the previous day the group figured out that even the (bridges of the) jungle villages of Northern Thailand could not withstand the influence of such a large group of Bernoullians, so an offer was made to connect the different sides of the village once again. This offer was highly appreciated by the local inhabitants, who had cut down two special termite withstanding trees high up in the adjacent hill the previous night. Today the assigned task was to get these trees safely down to the village

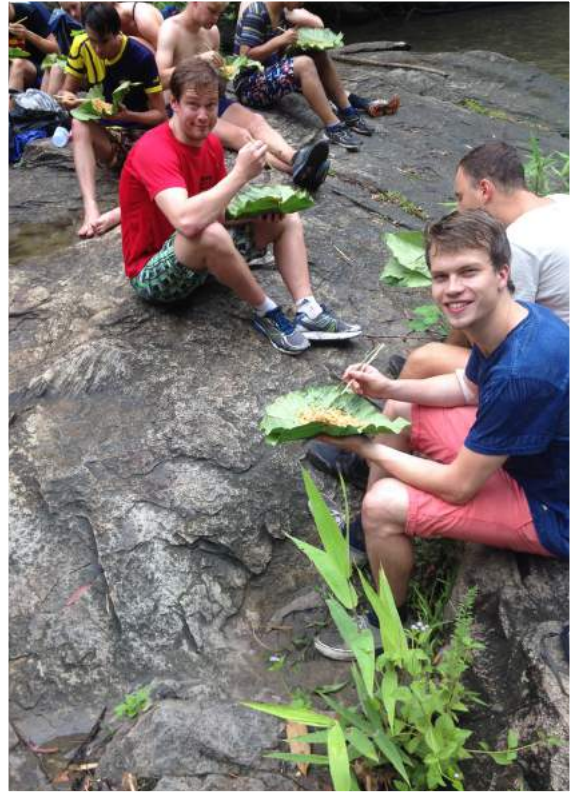
and rebuild the bridge. Along with the locals, the remaining fit people pulled down the heavy trees for a couple of hours until the river at the base of the hill was finally reached. Subsequently the river was used to carry the logs to location of the previous bridge, where the group practiced some simple jungle village engineering and built the new and improved Bernoulli-Bridge!

After this exhausting morning, the group was relieved to hear everyone should get ready for the return trip to Chiang Mai and that they had endured this 3-day jungle trip. After a trip of one hour through the mountains and farmlands with a quick stop for lunch along the way, the group had returned to civilization to much relief of most of the students. For the rest of the day the students enjoyed some

well needed rest, a well-deserved shower and relaxed in the pool at the hotel. Some students even went out to visit a temple on one of the mountains surrounding Chiang Mai. Nearing the end of the day the whole group enjoyed a nice Mexican dinner and received the programme for the next couple of days along with the message to wake up very early the next morning. This however did not stop a part of the group that saw this last night as an opportunity to have a party one more time in the pub street of Chiang Mai. Luckily for the group a party was starting in the pub street by some Americans looking to celebrate the fourth of July. Having seen the Thai culture for more than a week now the group had the opportunity to witness a different more western event and taste the American Dream!











# DAY REPORTS

PATTAYA



# Custom Based Pricing

Day 11, Monday the 5<sup>th</sup> of July 2016

Stefan Arends

The alarm went off at 6 am this morning, which was not a very pleasant message for a fair share of the participants who enjoyed the last night in Chiang Mai. However, it was now time to depart to beautiful Pattaya.

After a short ride to the airport the participants flew to Pattaya by Air Asia in 1 hour and some taxis took everybody to the Thai Garden Resort in Pattaya. The resort was located in the North of Pattaya and is known for its luxurious pool; it was 63 meters long and contained everything from a kids bath to submerged sunbeds and bubble baths. The room was luxurious, equipped with a single and a double bed, television and a bathroom with a rainshower. After getting settled in the hotel, there was a need for some culture

that Pattaya had to offer. Some of the Bernoullians chose the Sanctuary of Truth as the place of interest. However, the ticket price to this gigantic wooden construction was 500 bath (€12.50). As real Dutchies it was decided that this was a ripoff compared to the temples in Ayutthaya which all charged a ticket fee ranging from 20 to 50 bath (€ 0.50 - 1.25). Luckily, there was a lot more to see in Pattaya, like the 4 km long crescent of coastline. After walking for a while across the beach the group was surprised by the culture they spotted; the Sanctuary of Truth was visible from its other side! This huge temple is entirely constructed from wood has only become a tourist attraction since 1981. With its beautiful beaches and favorable location the city of Pattaya thrives on (certain kinds of) tourism. The city has a lot of skyscrapers, some of them still

under construction. These are mostly resorts with either their own beach or excess to a public beach. Another remarkable fact is the customer based pricing present here, which means the prices you have to pay as a foreigner for commodities are considerably higher compared to prices for locals. The dinner was a large buffet in the resort consisting of an unlimited barbecue. There was also a large selection of European food and Thai curries. With the early rising and long journey, the party in Pattaya itself was delayed for another day. However many Bernoullians still saw the possibility to grab a single Singha beer and watch the Tour de France.





# The German Touch

Day 12, Tuesday the 6<sup>th</sup> of July 2016

Hero Goldhoorn

The 6<sup>th</sup> of July was the day the whole Bernoulli crew went on tour to visit two different companies. The first one was a subsidiary of Zeolyst called PQ Corporation, producing zeolites.

After a short presentation and a lot of detailed numbers and facts about the company, a brief instruction about safety was given. Besides a short presentation about safety, also a safety movie was presented in which all possible accidents were clearly reconstructed. To give the Bernoullians an idea of risks and dangers, even a small quiz was connected to these safety instructions after which the winners got a nice company polo shirt. The fully prepared Bernoullians were given a tour through the labs and the plant in two different groups. The plant tour provided nice insights into the

processes, as well as chemical insights into the zeolites. The researchers gave a lot of information about the different ways of quality measurements and purity tests of the different zeolites.

After the tour the company provided a very nice meal for the Bernoullians, which was enjoyed by the group in absence of the people of PQ. Even some very nice special Thai candies were provided for the group. These special candies were really appreciated by some of the Bernoullians; even to the extent that it was randomly determined who was the lucky one to get the last tasteful cake.

In the afternoon the company SCG chemicals in Rayong was visited, which is one of the biggest chemical companies of Thailand. This company

visit was well arranged with the help of Bernoulli's contacts at the Dutch embassy in Thailand. The office buildings of the company were located in a very quiet and peaceful area. After a general introduction into the company and presentations from PhD students of the plant, an interesting plant tour was provided. During this tour it was clearly visible that the logistics in this company were well ordered and that the storage of the chemicals and products were executed in a structured way. The amount of operators on site and amount of researchers busy at the labs of this company was strikingly high compared to the other company visits in Thailand. The company was also highly focused on getting more knowledge and therefore hired many PhD students during the last years.



After the plant tour there was a discussion session with nice dialogues between the Bernoulli group and the presenters.

In the evening the group went to a typical German restaurant in Pattaya and due to the high numbers of German tourist in Pattaya, it was not too difficult to find such a place.





# Wow! What a Ride!

Day 13, Friday the 7<sup>th</sup> of July 2016

The best activity of the Thailand journey was announced 3 days beforehand, such that everyone could look forward to it; an ATV tour across the countryside outside of Pattaya.

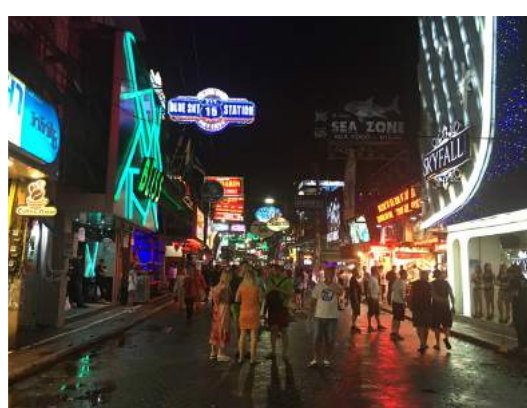
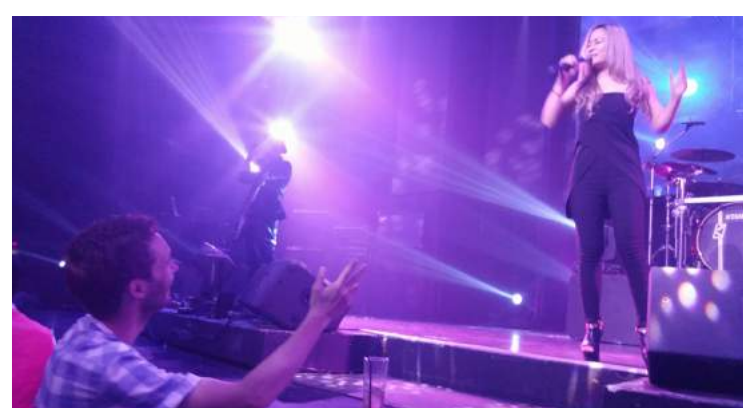
Despite the rainy season, on the day of the tour the weather was nice and very sunny. So, nothing could go wrong with a cool activity like this. Beforehand, clear safety and operating instructions were given by the tour guides. Once on the quad, the 330 cc vehicle felt like riding a big, roaring beast. The ATV tour went along rubber tree plantations and through dirt roads, streams and desert-like sandy roads: simply AMAZING! Unfortunately, one of the BGA members was not really aware of the safety instructions. (For all engineers it cannot be sufficiently stressed: safety first!!!). This unawareness led to a small

collision between two ATVs, leaving one of them with a broken tire and headlight – and leaving the driver with a 3000 baht bill. After one hour of burning in the sun and waiting for the guides to fix the quads, the tour could be continued. The rest of the tour was very nice and only minor accidents occurred, like a vehicle falling sideways on a steep track and buckling of its rider. At the end of this adventurous day, luckily no one was seriously injured – apart from the heavy sunburn that caught all Bernoullians. As a final treat, there was a nice BBQ and a swimming pool to cool the sunburned skin. After everyone swam a few rounds in the pool and discussed their ride, it was time to go back to the hotel to refresh for the evening. The dinner consisted of an exotic Italian cuisine. From experience the day before, it was

Martine Schouten Hoogendijk











# DAY REPORTS

## KOH CHANG



# Welcome to Paradise

Day 14, Saturday the 8<sup>th</sup> of July 2016

Frank Hogewoning

After breakfast at 8:45 am the luggage was packed again for the ongoing journey to Koh Chang Island. Koh Chang is Thailand's second largest island after Phuket. Located around 300 kilometres to the east of Bangkok in Trat Province, in the Gulf of Thailand near the Cambodian border. The first foreign backpackers started arriving on Koh Chang in the 70s, using local fishing boats, when the island was still undeveloped. Since 1982, Koh Chang along with the surrounding area became part of the protected Mu Koh Chang National Park and became a major tourist destination with a number of tourist resorts being developed. Despite this, tourism on Koh Chang had remained considerably less developed than on Koh Samui or Phuket until now.

The trip from Bangkok to the island started in buses equipped with wifi, television and a handful of interesting and amusing DVDs. When arrived at the car ferry terminal, there was some opportunity to enjoy the view and to buy some refreshments to get rid of your 1 baht coins. However, some companions preferred to stay in the shades to take care of their skin with after-sun cream because of sunburns from the ATV tour. The trip continued in the buses to Klong Prao Resort. This resort is enclosed in stylishly laid out bungalows surrounded by the renowned white-sandy "Klong Prao" beach. Relaxing on the beach and a dip in the sea with strong sea current gave some refreshment after this long day of traveling.

The pool, located on beachfront, gave a fantastic view over the sea. The pool also provided a bar with a bartender who luckily ignored the times of happy hour. During happy hour, instead of offering drinks for half the price, the double amount of drinks were served. At 7 pm dinner was served at the resort restaurant with a fantastic seaview. After dinner some Bernoullians went back to the pool/beach at the resort and some others got a taxi to an empty bar with the delight of some live music.





# Shaka Brah!

Day 15, Saturday the 9<sup>th</sup> of July 2016

Martijn Hazenberg

It's Saturday. Probably.

After a good night of sleep, everybody woke up believing a speedboat tour was made for that day. Unfortunately the tour was cancelled due to extreme weather conditions. The sun was shining bright, but the sea was too wild. Maybe better luck tomorrow. This cancellation is the reason why the activity of 10 July was preponed to this day. Ziplining it is, at Tree Top Adventure Park Koh Chang.

For many people it was the first time to go ziplining. To be fully prepared, the educational South Park episode 'I should have never gone ziplining' was watched. The most important lesson learned from this episode, is to shout out 'Shaka Brah' while going down a zipline. Shaka Brah means 'to hang loose'.

*" Nice Zip! "*

Unfortunately, phones and cameras were not allowed, nor was it wise to have them on. This explains the absence of cool photos which could be expected from a day like this. The Tree Top Adventure Park consists of two routes: blue and red. The first route is the blue route and consists mainly of climbing between trees on several structures built from wood and rope.

The red route, which starts on a geographically low point, started with a climb on a ladder made from ropes between two trees. Almost right after the start, a 150 meters long zipline was present; the longest of the day. The second route has many more ziplines than obstacles, but ends with a difficult

obstacle anyway. This particular obstacle, as referred to as 'the bicycle', was definitely one of the hardest hindrance. This activity, as opposed to the jungle tour, did not claim any victims.

*" Shaka Brah! "*



Back in the resort, many Bernoullians retired to the swimming pool, where Happy Hour had already started. After some cocktails it was time for dinner. That day's chairman of BGA had found an amazing and cozy restaurant called 'Blue Lagoon'. Located near the water, the taxi driver had to go offroad to come there. When 18 beers and some food was ordered, the waitress and owner left for a while. Apparently they are not used to groups this big, at least not in the low season, as a truck arrived with a crate of beers just for our group after a while. A second round of beer was out of the question. Their food is quite good though, except for the Pad Thai which tasted strange. Afterwards, half of the group was up for some more drinks, and went to Lonely Beach, on the south west side of the island where the party went on late into the night.





# Just Relax

Day 16, Saturday the 10<sup>th</sup> of July 2016

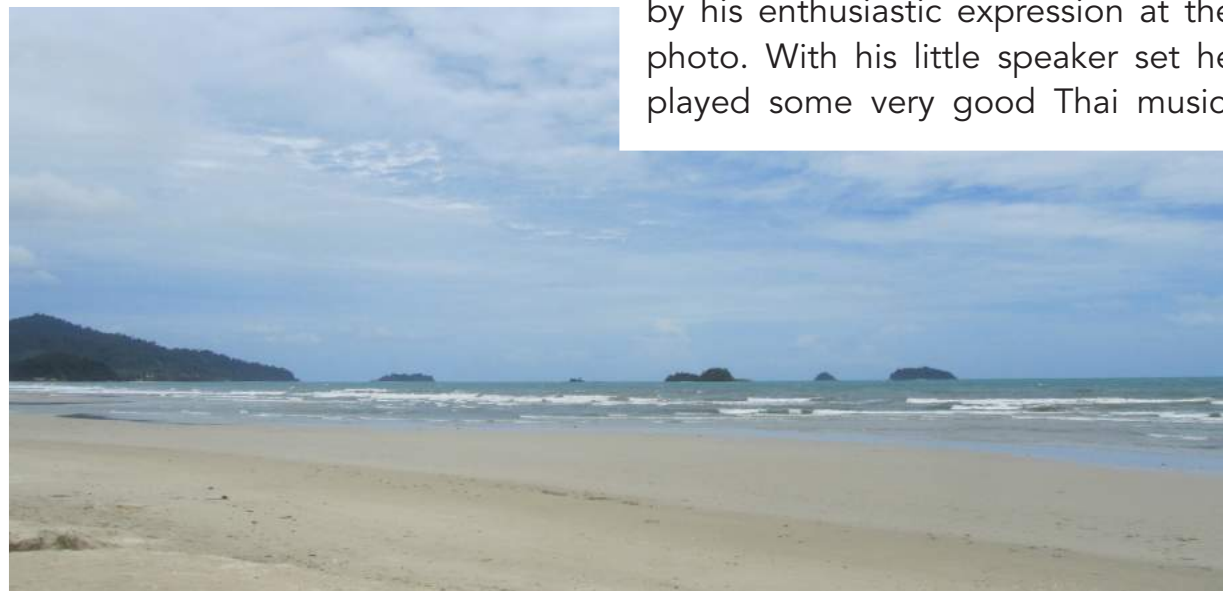
Folkert Keij

The alarm was set early in the morning because of the possibility that the boat tour should take place this day. For some of us that alarm rang very early because of a party from the day before. Unfortunately the speedboat tour was cancelled again due to extreme weather conditions. This meant there was nothing on the program today so everybody could relax, enjoy the beautiful view from the island and spend some free time!

Some of the group went to the spa near the resort for a relaxing massage. The spa was not prepared for such a big group so they had to call some other masseurs from around the island to come over. Besides the famous Thai massage there was plenty of choice to take other kinds of massages. Above all the choices there was a possibility to

go in a steam cabin to relax some more! The whole day chilling makes you hungry and that is why the group did get a good lunch at the restaurant of the resort. After the lunch some of us took a dive into the sea and tried to swim with the strong current of the ocean. Others did get some rest or explored the island some more by foot.

In the afternoon most of the group gathered at the swimming pool for a swim and the delicious cocktails, an advantage of having a bar in the pool. With the two hour during happy hour many cocktails could be drunk, tasted and compared. The friendly barman enjoyed having such a big group at his bar, as could be seen by his enthusiastic expression at the photo. With his little speaker set he played some very good Thai music.











# DAY REPORTS

## BANGKOK



# Seeing the Contrast

Day 17, Monday the 11<sup>th</sup> of July 2016

Arjan ter Horst

The 11<sup>th</sup> of July was a day of travelling. The tour across Thailand was completed by leaving Koh Chang and returning to Bangkok. After a short night and a quick breakfast at the resort the three vans headed back to the ferry, which brought us to the mainland. The early morning views from the ferry were breathtaking.

After reaching the mainland, the rest of the morning and mid-day were spent catching up some sleep. This resulted in a reborn, vibrant group of students arriving in Bangkok in the early afternoon. After a short swim at the Le Tada Parkview Hotel, the souvenir hunt began. Different groups hit the roads of Bangkok in search for presents and memories for the domestic front. The free afternoon also provided a nice opportunity to

explore Bangkok's sky-train during rush hour. Moreover, during the first stay in Bangkok this mode of transport had not been used. The sky-train can be best described as a railroad on concrete piles towering over the city. In contrast to the somewhat chaotic street life of Bangkok, transport by sky-train is easy and structured. The passengers automatically tend to queue up on the platform and give space to the disembarking crowd. On top of that the Thai seemed to have no interest in Dutch tourists, which was refreshing.

After a few stops it was time to start looking for the agreed restaurant. From the railway station a shortcut was found on the map. This path would lead us along a conventional railroad to the restaurant. Surprisingly, many people seemed to live up and along the track.

After walking a few hundred meters a remarkable view was encountered. Children were playing on the railroad, while in the background the 313 meter high Baiyoke sky tower and the sky-train track could be seen. This picture gave an interesting perspective on the wealth distribution in Bangkok. On the one side there are expensive buildings and a concrete sky-train towering above the city, while on the other side normal people seem to live right under this sky-train and next to the sky towers. The differences between the people in the sky-train and the people underneath it, showed how diverse and surprising Bangkok can be. The day was concluded in a typical Thai restaurant with fish, duck, curry, chicken cashewnut and noodles.





# Bernoulli Worthy

Day 18, Tuesday the 12<sup>th</sup> of July 2016

Johnny Tran

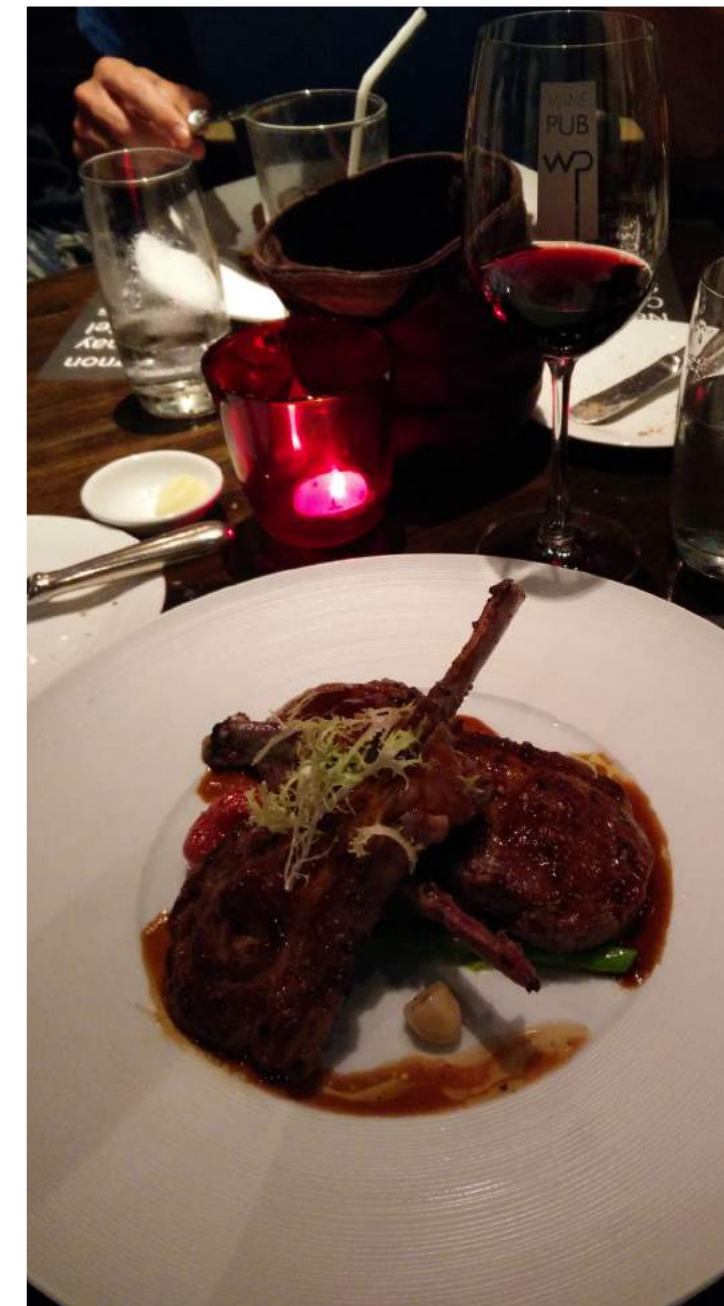
On the last official day before the group flew back towards the Netherlands three activities were planned. In the morning the participants were picked up by buses and travelled to the last company visit in Thailand; DyeCoo.

DyeCoo is a company that makes machines which color polyester fabrics with  $\text{ScCO}_2$ . This has many advantages regarding sustainability and ease of use which was clearly explained by a Dutch expat. A tour was given through the plant and at the different equipment explanations were given. Besides  $\text{ScCO}_2$  dyeing, also water and solvent based dyeing was done on the plant since DyeCoo is hired by a Taiwanese to implement the system and this Taiwanese company also dyes with conventional methods. The tour was followed by a presentation

of pros and cons of the expat life. The most important conclusion from this was that a lot of money could be earned, but on the other hand friends and family are far away. In the afternoon it was the last moment to buy souvenirs and many people took this chance for a last walk through the busy streets of Bangkok. In the evening the committee decided to go to a 'Bernoulli worthy' restaurant with the whole group; The Wine Pub in the Pullman Bangkok King Power. The French owner offered great red wines and told the history of every wine in very much detail. As main course luxurious food was served ranging from pork and lamb chops to Canadian lobster. The most delicious meal was the Wagyu beef, a special beef from Japan where rumors state the cows were massaged and listened to classical music.

After this nice dinner a few games of Petanque were played with the owner and the participants got some time to prepare for the last evening. When everybody was neatly dressed, the group headed to Club Onyx, which was a large club in the Bangkok RCA. As entrance fee, a few bottles of liquor had to be purchased. The club was quite large and there was a nice atmosphere in the club. Just like the rest of Thailand, there were so many servants around that nobody had to walk to the bar to order drinks. Some people went to other clubs later that night, but most stayed the night in nice clubs and enjoyed the hospitality of Thai women.

The author would like to thank the BGA committee for the organization of this study trip, the best trip in 10 years!





# Khob Khun Krab

Day 19, Wednesday the 13<sup>th</sup> of July 2016

Thiadrik Kramer

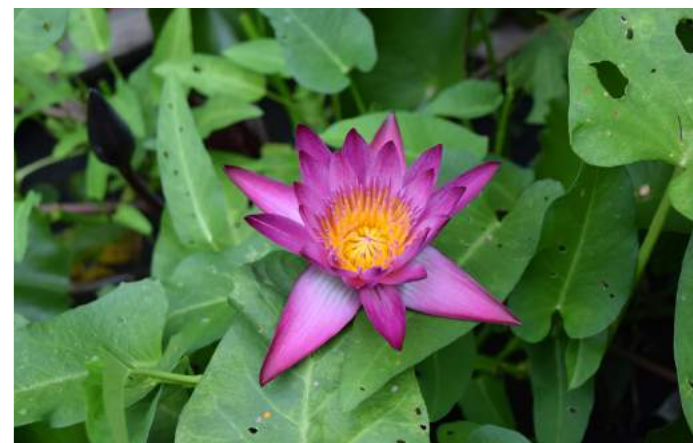
The last day of our travel was probably a tough one for many of us. Being slightly hungover from the party last night, everybody had to get up early and leave our hotel for the airport.

At the airport there was almost no time to say good bye since everybody rushed to their train. Luckily we still can come together at the afterborrel to once more discuss this amazing trip.

The last day of the trip was one with many lasts. One last time checking out, one last time riding in a taxi and one last hotel breakfast before arriving at the Suvarnabhumi airport. In the plane everybody watched some movies or tried to sleep. When landed in Amsterdam it was still sunny. It was a strange feeling as there was still some daylight in the evening and we were already used to the dark since the sun goes down much earlier in Thailand.











# CASE STUDY REPORTS



# AkzoNobel

*Henk Botma & Thiadrik Kramer*

*Supervisor university: Francesco Picchioni  
Supervisor company: Douwe Tuinstra*

This case study was done for the Mebraan-Elektrolysebedrijf (MEB) of AkzoNobel in Delfzijl, the Netherlands. At the MEB brine is converted through electrolysis to chloride, hydrogen and sodium hydroxide. The MEB is the most modern, most durable, safest and most economical chlorine plant in the world.

For various companies in the Chemical Park Delfzijl, chlorine is an important chemical. The chloride is supplied to other plants on site such as the AkzoNobel Monochloorazijnzuur fabriek (MCA), Teijin Aramid and Lubrizol. The hydrogen is also supplied to other plants on site such as Teijin Twaron, Noveon, Delamine and Delesto. The chlorine is eventually used in drinking and bathing water, cleaning products, but especially in plastics. For example,

DVDs, iPods and iPads. As byproduct of the chloride production sodium hydroxide is produced. This sodium hydroxide is sold to other companies.

The project started with the attendance of two HAZOP (Hazard and Operability study) meetings. These HAZOP studies are conducted every five years and play a big role in improving safety. The structured and systematic examination of the plant provides a great way to get to know the ins and out of the plant.

In the case study the main focus was on the hydrogen compression section. Hydrogen from the electrolyzers is compressed and supplied to other plants on site. Some of the hydrogen first needs to be dried before being supplied to other plants. The control of the plant is a main issue. The main

concern in operating the plant are the membranes in the electrolyzers. A pressure difference over the membrane prevents the membrane to come in contact with the electrodes. When in contact, the membrane would be punctured and starts to leak. As the membrane are very expensive this has to be prevented at all time.

For this reason, the startup of the plant is done with great caution. One by one the electrolyzers restarted and at first all hydrogen production is flared. At full production, the compressors are started and slowly more and more hydrogen is led through the compressors. Small problems occur often, making the startup relatively time consuming. To help this, an idea was opted to separate the electrolysis from the compression section.

This way, both the electrolyzers and the compressors could possibly be started and stopped independently of the other. This could possibly be realized with the existing setup of equipment. Operating the two sections separately has numerous advantages. Not only would the startup time decrease, leading to more production hours, also the electrolyzers could still be running when maintenance has to be done at compressors. This way more chloride could be produced. To investigate this, all aspects had to be taken into mind.

Whether the equipment was suitable for different circumstances, whether there would be too much leakage, and whether safety instruments would still do their job. To obtain this information, several meetings with process engineers, operators, mechanical engineers, and instrumentation engineers were organized. A report has been written with advice together with calculations, and proposals for changes in the plant and operating manuals. AkzoNobel has reviewed the report and even implemented some of the proposed changes.

**AkzoNobel** is a leader in global paints and coatings and a major producer of specialty chemicals. The specialty chemicals plant in Delfzijl produces 2.6 million kilograms of salt, which is used in the production of for example chlorine and monochloroacetic acid (MCA) for a broad range of purposes in industry.





*Arne Hommes & Martijn Hazenberg  
Ibrahim Chaabane & Arjan ter Horst*

*Supervisor university: Francesco Picchioni  
Supervisor company: Kees van der Voort Maarschalk*

Dear reader, we do understand that you might be thinking about skipping the pages with text and move on to the pictures, but please do not! We will explain shortly what we did to get on those pictures.

In the last week of November, just after applying for BGA, we got word that we were chosen for the case studies of Corbion Purac. A mere week later we were in the office of prof. dr. ir. K. van der Voort Maarschalk (Kees). The four of us were divided into couples to work on two separate assignments. The project was off the ground. Corbion is the global market leader in lactic acid, its derivatives and lactides. Furthermore, it is a leading company in functional blends that

contain enzymes, emulsifiers, minerals and vitamins. The company employs roughly 1,700 people. When the four of us visited Corbion's manufacturing plant in Gorinchem last January, we got to see the real size of the company and were impressed. It was interesting to see the huge drying units in reality and to have someone explain us how Corbion produces ethyl lactate with impurities on the parts per billion scale.

*"Don't fall into the pit of excessive refinement"*

Our case studies were generally about drying and were a part of one of the drying projects of the Institute for Sustainable Process Technology (ISPT).

The ISPT is a collaboration between different companies, corporations and research facilities. The initial assignment was to perform a techno-economical evaluation of novel drying methods compared to conventional drying methods such as spray drying and drum drying. The extent to which we were able to do this depended on the stage of novelty the methods were in, the so-called technological readiness level. Details are irrelevant if only the process' main lines are known, while an initial analysis already shows the critical points. What we did exactly is classified.

*"I think it's time for a bio-break"*

The four of us enjoyed working on the cases. We met new people and got a unique insight into the activities of companies and universities in the drying cluster. The atmosphere during meetings was pleasant while the meetings themselves had a formal setting and were often very efficient. Bio-breaks contribute to the efficiency because people can focus better afterwards. It was interesting to see the plant in Gorinchem, as well as having a tour at ECN in Petten and at FrieslandCampina in Wageningen.

**Corbion** is the global market leader in lactic acid, lactic acid derivatives, and lactides, and a leading company in functional blends containing enzymes, emulsifiers, minerals, and vitamins. These products are used in the biochemical, biomedical, bioplastic and food industry.





# ZEOLYST

## INTERNATIONAL

In the case provided by Zeolyst C.V. (a joint venture of PQ Corporation and Shell) our task was to find a solution for the waste water streams of the plant.

Zeolyst C.V. produces large amounts of high quality zeolites for different kinds of applications (e.g. hydrocracking in oil refineries). The mother liquor of the zeolite synthesis and the washing water for the zeolite purification creates an effluent stream of water containing unreacted chemicals. In the current process, the effluent is sent to a waste treatment company at high costs volume. Zeolyst C.V. wanted to reduce the costs and we were asked to perform a technical and financial analysis of possible solutions. The effluent consisted of different kinds of chemicals.

However, the chemical with the highest priority to be removed was an ammonium-type chemical. Since the effluent consisted of only starting materials, the first possible solution was recycling of the effluent. Two other indicated possible solutions were the use of carbon bed filters or sending the effluent to another waste water treatment plant. All these three possible solutions were researched in more detail. The option of recycling could not be directly executed, since the concentration of unreacted chemicals in the effluent stream was too low to directly feed the stream back in the reactor. To increase the concentration, evaporation of water was required. Since Zeolyst C.V. already had a vacuum

evaporator available, investment costs were rather low. Applying mass balances, the concentration of the effluent was matched to the desired reactant ratio in the reactor. Therefore, addition of fresh reactants was needed in order to obtain the right ratio. Initial results showed that it is possible to come very close to the starting ratio. The product is however very sensitive to small changes in ratios and besides that, there existed some potential disadvantages that needs to be investigated, making this solution a long-term project. The second option was to send the effluent to another waste-water treatment plant. However, this plant has some more limitations than the current one.

*Bas Disselhorst & Johnny Tran*

*Supervisor university: Paolo Pescarmona  
Supervisor company: Henk-Jan Veenhuis*

On the other hand, the disposal costs for the effluent are significantly lower. For this option, pre-treatment was investigated in order to overcome these limitations. An estimation of the investment costs and the operating costs were made and it was proven that the costs for disposing the effluent were reduced pronouncedly.

The third solution was the use of carbon bed filters. Activated carbon is known for its adhesive properties for organics from water purification. Another plant of Zeolyst C.V. had a proof of concept for the use of carbon bed filters. With the data from this plant, a proof of concept was shown for the Delfzijl plant. The carbon bed filters were designed and the operating costs were estimated.

In conclusion, significant cost reductions were found regarding the effluent stream. However, not one solution was regarded to as the single best solution. A combination of the described solutions might yield the largest cost reduction. We would like to thank Zeolyst C.V. for the opportunity to perform the assignment and we hope that we have taken them one step closer in the cost reduction of the effluent water.

**Zeolyst International** is a global leader in the disciplines of zeolite powders, catalysts and adsorbents. It combines the product development and manufacturing expertise in zeolites and catalysts from its parent companies, PQ Corporation and the Shell Global Solutions affiliate CRI/Criterion Inc., into a single entity that can handle the entire development and commercialization of zeolite applications.





Jasper van den Sigtenhorst & Remon Schuring

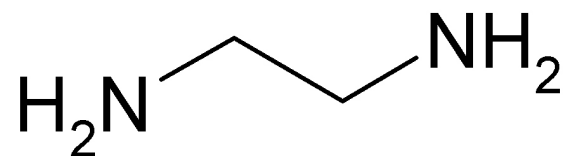
Supervisor university: Marc van der Maarel

Supervisor company: Henk Kuiper

Delamine, a name combination of the city Delfzijl and amine, is a joint venture between AkzoNobel and Tosoh Corporation. It produces ethylene amines like ethylenediamine, diethylenetriamine, triethylenetetramine and so forth.

The ethylene amines that are produced by Delamine are synthesized via the EDC route. This is a continuous process in which ammonia reacts with EDC (ethylenedichloride) under high pressure and at high temperature. After this reaction, caustic soda is added and the resulting salt is separated in a crystallizer. Distillation of the reaction mixture subsequently isolates the different ethylene amines. You might not be familiar with the applications of ethylene amines, but you undoubtedly have used products containing

ethylene amines. For example, ethylene amines are essential to keep tea bags together when making tea, they are present in the petrol in your car as dispersant detergent additives, and are used to make 'asphalt-in-water' emulsions. Even viagra contains piperazine, a cyclic ethylene amine.



Delamine kindly provided Bernoulli Goes Abroad with the opportunity to perform a case study. Unfortunately, it is not possible to disclose too much details about this case study. It can be best described in one word: patents. First, our knowledge on patents was expanded by doing an interactive e-learning module of the Netherlands

Enterprise Agency and by talking to prof. dr. M.J.E.C. van der Maarel. After having a better understanding of patents, actual patents were searched for Delamine. It was quickly found out that patents are not always present in English. Some patents are only published in the language of the designated country such as Chinese, Japanese or Korean. In those cases, there was relied on a machine-generated translation to English. Although those translations not always made sense, it was possible to grasp the concept of the patent, next to some odd sentences that resulted in fun times reading the translations. The found patents were clearly reviewed in a self-made template.

In addition to the patents, a report with background information of the other companies that produce ethylene amines was made and a detailed summary of all the various methods that exist for the synthesis of ethylene amines was added to the report. The progress of the case study was discussed on a biweekly basis with Delamine. Performing this case study, insight into what happens at a chemical company was gained.

**Delamine** delivers different kinds of ethylene amines, a specific field of chemistry. These chemicals are for example used for shipbuilding, the automotive industry, customer products and healthcare. The production plant in Delfzijl is the largest 1,2-dichloroethane (EDC) manufacturer in the world and exports its chemicals to over 50 countries globally.

This way, the business side of the study Chemical Engineering was highlighted, which is a valuable addition next to the theoretical courses the University offers. On top of that, knowledge about ethylene amines and patents was expanded. After a satisfying collaboration with Delamine, it is time to explore Thailand.





Martine Schouten Hoogendijk & Frank Hogewoning

Supervisor university: Francesco Picchioni

Supervisor company: Klaas Remerie

Commissioned by SABIC Geleen, a report concerning a literature review on polymer modification by azide-assisted chemistry was written by Frank Hogewoning and Martine Schouten Hoogendijk.

SABIC Geleen is a petrochemical site with two naphtha crackers and several polymerization plants for the production of the following polyolefins: polyethylene and polypropylene. These polyolefins share a large portion of the plastics market because of their low cost and versatile properties. Important ways to further widen the application scope of polyolefins make use of blending and compounding, as well as reactive modification.

Reactive modification typically uses non-selective chemistry involving free radical generation, for instance by using peroxides. For instance the peroxide-initiated controlled degradation of polypropylene during plant extrusion is a well-known example.

Another example is the peroxide- or radiation induced crosslinking of polyethylene for cable application. Although these techniques are useful, chemistries involving free radical generation usually are not very selective, suffering from a multitude of side reactions, which is one of the main disadvantages of this approach.

An alternative approach to the peroxide-based radical processing strategy described above involves the use of organic azides, such as: alkyl azides, aryl azides, sulfonyl azides, azidoformates and di-azides. Organic azides consist of an organic group R connected with a resonance structure of three nitrogens. Thermal decomposition of azides at appropriate processing temperatures is known to generate reactive intermediates. This class of compounds could therefore potentially be used for reactive modification of polyolefins.

This alternative approach might be a very interesting alternative for bulk modification of polyolefins. Therefore, the suitability of different azide compounds was compared by analyzing the decomposition temperature, reaction products, reaction paths and efficiency, and some mechanical properties of polymer products formed. This led to an inventory report about all known data of azide-assisted bulk modification of polyolefins as found in available literature and patents.

**Sabic** is an international company with 40,000 employees, having a production location in Geleen with 1800 employees. In Geleen raw materials for the production of different plastics are being produced from hydrocarbons obtained from refined oil.











THE FINISHING TOUCH



# How Did We Set This Up?

## Part 1

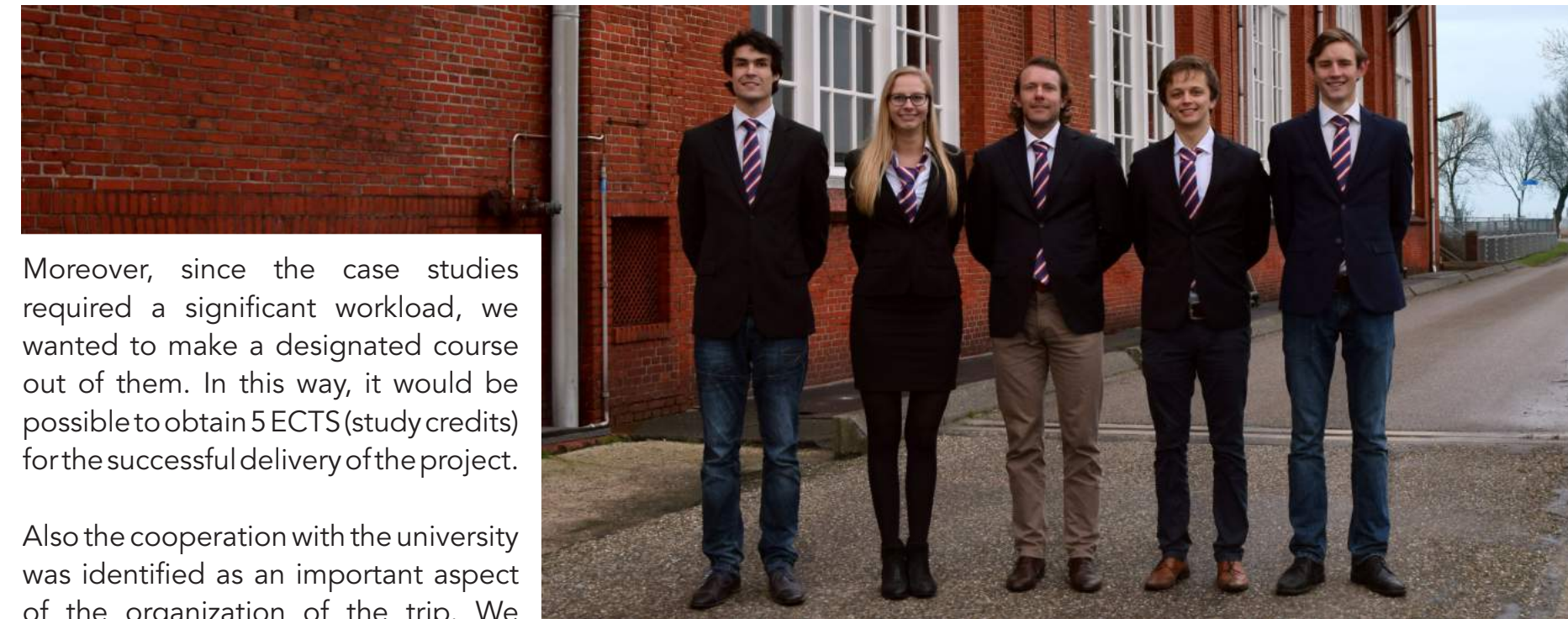
Frank van Mastrigt & Loes van der Net

In May 2015, the idea for organizing a Bernoulli foreign study trip was born. Inspired by stories of study trips organized in bygone times mentioned at the 6th Lustrum of Bernoulli, momentum was gathered. After a brief discussion with the board of Bernoulli (Board Disselhorst) it was decided: The next step in the maturation of the association would be the organization of a foreign study trip.

After the formation of a motivated committee for the organization of the study trip in collaboration with the Board, we immediately started creating ideas and making plans. However, many years had passed since the previous trip was organized, where should one start? We decided to dive into the archives of Bernoulli, that are carefully tucked away in the basement of the building

and locked with a chain lock impossible to break. Fortunately, we got ahold of the key. We found some summaries of case studies that were performed over ten years ago. Moreover, some budgets were present in the archive, but the majority was still originating from the guilder era. Time to start over completely, we grasped. Very quickly already, we realized we had to organize an incredible amount of different things. One of the very first things was a quest to find participants for the study trip. Who is interested in joining a foreign study trip? What are their expectations? What will be the limitation in terms of financial contribution for participants? Next to financial contributions by participants, we identified the need for external funding. Without external funding it would be impossible to organize a successful trip.

On top of that, we were ambitious. Yes, it was the first trip in years, but we organized it for G.T.D. Bernoulli, so it had to become an unforgettable trip. We had to approach funds, the study association, but also industrial companies for general sponsorships and to execute case studies with us. Especially the latter proved to be very important in generating sufficient funds. Students were performing case studies in duos for different companies. Both students worked together with the company (140 hours per student) on a topic that is relevant for the company. A great concept and a great real-life experience for students, but it meant that next to the selection of suitable students, we had to acquire the case studies, find a supervisor within the company, and a professor at the university for supervision.



Moreover, since the case studies required a significant workload, we wanted to make a designated course out of them. In this way, it would be possible to obtain 5 ECTS (study credits) for the successful delivery of the project.

Also the cooperation with the university was identified as an important aspect of the organization of the trip. We needed to find a supervisor from the university that was enthusiastic about us organizing a foreign study trip and would help us with contacts, the exam committee, and formalizing the study trip. Fortunately, Francesco Picchioni was very enthusiastic from the beginning and we shared a great time in Thailand! Still, we were not well known yet at local companies and especially not abroad. In order to streamline communication and display our

serious intentions, we required a Committee of Recommendation. We were very fortunate with the well known members from both industry and the academic world and we are certain that mentioning our Committee of Recommendation at first contact with companies and universities has been of great importance in the realization of this study trip. However, without a destination there would be no study trip.

Of course, the choice for a certain destination is of major importance for the successfulness of the study trip. Still, in the beginning of the organization, it was not known how much funding and case studies could possibly be obtained. Several scenarios were created with varying amounts of case studies and participants, leading to several different budgets with corresponding destinations and durations.



# How Did We Set This Up?

## Part 2

Frank van Mastrigt & Loes van der Net

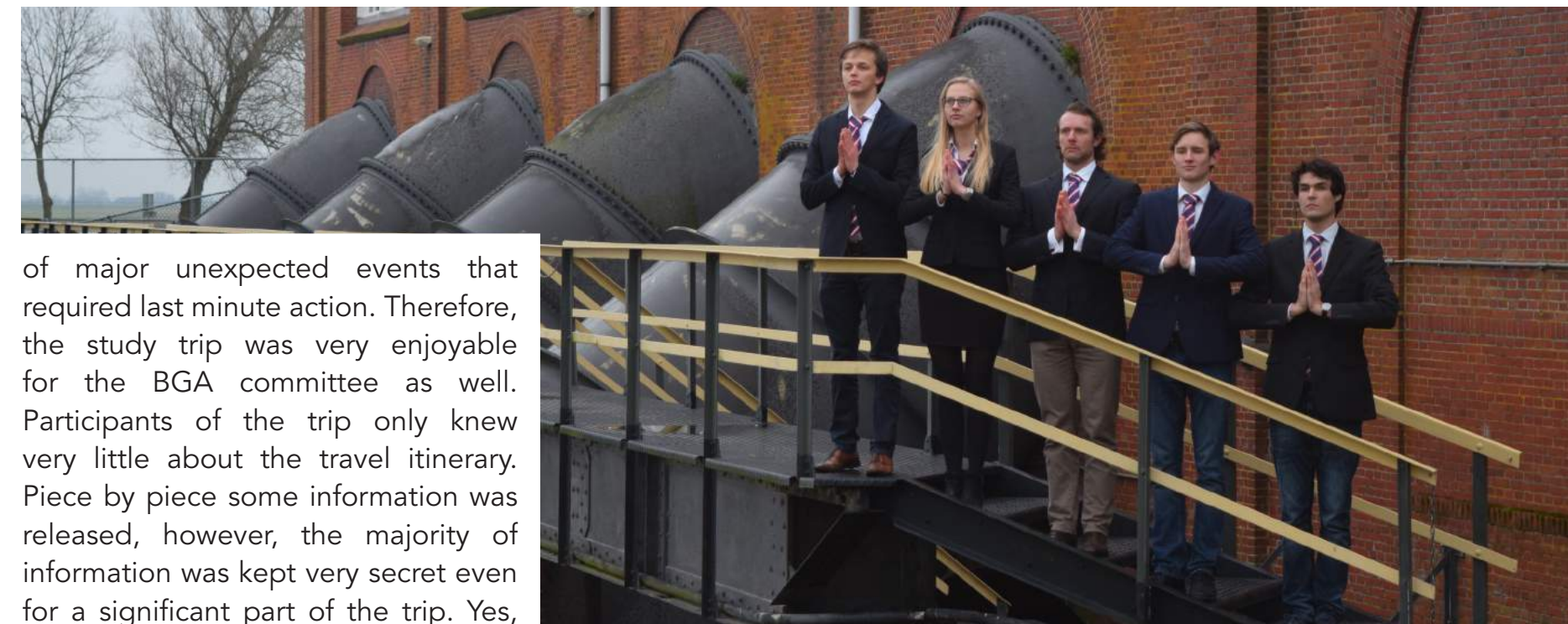
On a certain moment the applications for participants were already being held, without knowing the exact destination of the trip due to uncertainties in the number of case studies. At this point we decided that we could afford a destination that was far away, however, that would offer affordable cost of living at the same time. Several countries were investigated and the best option in the end turned out to be Thailand, a beautiful country which could make our study trip a huge success, with its big cities, fantastic nature, culture and many islands.

After selection of the destination, the predominant next step was cooking up a travel itinerary. A study trip without a programme is as a Pizza Carciofi, without artichokes: plain. In order to come up with a programme that would

be both informative and entertaining, we questioned participants about their wishes. Based on their feedback, the number of university and company visits, as well as other activities was determined. In the end, we ended up with a challenging schedule, including very diverse activities. Following the general itinerary, the next exciting stage of the organization was initiated: making actual reservations for accommodation and transport. First, we booked flights and we made sure that we were able to cancel some of the tickets upon request. We already searched for comfortable hotels to guarantee a pleasant stay during our trip. Some of these stays (with the option to cancel) were already booked in a very early stage. During the next period, the final number of case studies became

apparent, making it possible to select the definitive group of students that reached the honourable status of 'participant'. Participants signed up for the study trip, without knowing the exact destination. Can you imagine, the kind of reputation the BGA committee had already built over the course of the first six months!

In the last couple of weeks in the build-up to the study trip, a very detailed travel script was realized, containing tasks split up over 10 minute periods. This very script and the rotating of the person responsible for the activities per day proved to be extremely welcome for the organizing committee. By splitting up responsibilities and going through different scenarios in advance, it was possible to organize a trip that was pretty much free



of major unexpected events that required last minute action. Therefore, the study trip was very enjoyable for the BGA committee as well. Participants of the trip only knew very little about the travel itinerary. Piece by piece some information was released, however, the majority of information was kept very secret even for a significant part of the trip. Yes, participants did know that they were going to Thailand, to Bangkok. But, little did they know that local transportation in Thailand would lead them to Ayutthaya, Chiang Mai, Pattaya, Koh Chang, and finally back to Bangkok.

In order to arrange everything, the BGA committee had over 60 meetings in which everything was planned, coordinated, workload was divided, worries were put on the table, and

problems were tackled. Looking back on the whole sequence of events over the past year, it is remarkable that the BGA committee still gets along very well. Next to that, we have to give our Business contacts (Jesper Zwart & Folkert Keij) a lot of credit! Arranging sufficient funds proved to be difficult, resulting in uncertainties regarding what kind of destination was attainable. Would an intercontinental trip be economically viable?

And, how do we start? A lot of experience with organizing a foreign study trip was lost, everything had to be built from scratch. Moreover, the stake of the committee was to not only organize a foreign study trip, but also to build a foundation for further study trips. If proven successful, BGA will namely be organized every other year!



## What a Trip!

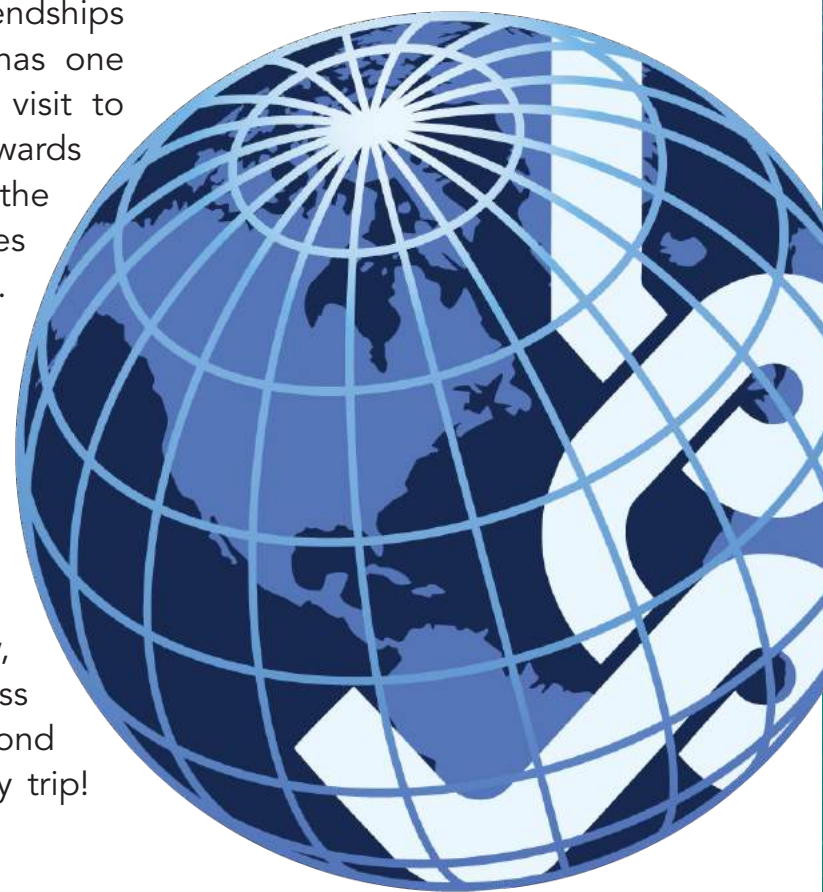
*Loes van der Net*

What a trip, what a trip! Almost a year of preparation and a lot of effort was put into the organization of this trip, but it was totally worth it.

Keeping everything secret was kind of a risk, but from stories we can definitely conclude that the 19-day trip was a reward that even exceeded expectations. It was a busy, exciting, beautiful, surprising and maybe even exhausting trip for the group of 18 Bernoullians, with a lot of contrasts. From living in luxurious hotels in the chaotic and busy city of Bangkok to the survival in the quiet and small jungle villages with the native people of the Karen culture. From the educational and exciting days at companies and universities to relaxing and social activities at the beach on a beautiful island with stunning views. Existing

friendships were strengthened and at the same time, new friendships were born. But, everybody has one thing in common. This very visit to Thailand opened our eyes towards the local culture in Asia and the very significant differences in wealth present there.

The goal of the committee is to give a good starting point for next generations to make the organization of such a Bernoulli trip a biennial event. The applications for a new committee are almost open now, so we wish them a lot of success with the realisation of the second 'Bernoulli Goes Abroad' study trip!





# Expression of Gratitude

Loes van der Net

This amazing trip could not have been organized without the help of a lot of people. We want to thank all these people for their contribution making this study an enormous success.

## General

Prof. Dr. F. Picchioni

Francesco, we want to thank you once again for your generous support before and during (the organization of) the trip. Francesco was coordinator of the case study course in general, as well as supervisor of some of the performed case studies. We also want to thank Francesco for sharing his connections from the local industry and for helping us with establishing contact with companies and universities in Thailand.

## Supervision of the case studies

Prof. Dr. F. Picchioni

Prof. Dr. Ir. K. van der Voort Maarschalk

Dr. P.P. Pescarmona

Prof. Dr. M.J.E.C. van der Maarel

## Organization of the trip - Contact with Thailand

A. Niehof - Nuffic NESO Thailand

T. Zwaagstra - Program manager Southeast Asia

Your support and contribution helped us opening opportunities and possibilities in Thailand during the organization of the trip by bringing us into contact with interesting companies and universities, organisational work, and by providing us with a lot of general, useful information.

## Visited companies and universities in Thailand

We want to thank the companies and universities who invited us and gave us all a very warm welcome. All took excellent care of hosting us during very interesting and educational days at their sites and university complexes.

## Financial

On a financial level, we would like to express our sincere gratitude to all our sponsors. We really appreciated your support and we hope to collaborate again during the organization of a next trip!

## Case study sponsorships

We would like to thank the companies that participated in performing one or more case studies with us. Thank you for your cooperation and your trust in us!

AkzoNobel:

Corbion:

Delamine:

Zeolyst:

Sabic:

A. Jonkman and D. Tuinstra

K. van der Voort Maarschalk

H. Kuiper

H. J. Veenhuis and J. Leuveld

K. Remerie

## General sponsors

AkzoNobel

## Subsidies

Hoogewerff foundation

University of Groningen

Groningen University Fund



# Committee of Recommendation

The Committee of Recommendation consists of the following members:

*H.E. Mr. I. Boonpraong*

Ambassador of the Kingdom of Thailand to the Kingdom of the Netherlands

*Prof. A. A. Broekhuis*

Professor Chemical Engineering at the University of Groningen

*Ir. A.C.M.A. Büchner*

CEO & Chairman of the Board of Management and the Executive Committee  
Akzo Nobel N.V.

*Prof. dr. ir. L. P. B. M. Janssen*

Professor Chemical Engineering at the University of Groningen

*Ms M. dos Ramos, MSc*

Director of the Royal Netherlands Society of Engineers (KIVI)

*Prof. J. M. A. Scherpen*

Director of the ENgineering and TEchnology institute Groningen (ENTEG)

*Prof. E. Sterken*

Rector at the University of Groningen

*Mr J. W. Toering, LL.M., MSc*

Director of the Royal Netherlands Chemical Society (KNCV)

With the help of this committee, it was possible to organize a both informative and unforgettable study trip to Thailand!



## Case Studies



**Corbion**  
purac

**AkzoNobel**  
**ZEOLYST**  
INTERNATIONAL

سابك  
سابك  
delamine

## Subsidies & Sponsorships



**Groninger Universiteits  
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**Undergraduate School  
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**‘A great idea to  
help your career  
take off’**

### Meet Désiree

She joined AkzoNobel after a Masters in Strategic Management and currently works at our Aerospace Coatings business. In her role as Market Segment Manager she acts as a portfolio manager servicing all segments of Aerospace Coatings, like OEM, Maintenance and Defence. “I have direct contact with different functions in the organization, such as RD&I, Marketing, Sales and Production. We are truly customer focused and everyone puts their heads together to find the best solution for our clients”, she says. “There’s a good reason that one out of every three airplanes worldwide is coated with our products.”

She encourages Masters students to take part in international study trips. And AkzoNobel supports such tours by granting financial contributions. “The trips are a great way of gaining experience and exposing yourself to new ideas and cultures. That’s essential as you - and we - strive to succeed in a competitive global marketplace. And participation could help your career take off at a forward thinking international company like AkzoNobel.”

**Désiree Oldenburger**  
Market Segment Manager

**Where your ideas go far**

To find out about our career opportunities, please visit our website [www.akzonobel.nl/careers](http://www.akzonobel.nl/careers)

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# Bernoulli Goes Abroad 2016

Frank van Mastrigt

Chairman

Loes van der Net

Secretary

Hero Goldhoorn

Treasurer

Jesper Zwart

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f.l.t.r. Hero, Jesper, Frank, Loes & Folkert