LEARNING EXPEDITION

MARCH 2023

MUNICH

ZURICH

GENEVA

MASTER PIC

Master PIC

INSTITUT POLYTECHNIQUE DE PARIS

ÉCOLE POLYTECHNIQUE

HEC PARIS

TELECOM Paris




Table of contents

MERCI
DANKE
THANK YOU !

We would like to start the report of this learning expedition by thanking our teachers for their support and the team of students who organized the expedition. We would also like to thank the partner companies of the Master PIC who contributed to the financing of our trip. And last but not least, we would like to thank all the companies that welcomed us during this week.

Thanks to :

Companies met during Lex

Alnylam
Cartier
CISCO
Creaholic
EPFL RT
Givaudan
Google
Hitachi
Hyperloop
Klockner
Lilium
Omega
Personico
Rubis Control
Siemens
SP80
UEFA
Unitaid
WHO Innovation Hub
ESG

Partner companies of the Master PIC

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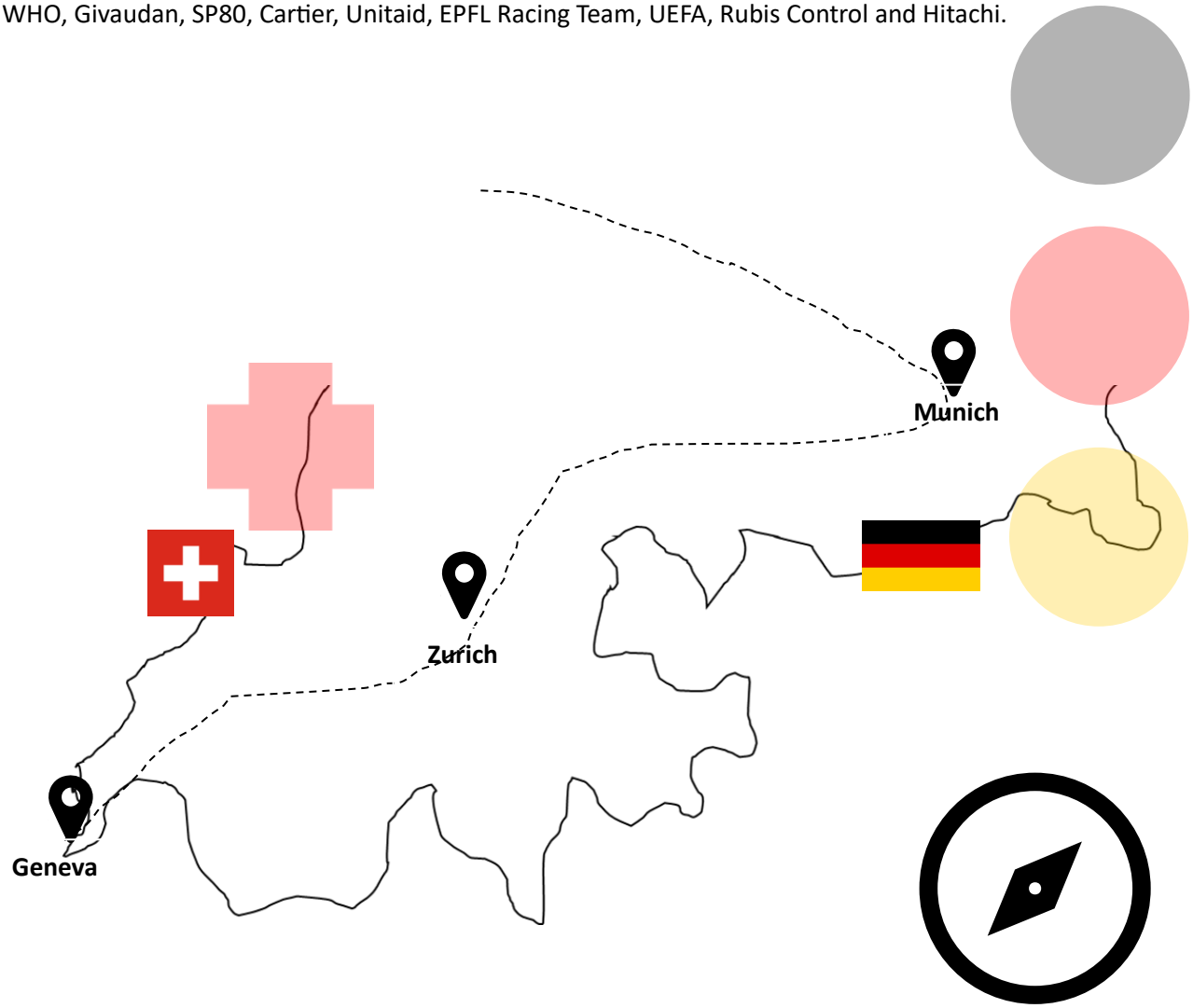
Ubisoft

Introduction

Like every year, the PIC master organizes a Learning Expedition. This is a one-week study trip during which students visit companies related to innovation and exchange with professionals from different sectors (energy, industry, tech, health,...). This year, the students of the PIC master went to Germany and Switzerland from Thursday, February 23rd to Saturday, March 4th.

In detail, the students stayed in Munich from Thursday, February 23 to Monday, February 27. In Munich, they were able to meet the managers of ESG, Personio, Lilium, Siemens, Klockner and Hyperloop. Then from Monday, February 27 to Wednesday, March 1, they went to Zurich. They were able to visit Google, Alnylam, Creaholic and Omega. Finally, the students ended their trip in Geneva where they visited Cisco, WHO, Givaudan, SP80, Cartier, Unitaid, EPFL Racing Team, UEFA, Rubis Control and Hitachi.



Hyperloop

TUM HYPER LOOP

Hyperloop is a proposed mode of transportation that would use magnetic levitation and a near-vacuum tube to transport passengers and cargo at high speeds. The concept was first proposed by entrepreneur and Tesla CEO, Elon Musk, in 2013 as a response to the inefficiencies and high costs associated with traditional modes of transportation. Hyperloop would operate in a low-pressure tube, with pods or capsules traveling at speeds of up to seven hundred miles per hour, significantly reducing travel time and increasing efficiency. The technology is still in the development phase, with several companies working on prototypes and feasibility studies. If successful, Hyperloop has the potential to revolutionize long-distance travel and transportation infrastructure.

The Hyperloop Pod Competition

The Hyperloop Pod Competition is an engineering competition that was initiated by SpaceX, the space exploration company founded by Elon Musk, in 2015. The competition is designed to encourage the development of functional prototypes of the Hyperloop transportation system. Participating teams are tasked with designing, building and testing their own pods, which will eventually be launched and raced on a SpaceX-designed test track. The competition has attracted teams from universities and private companies worldwide, and has been successful in promoting collaboration and innovation in the field of transportation. The competition is ongoing, with several rounds having taken place since its inception.

The TUM Hyperloop

On February 27th, we were kindly invited by the TUM Hyperloop student association, who is a remarkable actor in this landscape. Indeed, they won every one of the four design competitions that took place and managed to bring their module to 482 km/h. The project is strongly supported by the university and by local politicians (3.5m€ budget given at the start of the project, coming from a Regional Innovation Fund). It was a period of intense activity for them as their new prototype has to be ready by mid-2023.

The PIC visit

We were welcomed by Mats Claussen, a Bachelor student who is the Team Lead of the TUM Hyperloop student association. He first introduced us to the track record of the association regarding the global design competition on Hyperloop. Since the last competition in 2019, the association is more focused on developing a scalable design and on studying the economic viability of the project. During his presentation, he also compared Hyperloop with other means of transport to insist on the overall benefits in the mobility sector, insisting on the speed and the ecological benefits mainly. He kindly answered our questions about infrastructures, competitors, the student team structure and his first findings on the topic of the economics of

innovation under scrutiny. As a matter of fact, a dozen TUM PhDs are the core members of the theme and are in charge of developing a specific part of the whole module (levitation, propulsion…). Also, the team is very diverse : about 25 nationalities are represented !

« The objective of this tunnel is to prove that all the technologies work together »

Then, he brought us to their “playing ground”, a dedicated area on the campus where they gather and work. In their workshop, they showed us the technology making the train levitate. Next to their workshop, the students built a tunnel of about twenty meters long. The objective of this tunnel is to prove that all the technologies work together, on a human scale. The first tests are planned for this year and should transport the first human beings. Yet, given the length of the tunnel, the test will only be run with a speed of about 16 km/h maximum.

Debriefing

During the debriefing, the students from the PIC master's program were impressed by what a team of young students had already achieved. However, while everyone would like to see this project succeed, some have expressed doubts about its economic viability. Indeed, taking the example of France, the TGV, which is much less technically complex, is not profitable, except for the Paris-Lyon line.

However, it is certain that the multiple technologies developed as part of this project will have many other useful applications in many other fields. If the first test phase in the current tunnel proves successful, the second phase of the project plans to build a much longer tunnel, allowing for testing of curved trajectories. We are all eager to see the progress of this project and thank TUM Hyperloop for their hospitality!

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Esg

ESG (Electroniksystem und logistik GmbH) was founded in 1967 by four companies : AEG-Telefunken, Rohde & Schwarz, SEL (Standard Elektrik Lorenz) and Siemens. In the 1960s due to numerous problems in connection with the controllability of the Lockheed F-104G Starfighter, which resulted in many crashes and tragic deaths, the Federal Ministry of Defense (BMVg) demanded measures to increase the safety and operational readiness of the Starfighter. The BMVg pushed for the establishment of a company that would bundle the defense technology development expertise of the electronics industry. ESG's first order was the preparation of a project proposal for the weapon system electronics of a new combat aircraft. Today, 1200 people work for ESG. The group is divided in four companies :

- ESG Aerosystems Inc., based in the US, stands for excellence in training, delivering mission-critical, first class training solutions to keeping personnel combat ready and operational.
- ESG consulting GmbH combines consulting with technology, strategy and innovation, they realize individual and sustainable IT and technology projects.
- ESG InterOp Solutions GmbH, is responsible for the development, integration and operation of complex IT systems.
- PTL Luftfahrt GmbH is a licensed aviation company that has been operating charter flights in Germany, Europe and other international destinations.

The main goal of this company is to provide equipment to the German army. Most of the time it does not deal with the equipment production itself, but integrates new systems into the German army. One of our interlocutors used the term “Germanization” of the systems. Integrating software and hardware in a system of components from many manufacturers in an ecosystem with many constraints (performance, reliability, security...) is not an easy task, indeed many military and civilian projects have not succeeded because of a lack of interface management between components.

We visited the site of Fürstenfeldbruck near Munich, the headquarters of ESG.

The visit

The students were first welcomed by Guillaume Uhlrich, Head of Business Unit Combat Aircraft (in the fixed-wing aircraft division) who presented the company and its main activities.Today, ESG is a manufacturer-independent system integrator for the defense and public security fields through various dimensions : air, land, sea, cyber and medical. It can operate between producers (such as original equipment manufacturers (OEM) of planes or platforms) and equipment industries, or between producers and governmental customers. This level of proximity to states induces the necessity for ESG to own numerous certificates which contribute to giving the company military as well as civilian recognition.

The company operates on the whole product life cycle, from the studies, concept

definition, development and realization to the integration and MRO (maintenance, repair and operations) of various solutions, services and complex systems.

The visit was also the occasion to have an insight into Technology and Innovation Management at ESG. As it is a project company - mostly system integration projects - the product innovation usually comes more from OEMs themselves. However, ESG has a strategic approach to step into product innovation. According to their vision, there can be two types of triggers for product innovation :

- Innovation from scratch, which focuses on an identified business case (with a high interest towards returns on investments)
- Project spin-off, which focuses on the internationalization of existing projects. This question has indeed been identified by ESG as crucial, particularly because of the norms and regulations specific to certain countries which impose technical product adaptations. Such spin-offs could lead to the development of products interesting for multiple clients, and would allow to avoid IP costs.

On that note, we also learned about the funding for innovation at ESG, which comes from several sources (tax refund, European or National funding programs, internal venture capital, etc.).

Overall, innovation is at the heart of ESG's business strategy, all the more that it aims to develop products of their own. Its goal is to encourage innovation at every level to seek for "eureka moments", as they called them, which refer to the moments when a potentially successful and innovative idea is found. In order to diffuse the innovation culture throughout the company, innovation managers are spread across the whole company and marketing helps encourage innovative initiatives (mentions in communication plans to increase the visibility of success stories or communicate about internal and external innovation awards…).

The students then had the opportunity to have a look at some of ESG's technical and innovative products, such as :

- a drone fall protection device involving a parachute system triggered in the case of a crashing risk identification, in order to avoid the loss of key materials and devices
- an overview of a series of devices for defense against enemy drones which involve various artificial intelligence technologies such as deep learning and visual detection algorithms
- anti laser attacks glasses for pilots with a specific wavelength blocking technology
- an augmented reality simulation for medical education and training in the armed forces and government agencies

Key learnings and highlights

Overall, the discovery of ESG was enriching as it allowed us to have an overview of a company focused not on a specific product or service that can be displayed in a portfolio, but on the integration part of such products or services. This company is very specific to the German market of defense and doesn't exist in all countries. It made us realize the importance of this integration step, that is sometimes lacking in some fields (for instance the public health sector), and that is key in the case of the same product in various countries following different regulations, and represents a necessary innovative process.

Personio

Personio
The People Operating System

Personio is a German software company headquartered in Munich. The company develops software that simplifies or automates HR management processes for SMEs (Small and Midsize Enterprises), following a B2B SaaS model. As of 2023, it has more than 8,000 customers throughout Europe, and more than 1,700 employees. Moreover, the company is valued at $8.5 billion, which makes it the third most valuable unicorn in Germany.

To gain an edge over its competitors, Personio tries to have a holistic approach when it comes to HR tooling, with its main goal being to automate HR workflow as much as possible. As such, its software is modular, and data is fully and seamlessly integrated between the different components. Its main features are human resources management, recruiting, talent management and payroll management.

Visit description

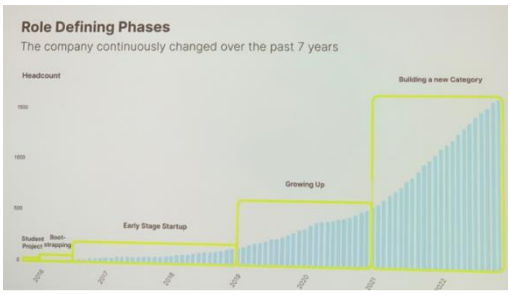
To more deeply understand Personio's core, we first had a presentation by Henri Heß, a Junior Business Operations Manager, then we toured the Munich office, and finally, we had a networking session with some of their local colleagues.

Henri Heß's presentation

Firstly, Henri Heß gave us key insights on Personio's growth. It all started with a student project: Hanno Renner, Roman Schumacher, Arseniy Vershinin et Ignaz Forstmeier met at the Center for Digital Technology & Management of the TUM (Technical University of Munich). They registered Personio during a sailing trip. Today, the CEO is Hanno Renner, and the others decided either to specialize within the company or to leave. In only a few years, this group of 4 students became a European software champion with 1'700 employees, 10'000 clients (approx.) across 80+ countries and with 7 offices (Munich, London, Madrid, Dublin, Amsterdam, Barcelona, and Berlin).

To go from a start-up to a scale-up, they raised (lots of) funds. First, in 2015, they bootsrapped for a 12-month period which led to the first fundraising round in 2016 ($2,2 M as seed money). Then followed 6 fundraising rounds, for a total of $722 M from 2016 to 2022. Famous investors took part in Personio's adventure, such as such as Northzone, Lightseed or Greenoaks which acted as advisors to help the firm scale faster. This incredible journey can be divided into 4 stages.

Personio's journey: 4 stages of growth



Slide from Henri's presentation on the defining phases of Personio's growth

The growth stages identified by Personio differ in terms of headcount, organizational structure, and accountabilities. At the beginning, Student Project + Bootstrapping, 0-10 employees worked for the start-up and everyone's tasks depended on the job to be done. There was no need for a functional organization, they developed features going from a customer to another.

Then, during the Early stage, 10 to 150 employees were

divided into teams, the start-up began structuring its activities and the founders delegated some of their responsibilities. At that time, they also defined the purpose, strategic vision and BHAG ("Big Hairy Audacious Goals" = audacious goals).

From 2019 to 2021, Personio entered the Growing up phase in which the headcount went from 150 to 550 people, partly due to the acquisition of a Spanish payroll provider (Rollbox), increasing the headcount by 30%. The speaker highlighted the difficulties of internationalization, as Personio's brand awareness, the maturity of existing solutions and the legislative systems differ in Europe, and thus needing country-specific adaptations. With the beginning of internationalization, the firm also increased its marketing efforts by organizing their 1st Personio HR Conference. It is interesting to note that in order to grow significantly at that time, they decided to acquire skills. As such, they hired senior leaders with significant experience in scale-ups: Chief Revenue Officer (Geraldine MacCarthy, worked at Google and Dropbox before), Chief Financial Officer (Birgit Haderer, worked at Zalando and Goldman Sachs) and Chief People Officer (Ross Seychell, worked at Northzone).

« For first-time founders, there is no way to prepare for this journey »

Finally, in 2021 they entered the Building a new category age which started with a substantial change in the product: they went from an HR tool focused on services – such as absence or recruiting management – to the People Workflow Automation offer which is interconnected with all the other tools of the customer, thus helping to reduce manual errors and allowing for better time efficiency. During that time, they also tripled their headcount – up to 1'700 today, acquired Back (a German HR company), and gained more expertise by welcoming to their Board Spotify's Chief Human Resources Officer, Katarina Berg. She acts as an HR & Strategic advisor to the firm, as she worked at Spotify while they went from 1'000 employees to over 7'000. This age is also marked by the creation of the Personio Foundation to which the firm dedicated 1% of its equity, plus $3M in donations from its Personio's founders, investors, and the firm itself. They act for education and climate change mitigation.

To conclude his presentation on Personio's journey, Henri showed us Hanno (CEO)'s key

takeaways:

- "After you hit your product-market-fit and your start-up starts to scale, your role changes every 6 to 12 months",

- "For first-time founders, there is no way to prepare for this journey",

- "You have to be comfortable with uncertainty and constant change",

- "But while it is a lot of hard and non-glorious work, it also is probably the most fun and rewarding job there is".

Personio's business

Today, according to the team, there are 1.7M SME (10-2000 employees) in Europe and with its 10'000 customers, Personio only covers 0.5% of the overall market. As such, they have still room to grow, with only a handful of global competitors. Moreover, they noted it is important to compare oneself to others as it provides guidance, and Personio's revenue curve over a 8-year period is aligned with the ones of best-in-class Saas companies such as SalesForce, Slack, or Hubspot- which is encouraging.

Working at Personio

They have a code of conduct highlighting their core values: team spirit, fun, customer empathy, transparency, and social responsibility. As, their culture is a key component, they host a "all company culture week" allowing everyone to reconnect once a year; they also train their leaders to embody their culture, they have expert programs, culture exchanges, as well as personal touchpoints.

What's next ?

According to the team, the goal is now to focus on productivity with the existing resources rather than pursuing more expansion.

Office Tour

We toured the offices, which were representative of what we can expect from a scale up: two floors of open spaces, shared places, conference bubbles and meeting rooms. Everything is designed to foster communication, reduce barriers between people and increase well-being.

Key elements & highlights

Personio has experienced remarkable growth in a short period of time, going from a start-up of four to a scale-up with 1,700 employees and 8,000 customers throughout Europe. Thanks to low marginal costs and a relative ease for scalability when compared to traditional companies, software companies experiencing massive growth are not that uncommon nowadays (e.g. Zoom, Slack…). Yet the company managed to preserve its culture amid its growing size, thanks to having a few core operating principles that define the "Personio way of doing things", as well as organizing regular company-wide events. Moreover, its culture is heavily centered around the founders, which are seen as role models who help keeping these ideas alive.

For 2023, the company has slowed its hiring frenzy. As we were told, Personio now wants to focus on improving productivity instead of headcount. Nonetheless, Personio still thrives on the recent tech layoffs from big tech companies, as this wave of new candidates has made the hiring landscape much more dynamic.

Overall, Personio is a prime example of a software company that managed quick growth scaling in a relatively short period of time, leveraging the pandemic needs for digital tools as an opportunity to grow its offers and ambition.

Lilium

Lilium is a German aeronautics start-up that is at the forefront of revolutionizing the way we think about air travel. The company specializes in designing and building air mobility services, with its flagship product being the electric Vertical Takeoff and Landing (eVTOL) aircraft. Lilium's mission is to create sustainable, high-speed transportation solutions that are accessible to everyone, no matter where they are.

Founded by four former engineers of the Technical University of Munich (TUM) in 2015, Lilium has quickly become a leading player in the eVTOL market. Their vision for a flying cab has captured the imagination of the public and investors alike. The company is currently in the testing phase, with plans to certify their first aircraft by the end of 2024.

With a team of experts from the aviation, automotive, and technology industries, Lilium is well-positioned to lead the charge in creating a new era of urban air mobility. The company has already made significant strides in developing their eVTOL technology, and their innovative approach to air travel is sure to have a major impact on the future of transportation.

« Lilium went public on Nasdaq in 2021 at a valuation of $2.8bn »

Lilium went public on Nasdaq in 2021 at a valuation of $2.8bn via a merger with a speculative SPAC investment vehicle, a route also taken by several other eVTOL start-ups. Since then, its market capitalisation has fallen sharply, sinking to just $447mn at the end of 2022. Many analysts cast doubt on their ability to succeed. According to an article of the Financial Times, they were burning $60m a quarter in 2022 and had only $215m in the bank in August 2022.

Visit

We were welcomed by Dr. Jan Krollman, research & technology lead at Lilium. Dr. Jan Krollman was a researcher at TUM and joined as a composite manufacturing engineer. He gave an introduction about Lilium and their latest developments. An important milestone for Lilium was reached earlier in 2022 when they achieved full transition on wings and canards in flight at their test site in Spain.

We then had an intervention from Saskia Horsch, Head of Global Regulatory & Public Affairs. Her focus is to work with authorities to build the regulation framework for that new type of mobility. To do so, she spends time with agencies like EASA (European Union Aviation Safety Agency) and the FAA (Federal Aviation Administration). The presentation was about the relationship between innovation and regulation. Indeed, Lilium evolves in an environment whose regulation is still to be determined. Hence, they have to strike a balance between pushing the boundaries of innovation and complying with the evolving regulatory requirements. Saskia highlighted the need for collaboration between regulators and industry players to establish a safe and efficient regulatory framework that fosters innovation and enables eVTOLs like Lilium to take flight.

One of the key regulatory challenges that Lilium faces is the requirement for pilots to

be on board during the initial go-to-market phase. This means that Lilium's eVTOLs will not be autonomous, at least initially. Although Lilium initially wanted to operate the aircraft themselves, they will instead focus on selling the aircraft to private jet companies and private owners, before expanding to airlines for transfers and their own Lilium network. The ultimate goal is not to be a tool exclusively for the rich, but to provide a sustainable and accessible transportation solution for everyone.

To achieve this goal, Lilium plans to obtain certification from EASA in the second half of 2025. This will require extensive testing and collaboration with regulatory bodies to ensure that Lilium's eVTOLs meet the necessary safety standards. These standards are the most demanding in the aerospace industry since eVTOLs will be flying in urban areas. They aim at less than one critical failure on a billion hours of flight. By working closely with regulators and adopting a collaborative approach, Lilium hopes to establish a regulatory landscape that enables them to achieve their vision of transforming the way we think about air travel.

Following that presentation from Saskia Horsch, we headed to Lilium's factory where we stopped at several production and test posts, including the place where they test the jet engines (that are not really jet engines but electric ducted fans). We ended up the visit in a

showroom where we could visit their first real-size prototype. Lilium's CTO, Alastair McIntosh, a Rolls-Royce veteran, joined us and answered our question about Lilium's technical choices and their plans for the future.

Debriefing

The recent visit to Lilium's factory and HQ near Munich was a fascinating experience, providing an insight into an industrial startup. It was interesting to learn that many executives from leading aerospace companies have left their jobs to join Lilium, including their CTO, Alastair McIntosh, and other C-suite executives.

One surprising aspect of the visit was the size of their warehouse and the number of engineers employed, considering that they have yet to generate any revenue. Nevertheless, the visit highlighted that Lilium is committed to pushing the boundaries of innovation and investing in the development of their eVTOL technology.

The visit included a tour of their showroom and a real-size prototype, which was impressive. It was also possible to chat with the CTO, which was a highlight of the visit. It was clear that Lilium has deeply integrated and verticalized the development of their eVTOL, covering aspects ranging from propeller to batteries and material. This approach has enabled Lilium to have greater control over the design and production process, which is critical for achieving their ambitious vision for the future of air travel.

Overall, the visit provided a unique and informative experience, showcasing the dedication and passion of the Lilium team in pursuit of their vision.

Klöckner

klöckner & co

To set up the context we can start with few key figures :

- Founded in 1906
- Group turnover : 6.3bn€ (2019)
- 8500 employees
- >100 000 clients
- 160 distribution sites in 13 countries

Quick overview

Klöckner & co is one of the world's largest producer-independent companies. Its main activities focus on warehousing, processing, and distributing steel and metal products.

We went to the site of Regensburg (Germany) where we were welcomed by Joffrey Biard, head of Business Transformation and Excellence Europe, and also a former student from HEC Paris.

The visit started with the presentation of three topics that Klockner mastered particularly.

Innovation as a differentiation

For Klöckner, products in themselves are not enough to differentiate from competitors, as the company does not produce the materials. The advantage of Klöckner relies in the meeting of clients' needs and the stock portfolio management. Steel and other metal prices are highly volatile and subject to context: the examples of Suez channel (March 2021), the battle in Marioupol (2022), the loss of Naval Group's contract with Australia (2021) were given. Part of Klöckner's expertise relies in stock portfolio management: buy steel at the right time and amount, store it, process it, and sell it to clients at the right time and amount. "We finance our clients' WCR (working capital requirement)" as Joffrey said.

The Regensburg site has a share of approximately 60% steel products and 40% aluminium and stainless products. The company has acquired specific laser machines for metal processing. This technology gathers seven processes into one. With such machines, Klöckner is actually the leader on the European market for metal processing (cutting, slitting, drilling).

Digital innovation

Klöckner.i was founded in 2014 in Berlin and aims at becoming a leading digital one-stop-shop platform for steel in Europe and the Americas. Over 100 employees are now working in this hub. Klöckner.i focuses on e-sales as well as internal digitalization. The company has developed AI algorithms to read and classify clients' pdf orders. Although the digitalization of platforms for clients has been launched by the company for ~10 years… several of them (about half!) still prefer traditional methods (calls, emails, pdf sendings for orders).

Green steel

7%, it's the part of the global CO2 emission due to the steel sector. Klockner understands their responsibility to bring these emissions down. But as a distributor they cannot act directly on the more polluting phase of the cycle of life, the extraction and production. Then their best lever was to act on their supply chain to encourage more sustainable ways of producing. To achieve that the first step was to develop a metric to compare the emissions of the variety of steel products. In one year, Klockner with the help of BCG managed to categorize all their products using an algorithm to calculate the footprint of their 200 000 products. They precisely define green steel as the steel that has a carbon footprint under 1750 kgCO2/t steel and they proposed five levels of green steel (fig1).

The strategy is now to mobilize the whole value chain to transform the industry in a more sustainable way. It is the purpose of the brand Nexigen that uses the previous metric to highlight the efforts of their suppliers and to put pressure on those that are moving too slowly. They also help the suppliers to expand their CO2 reduced product portfolio. On the client side, Nexigen gave full transparency on the CO2 emissions to responsibilize them and encouraged them to prefer green steel knowing the emission they avoid. Klockner is then an example of how to mobilize a whole value chain to a more sustainable future. They reversed the power relationship with their supplier to become the driver of the change. Their ambition is to have shifted 70% of their total volume to green steel before 2025.

What we saw during the visit

After these interesting presentations, we had the chance to visit the warehouse where they stock beam, plate, tube and all the types of products that this site manages. It is a very accident prone area so safety is the priority. Everything is done to reduce the risk at work, to achieve less than one accident a week counting all the sites of the group.

The first thing that jumped out at us was the huge hoist equipped with a magnet that was used to move steel products. The magnet technology helps reduce the risk of handling linked to the use of webbing.

While walking through the alleys we noticed the versatility of products and the medium size of series that follows the differentiation strategy presented before.

Finally we were lucky to see their two laser cutting machines in operation. The speed of the cut, the power of the laser and the precision was impressive. These tools really help the company to produce very specific products to tackle small local markets and to be the only international group to propose these kinds of products. Their concurrents are then limited to local actors that are more vulnerable to the volatility of the market.

Highlights

- The German market is different to what can be observed in France. In Germany, some SMEs like Klöckner reach market dominance in specific niche markets, whereas in France the whole market is generally dominated by majors (eg ArcelorMittal).
- Klöckner differentiates from competitors with its stock portfolio management expertise and its investments in specific laser machines to serve clients' needs more efficiently and more rapidly.
- The steel sector is responsible for around 7% of global greenhouse gas emissions. As the major part of those emissions is due to the extraction of raw materials and steel production phases, Klöckner has no direct lever on the value chain to reduce those major emissions points. Thus it has developed a classification method to select best-in-class suppliers.

Siemens

Siemens is a large engineering group founded in 1847 by Werner von Siemens who invented the electric telegraph. It is Germany's largest private employer and Europe's largest technology group in terms of employees.

The group has several subsidiaries centred on one field and headed by the parent company Siemens AG (for *Aktiengesellschaft*, the equivalent of a limited company):

- **Smart Infrastructure** for buildings and energy systems
- **Digital Industries** to digitalise the processing and manufacturing industries
- **Mobility** for rail and road transport

Siemens AG is also a majority shareholder in Siemens Healthineers, a company specialising in high-tech medical equipment.

In 2022, the group achieved sales of 72 billion euros with a net profit of 4.4 billion euros. 311,000 employees are employed worldwide. Siemens recently won the largest contract in its history (€8 billion), for the construction of the new railway network in Egypt.

The Master PIC visit

On 27 February 2023, a group of about 30 students from the Master project innovation design went to the headquarters of Siemens AG, which is located in Werner Von Siemens Street in Munich.

First of all, the students were welcomed by **Mathias Oppelt, head of "customer-centric" innovation at Siemens Digital Industries**, who insisted on the specific problems encountered by Siemens as a group with a strong technological dimension. Indeed, its activity places it among the 10 largest software publishers and has enabled it to maintain its growth during the Covid-19 pandemic.

Siemens' strategy is to be a forerunner in linking the physical and digital worlds. Since change is significantly faster in the digital world, the group has set up an open software platform for the optimisation of physical industrial systems, called Xcelerator. Such a solution calls into question Siemens' traditional innovation management, which must now focus on the problems encountered by its customers (customer pull) and integrate the solutions into its platform: this is an evolution in the company's culture.

Then, **Christoph Krois, co-director of the innovation ecosystem at Siemens AG**, spoke about the implementation of open innovation at Siemens. These new open projects respond to the group's need for exploration, which must compete with much younger companies. Mr. Krois presented two examples: a set of intrapreneurship training (Intrapreneurs bootcamp) mobilising employees in teams to solve problems encountered by customers, and a public open-innovation platform (Siemens innovation ecosystem) offering challenges for startups, students and researchers.

Finally, **Roswitha Skowronek (Head of Communications) and Sebastian Wolf (Head of Strategic Marketing Programmes)** presented a concrete case of smart city implementation managed by the Siemens MindSphere suite. In the context of the Dubai World Expo 2020, data from 130 buildings in a new district were collected in a dedicated cloud, allowing for example the management of energy consumption or the monitoring of air pollution. This gave rise to an innovation challenge by teams with the aim of imagining the optimisation vectors of the city of tomorrow.

The lessons

What were the lessons learned from this visit?

With more than 300,000 employees and a turnover of 72 billion euros in 2022, Siemens is a giant. How does this giant manage to keep innovating and reinventing itself?*

PROMOTING IN-HOUSE INNOVATION

Any employee who wishes to do so can apply to participate in an intrapreneur training course. This training takes the form of a bootcamp during which employees are associated in teams and must develop an innovative solution to meet a customer need imposed by Siemens. Although some of the ideas proposed by the teams during these bootcamps can continue to be developed after the bootcamp and eventually become part of the Siemens solutions ecosystem, the main objective of these bootcamps is to change the company culture to enable employees to innovate in the position they hold.

These bootcamps enable the transmission of a culture of value creation to employees while providing them with the tools to better react in stressful or uncertain contexts.

PROMOTING INNOVATION IN COLLABORATION WITH THE OUTSIDE WORLD...

...In collaboration with major clients

Regular workshops are held with Siemens' major customers on the theme of "what will your business look like in 10 years' time? The aim of these foresight workshops is to understand how customers see themselves in the future. This understanding allows us to anticipate the future needs of these customers and to develop solutions now to meet these future needs. It is an approach that allows Siemens to innovate by capturing customer needs (market pull) rather than by techno push.

...Thanks to open innovation

Siemens has set up a public platform accessible to Siemens employees but also to any external person, where customer problems encountered by the group are regularly published. Employees, students, start-ups and private individuals can then propose their innovative solutions to these problems.

The aim of this platform is to help Siemens "not reinvent the wheel" by allowing it to use existing solutions developed by start-ups or students to respond to their customers' problems. In this open innovation approach, this platform acts as a privileged meeting point between Siemens' needs and solutions developed outside the group.

DOES THIS SEEMINGLY WELL-REHEARSED STRATEGY REFLECT THE REALITY?

A lot of care has been taken to deploy state of the art methods to foster innovation within the giant Siemens. When asked about the relationship between the pressure on teams to meet business objectives and the freedom of employees to innovate, stakeholders told us that business objectives remained the priority and that reconciling innovation with difficult business objectives remained a major challenge, despite the methods deployed to encourage innovation.

CARBON IMPACT, A DECLARED WILL AND AMBITIOUS OBJECTIVES

As with most of the companies that welcomed us during our stay, environmental concerns are at the heart of Siemens' values. This commitment is coupled with a very ambitious goal of carbon neutrality by 2030. Siemens, which has set itself this objective on its own initiative, has already halved the emissions linked to its activity since 2015, which is a very encouraging sign as to

whether it will be able to meet its objective by 2030.

Despite this declared determination and an impressive reduction in emissions, the example chosen to present us with a concrete innovation developed by Siemens is the smart city developed by the group in the context of the Dubai World Expo in 2020.

This smart city, which was created *ex nihilo* in the middle of the desert and air-conditioned 24 hours a day, is presented without irony as the "greenest city in the world". This is quite far from the standards of frugal innovation and eco-design that one would expect for this example, which is supposed to represent the flagship of innovation within Siemens, which raises the question of a certain innovation hype. **In the current climate context, can the development of such an innovation be justified, as it goes against reasoned and sustainable energy management ?**

Google

Key figures

- Around 280 billion USD turnover in 2022
- Budget of Google R&D represents 39,5 billion USD. This is an increase of almost 8 billion U.S. dollars compared to the company's R&D expenses in the previous year.
- At the end of December 2022, Google had over 190,000 employees. There are 5000 researchers in Zurich, 95% are software engineers

Brief description

The Google Zurich Research Center is one of Google's leading research centers in Europe. It is located in Zurich, Switzerland and was established in 2004 to work on innovative research projects in the fields of computer science, data science, artificial intelligence, and information technology.

The center employs 5000 researchers nicknamed “Zooglers” – mostly software engineers - who work on groundbreaking projects in areas such as natural language research, machine learning, computer vision, computer security, and distributed database systems.

The Zurich research center is also involved in many collaborative projects with universities and research institutes throughout Europe and around the world, such as ETH Zurich or EPFL. These collaborations enable Google to attract talents, stay at the forefront of computer research and to work closely with the best researchers and experts in the field.

In addition to its research activities, the Zurich research center is also known for its stimulating and innovative work environment. Employees enjoy a wide range of benefits and programs, such as regular conferences with leading guests, training and skills development workshops, as well as leisure and relaxation activities to promote collaboration and creativity.

The visit

We were greeted by Thomas Houit, senior product manager at Google and leader of a team working to reduce the carbon footprint of Google's transportation applications by exploring new implementation methods to promote sustainable solutions to customers.

We broke into small groups to tour the facility for an hour. We explored the many "mini kitchens", entertainment rooms, but also the hair salon and nap room. This interactive tour brought us closer to the Zooglers and we were able to ask many questions about how they use the facilities.

After the tour, we gathered in a large room to learn about the history of Google Zurich and the different tasks performed by the researchers at the center. Thomas Houit and his team also detailed their research area.

Highlights

This visit was rich in lessons learned.
First of all, we were impressed by the facilities. It looks like a giant playground, with slides, a relaxation area, video games, free food and drinks everywhere... It's a far cry from our traditional office! While the Zooglers have the opportunity to spend their day wandering around the entertainment, we met very few who actually used the games. This creates a disconnect between skilled software engineers (mostly "geeks") and their work environment, which seems to be designed for visitors as a

showroom rather than for employees.

With regard to the travel sustainability project led by our speakers, we could see that Google cares about these topics and is willing to allocate a budget to attract talent. Nevertheless, Google seems to be playing both sides of the fence by continuing to promote airlines through Google Ads while supporting travel sustainability research.

Finally, one of the main points of the visit was the innovation mentality that prevails within this structure. Indeed, innovation is omnipresent, both in form and in content.
This culture of innovation is reflected in several elements:

- The "20% time on project": one of the strong managerial concepts of Google is the fact of leaving 1 fifth of the employees' time free to work on a subject completely different from their core business. This creative niche offers employees the opportunity to start an entrepreneurial venture in parallel to their role at google, with prospects for growth within the structure itself. Interesting projects can then be pitched to Google, which can ultimately act as an incubator for these projects. From then on, employees leave their jobs and can form an independent team to grow their new project, which can then become a Google module. Successful projects include google agenda or google calendar features.

- Another important marker of this innovation mentality is what employees call: "project post-mortem ceremonies". Indeed, when a project developed at Google does not succeed, it is the subject of a small ceremony in which the failure is almost congratulated.
Mistakes and failures are necessary steps at Google and should not be an obstacle to trying, attempting, nor innovating. The history of the aborted project is then kept in the google databases, so that the failures of some can become the lessons of others, and why not become the basis of work for future projects that may prove to be fruitful.

- One of the latest highlights is the selection method of projects within the google incubator. Indeed, one of the key concepts is the "x10", i.e. the ability of the project to scale up to x10. The will of google is to focus only on the projects with the most potential, which could become full assets of the multinational that is google. Therefore, there is no room for a project that is not ambitious enough.

Conclusion:

Finally, the visit to google Zurich showed us a structure that lives up to its reputation. We could quickly feel the Californian atmosphere in the buildings, the work organization and the mentality. Within the framework of the PIC master and our focus on innovation projects, we were marked by the freedom and flexibility that is left to the employees, which creates a very favorable context for the emergence of new ideas.

The project led by our host Thomas Huit is the best example and we are all eager to see this project around the decarbonization of air

transport be integrated into the huge ecosystem that is Google.

Alnylam

"Challenge accepted". This is the motto of Alnylam, a 20-year-old biotech startup providing disruptive gene therapeutics. It was created in 2002 based on the discovery of ARN interference (ARNi) in the late 1990s. The company went public in 2004. The researchers were then awarded a Nobel Prize in 2006, thus confirming the potential of Alnylam's key technology. Since then, it has received multiple awards for most innovative companies.

There first treatments are focused on rare diseases, such as hereditary transthyretin amyloidosis, a genetic, progressive diseases resulting in debilitating symptoms. They already have 4 products available in 30 countries and have a strong pipeline for treatments, with more than 12 ongoing clinical programs.

What is ARNi?

ARNi are small molecules that interfere with DNA and can regulate genes expression. It can be used to inhibit a defective gene and prevent symptoms from occurring. The cure mainly consists in regular injections.

Alnylam in key figures:
+2000 employees
+7,5B invested
4 treatments available
660M turnover in 2021
30 countries with commercial presence

Visit program

It has been an intense and thorough dive into Alnylam's whole journey, from the first research to current successes. We met various profiles throughout the company, mainly related to the commercial functions: France marketing & sales director, the Head of Regional Commercial, the International Region Head, the Head of Communication…

We had various presentations on Alnylam's history and a testimony of a young woman with transthyretin amyloidosis, who is currently being cured by Alnylam. This combination aimed to convince us that Anlylam's main purpose, "saving lives" was something special for the speakers. Working in the medical sector, and especially with rare diseases, is a real motivation for them, and many came to this field in a quest for impact and meaning in their work. Both speakers wanted us to understand that this industry can have a real impact on the world and encouraged us to think about impact in our future careers.

We were also given insights on Alnylam 5-year P^5 strategic plan, which is based on five pillars: Patients – Products – Pipeline – Performance – Profitability. In a nutshell, the next period will be critical for Alnylam, to expand from rare diseases to specialty medicines and reach more patients, now that their technology is mature. In this next sequence, Alnylam will focus on the main mortality causes, such as cardiovascular diseases (hypertension, cholesterol…).

The Head of Regional Commercial then presented us his background, linking research and business and how he came to work in healthcare, after his wife suffered a serious health issue. He explained us Alnylam's commercial strategy, and especially the challenges for identifying enough patients to conduct clinical trials. For example, transthyretin amyloidosis has a prevalence of 1 case/million inhabitants worldwide. Identifying enough patients suffering from a specific rare disease is therefore a key know-how of Alnylam, that is decisive to go from laboratory tests to commercially authorised products. In an increasingly competitive market for biotech, this know-how is vital to be able to bring innovations to the market. This know-how consists in three main steps : 1) identifying an at-risk cohort

(higher prevalence in specific populations), 2) identifying who is diagnosing and treating them (relevant health professionals to contact), 3) identifying relevant communication channels. This enabled them to lead a targeted genetic testing campaign for transthyretin amyloidosis, where they found a prevalence of 5% in the tested population, i.e. 50 000 times higher than the average prevalence.

We continued with a presentation of France marketing & sales director, a PharmD and HEC graduate, on the French market specificities. Through his presentation, he insisted on the key role France played in Alnylam's strategy. With three national plans for rare diseases, the last one launched in 2018, France has established deep knowledge on this kind of pathology. Especially with the creation of a national network composed of local centers of expertise, which are crucial to identify and follow those rare patients on a global scale. He also spoke about the interest of partnerships in the sector. One product that Alnylam developed is now produced at industrial scale and distributed by Novartis. Alnylam 's cofounder is also one of the author of The Biotech Social Pact, which aims to demonstrate Biotech commitment to having an impact on public health .

We had a last presentation with the HR director to give us a glimpse of what a career in biotech looks like. The two commercial directors told us about their career path and their daily work at Alnylam, underlining how both purpose and challenge are key for them.

Takeaways – Surprises, highlights, key elements

It was interesting to discover that in the pharma industry rare diseases can be a real vector of innovation. In fact, the approval path is easier and quicker for drugs linked to this kind of disease, what allows biotech companies to create their first successes and show evidence of efficiency quicker while maturing their technology on a first small field.

What was also fascinating is the perseverance that Alnylam had during those years of development. They did 15 years of R&D to put their first treatment on the market, which is usual for the pharma industry, but can be very challenging for a new company. Their key motto "challenge accepted" is a good sum up of this observation. But we can easily imagine that such a perseverance, from the researchers and the investors, wouldn't have been possible if the purpose of the company, saving lives, was different. This persistence is also due to the strong involvement of Craig Mello, one of the researchers who received the Nobel prize, as an important investor in Alnylam.

But the real surprise for us was elsewhere. The French administrative system tends to be highly criticized, especially by French people, for his lack of agility and its tendency to slow innovation. In the pharma industry, those critics were especially strong during the pandemic because the French industry missed the opportunity of ARNm. However, Alnylam is a strong proof that the French healthcare system is also capable of fostering innovation through the collection of quality data and a local network of experts.

Creaholic

Creaholic is an innovation firm that brings together professional inventors who operate in different fields of innovation such as product development and new technologies, service design as well as the organization and culture of innovation. To fully understand the origin and ambition of Creaholic, it is necessary to look at the story of its founder, Elmar Mock, a singular and charismatic character.

In the 1970s, the Swiss watch industry was facing a major crisis that threatened its existence. Swiss manufacturers did not perceive the technological shift brought about by quartz and allowed Japanese competition to gain ground in the medium and low-end watchmaking markets. In the early 1980s, Elmar Mock and Jacques Müller, then at ETA, came up with a new concept of a watch with traditional Swiss quality but with production costs of less than 10 CPF. Not taken seriously except by its CEO and fighting against all odds, Elmar Mock and Jacques Müller developed the concept they had imagined and in 1983, the Swatch watch, halfway between a watch and a fashion accessory, was offered for the first time to the general public in Switzerland. The Swatch is a worldwide success and is sold in more than one billion copies throughout the world.

The success of the Swatch is little or not attributed to Elmar Mock, who is feeling the pinch. In 1986, wanting to stand on his own two feet and driven by the desire to continue inventing, Elmar Mock launched his company Creaholic, whose main goal is to generate innovation for its customers and internally.

Today, the company has 80 employees with expertise in design, engineering, fundamental physics, economics... Creaholic also has 13 spin-offs born from innovations generated within the company. The company bears the hallmark of its singular and brilliant founder. Indeed, at Creaholic, all employees are shareholders and must sell their share when they leave. The inventions generated by Creaholic are voluntarily not developed and produced. The activity of fructification of these inventions is left to the clients or to the spin-offs of Creaholic since, according to Mock, "to produce is to kill creativity and our position as inventors". The projects remain at the invention stage within Creaholic before being inseminated into the respective companies, which push the development process in order to produce an innovation.

Course of the visit

We are welcomed in the premises of Creaholic where Elmar Mock, accompanied by Gilles Garel, co-authors of the book "La fabrique de l'innovation" presents us his journey and the birth of Creaholic. His speech, frank and passionate, makes us understand that Creaholic is positioned as being detached from any process that would hinder its creativity. After the general presentation, we are separated in two groups to visit Creaholic's premises, discover projects and meet spin-offs.

The premises, a former soap factory, are intriguing and conducive to creativity. Offices, brainstorming rooms, a workshop and a space dedicated to start-ups incubated and born at Creaholic before becoming independent are mixed together. During the visit, the Creaholic collaborator in charge of the tour presents us projects of sustainable cups

made from tree fiber without using paper, a vinyl engraver for private use and a welding system for wood. Finally, we meet people from Joulia and Gjoza, two Creaholic spin-offs who talk to us more in depth about their products and offer us to test them. Gjoza develops a shower head technology that saves up to ten times less water than a conventional shower by misting the water. Joulia is a system for recovering energy contained in wastewater from the shower, which allows cold water to be preheated by

by thermal conduction, the clean cold water that will be mixed with the hot water in the mixer and thus gain energy efficiency.

Key points and general feeling

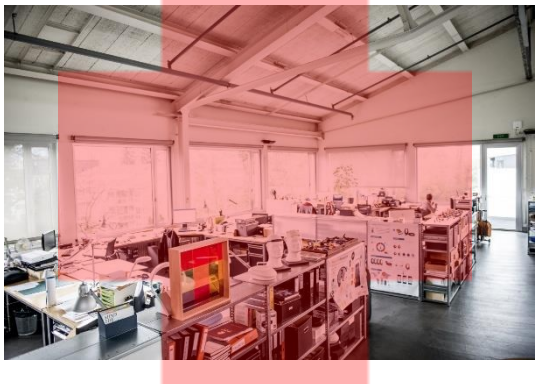
The return on the morning of discovery of Creaholic commits only its editors but, having discussed with several classmates, it is shared by several of them. Creaholic is the company whose work is the closest to the knowledge and to what we learned in the master in terms of innovative design. It uses existing methods (CK for example) to design new products and services. The business model is refreshing. Elmar Mock plays a central role in this fresh wind brought by Creaholic. Beyond the image of a serial and frenetic inventor that one could attribute to him, his frankness, his sincerity and his experience make us want to follow him in his ideas and to invent with him.

The whole group particularly appreciated the historical approach to Swiss watchmaking, which brought up, among other things, the history of the Swatch - this historical context course built on multiple references was unknown to most students.

Moreover, Elmar's expression of his lack of understanding of the watch industry and the decisions of its managers at the time he decided to embark on the project with Gilles was atypical and reassuring at the same time. In a context where, at this stage of our studies, we are used to questioning a lot of things and wondering about our ability to fit into the career models that are proposed to us, the reflective path proposed was very relevant. It was also relevant to understand how Creaholic was born from this reflection, and responds to the industry issues identified by Elmar.

The workshop visits were a real success among the students. The working environment is very creative, thanks to elements such as the shelves filled with archived projects, the exhibition of projects in development and the proximity to the spin-off workshops.

Finally, several students particularly appreciated the discussion of the administrative status of the company and its employees. The very atypical model of the different statuses aroused curiosity, and Elmar's very precise answers on this subject were appreciated by the students.



Omega

Overall

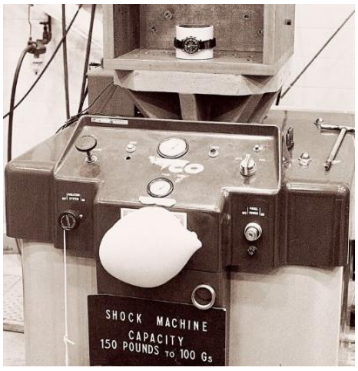
Omega SA is a Swiss luxury watchmaker based in Biel/Bienne, Switzerland. Founded by Louis Brandt in La Chaux-de-Fonds in 1848, the company formerly operated as La Generale Watch Co. until incorporating the name Omega in 1903, becoming Louis Brandt et Frère-Omega Watch & Co. Omega isn't the oldest Luxury watch brand that survives today, but with the first Omega watches appearing in 1894, from a workshop that had been making watches since 1948, Omega's history has a lead on Rolex of at least 50 years — and a storied history it is!
Today, we might know it as James Bond's watch, but there is much more to discover about this storied brand. In 2022, Omega is still one of the most dominant brands in the luxury timepiece industry. They have the largest production of luxury watches in Switzerland, creating over 240,000 luxury watches every year.

Bond, James Bond

Since 1995, James Bond has worn an OMEGA Seamaster in every one of his film appearances. Over the years, Omega has created very special limited editions with unique features that pay tribute to Agent 007's legacy and his 50 years of spying on the silver screen.

The Moonwatch

The OMEGA Speedmaster Professional Chronograph has a unique place in the history of space exploration. It is the only individual piece of equipment to have been used in all of NASA's manned space flights, from Project Gemini in the mid-1960s to the current International Space Station program. When Buzz Aldrin walked on the moon in 1969, he wore a Speedmaster Professional, since known as the Moonwatch. The Speedmaster was released in 1957, but its incredible (space) history began in 1965, when it was certified by NASA for all its manned missions. Since then, its role in the six moon landings has earned it the nickname "Moonwatch". The tests developed by NASA in 1964 to test chronographs were designed to destroy the watches. At the end of the tests, only one watch was still in working order: the Speedmaster.



Olympic Games

Since 1932, OMEGA has been the Official Timekeeper of the Olympic Games on 30 occasions. We also have the honour of timing the Paralympic and Youth Olympic Games, which will take place in Buenos Aires in 2018. From start to finish, we count every exciting second and record all the results. A great mission that we are honored to accomplish. At the 1932 Los Angeles Olympic Games, a single Swiss watchmaker showed up with 30 split-second chronographs. Today, a whole team of professional timekeepers travels with 450 tons of equipment. But the objective remains the same: to provide the world's best athletes with impeccable timekeeping.

Positioning

Omega's differentiator, and what they pride themselves on is precision, the quality of

the movement. Its brand ambassadors reflect this luxury excellence positioning: Daniel Craig, Cindy Crawford, Nicole Kidman, Sergio Garcia, Michael Phelps, George Clooney etc.

The Omega Museum

Revolutionary technologies, space travel, precision records, underwater exploration, sports timekeeping during the Olympic Games, a partnership with Agent 007... OMEGA's extraordinary heritage now comes to life in an exceptional setting: the company's splendid modern museum in Switzerland.

HQ visit

The master chronometer

Launched in 2015, the Globemaster was the first OMEGA watch to be Master Chronometer certified by METAS. Since then, the House has been subjecting an increasing number of mechanical watches to these ten-day tests.

An innovative manufacturer

Importance of IP in the luxury watchmaking market

Another component that plays a part in the high price of Omega watches is the company's ethos and commitment to innovation over its tenured history. Omega works to consistently improve their materials and design, not getting complacent with their models and always looking for upgrades and enhancements. For example, Omega uses special materials that blend precious metal alloys, ceramics, and silicon to create more durable, beautiful, and functional timepieces.

In its ongoing quest for material excellence, OMEGA has developed a variety of exclusive alloys, enriching its creations with distinctive new colors and enhanced durability. Ingeniously developed to offer their own unique advantages, each alloy gives the watches an aesthetic and quality unmatched in the watchmaking world. For example, OMEGA Ceragold™ is the first technology to decorate ceramic timepieces with 18K gold.

The true value of an Omega watch can be demonstrated by the amount of time it takes to create a single timepiece. The Tourbillon luxury watch is a work of art and takes 500 hours to create a single one. The watch is so highly regarded by everyone that the watchmaker who manufactured the watch engraves their initials into it.

Misinterpreting innovations - the quartz fiasco

In the 1970s, the timepieces industry trembled with the seismic shift that was the Japanese quartz watch phenomenon. It was the end of an era and, many believed, the end of the world for mechanical movements. Quartz-regulated, battery powered watches, with their accuracy and "no need to wind" practicality appeared to make mechanical watches obsolete.

Omega embraced the new technology with open arms, bringing out its first range of electronic quartz watches in 1970. This had an unexpected consequence.
By the time Omega had seen the error of its ways, the damage to its reputation was done. From the 1970s to the end of the 1990s, it was no longer seen as a luxury watch company. Its products were perceived as being more downmarket, sales plummeted and the Omega name lost its luster. To make a comeback, Omega was going

to have to come up with something big.
In the early 1990s, the Swatch Group chairman, Nicolas G. Hayek, acquired the rights from the English watchmaker George Daniels for his prototype of the Co-Axial escapement, proceeding to then perfect the invention before releasing it to the world in 1999 inside the Omega De Ville watch. Of this technical innovation, Mr. Urquhart, the Omega president, said, “It played an enormous role in putting Omega back on top.” It made the Omega calibers different and accepted by more “snobby” collectors.

Visit to the premises

A new manufacturing facility to support Omega's marketing

The visit organised by Omega was an opportunity to discover the group's new architectural project. This brand new building is the result of an interesting reflection to facilitate the production processes, limit the time between each step, and propose an immersive visit in a showroom that highlights the group's talents and technical expertise. From a production point of view, the building is organised by level where each floor is reserved for a production phase and these floors have been designed to reflect the watch production chain. The various floors are framed by a fully automated internal storage centre. Thanks to a labelling system and a mechanical arm, the boxes containing the parts are then placed on the chains to arrive directly on the workers' workbenches. This technology is coupled with strategic choices such as the arrangement of the same products in several storage aisles. This allows access to the products in the event of a technological breakdown, as they are located throughout the storage centre. Another safety measure was to reduce the oxygen level in the storage centre in order to limit the risk of fire outbreaks. All the conditions were studied in order not to stop the production lines but also to maximise the quality of production. Typically, the air conditioning blows from above with ceilings perforated by thousands of holes to keep dust particles that might persist in the production and passage areas on the ground. Finally, sustainable development was a leitmotiv with on-site energy production and regulation of air flows by giant slides to limit energy consumption.

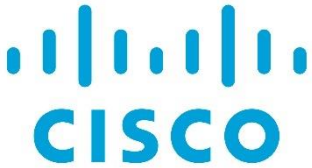
These observations were easy to make throughout the visit because the production site is also designed to be a showroom. Everywhere, huge glass walls allow direct observation of the workers making the watches. The workers, mainly women, are also very meticulous and must take into account safety and hygiene rules. They are trained internally to ensure that they feel good about their work. On each floor, small glass inlays in the wall allow you to see the mechanical arm at work, a technological feat. The visit's interest in Omega's know-how really set the pace for the company.

A museum of Omega's expertise

The Omega Museum is a showcase for Omega's history, its technological developments and its impact on society. With a chronological frieze of the entire history of the brand and the models on display, Omega has succeeded in highlighting its innovations and in situating the important milestones of its successes. The reproductions in terms of design are very telling, with a frieze integrated into a steel bracelet that stands out throughout the room.

Thank you to the organisers for taking us into this city of time and for enriching us with your history!

Cisco



CISCO system is a Californian company created in the middle of the 1980's specialized in the networking of hardware for companies. It has gradually diversified by offering activities of development and management of servers, cybersecurity or data management solutions. CISCO experienced an exponential rise at the end of the 20th century, becoming the world's most valuable company at the turn of the 19th century. Facing some difficulties in the early 2000s until the end of the crisis in 2008, CISCO managed to stabilize its business by becoming the world leader in network equipment for businesses and organizations. The company employs around 75,000 people worldwide, with a turnover of nearly $50B. As for its innovation activities, the company has 35,000 engineers in its ranks and invests nearly $6.5 billion in R&D per year. These investments allow the filing of nearly 25,000 patents per year. As a matter of fact, CISCO had 663 employees in Switzerland at the time of our visit, including 60 engineers based at the EPFL labs campus, where the innovation park has been located for 12 years.

Throughout this visit, we were accompanied by Erick Caron, who animated and transitioned the different interventions, allowing us in the mean time to discover the CISCO labs of the EPFL campus. As soon as we arrived at the CISCO lab at EPFL, we were virtually welcomed by the general manager of CISCO Switzerland, Christopher Tighe, who presented the company as a whole and more specifically CISCO's activities in Switzerland. Among other things, he defined CISCO as a partner-centric company that seeks to connect hardware with the needs and constraints of its partners.

After this brief but very appreciated presentation, we had the chance to discuss with Ursula Oesterle, VP of the EPFL's innovation park, the multi-integration challenge between researchers, students and companies. In particular, Ursula explained to us the difficulty of reconciling the different temporalities between the longer time of academic research and the faster and more constrained time of corporate R&D. We also understood the importance of the collaboration between companies and universities to finance academic research. We also discussed the students' role in these innovation ecosystems, in which they were pushed to apply their teachings by developing their technical and business capacities. In particular, it was very interesting to understand how this entrepreneurial commitment of students is both taught and valued in their curriculum.

« What can be delivered digitally must be delivered digitally »

Following this very interesting exchange, the lead engineer of the Lausanne lab, named Lorenzo Granai, talked about the innovation approach of CISCO, with some more details concerning the methods and subjects in progress conducted at that time in Lausanne. This intervention allowed us to understand the customer driven culture of CISCO, which aims to accompany their partners in the digitalization of their activities. He summarized this state of mind as "what can be delivered digitally must be delivered digitally". We also understand the flexibility of the CISCO Lausanne teams that helps them develop specific solutions for their partners. More specifically, we learned more about the research projects undertaken with EPFL researchers, faced by

the different time frames in which these subjects have to be addressed: a great illustration of the discussions with Ursula Oesterle!

We then exchanged with Raphaelo Dolci, in charge of the commercial direction of the relations with the public sector for Switzerland and manager of the country's digital acceleration program. It was interesting to discover these digital acceleration programs that CISCO has developed with several states. These very innovative programs aim to accelerate the digitalization of 4 key public sectors: private infrastructure management, smart village, health/education and defense/cyber. Raphaelo is in charge of piloting this program with the Swiss authorities. Through different examples of long-term projects in collaboration with public authorities as well as with other companies, we were able to better understand the plurality of actions carried out, the project management methods used and the challenges related to the management of such a project portfolio.

To conclude, this visit allowed us to understand the customer-driven innovation approach of CISCO. Although many projects were presented, they were often quite vaguely discussed, without really digging into the methods, issues and technologies used. This is probably due to the sensitivity and confidentiality of the subjects treated, a quite unfortunate aspect of the visit, but we were still able to understand the particular innovation challenges of CISCO, which must combine hardware and software developments to network their equipment. This is part of a proactive approach that seeks to support companies and administrations in their digital transition. As one of the speakers rightly pointed out, "customers and suppliers often look to the market leader to find out where the future is going". Their position, as a true market leader, is indeed quite remarkable.

Unitaid

&

WHO

vUnitaid was established in 2006. It's a global health agency engaged in finding innovative solutions to prevent, diagnose, and treat diseases more quickly, cheaply and effectively, in low- and middle-income countries. Thanks to the $3 billion in contributions from donors, by 2028, the work funded by Unitaid has the potential to save 1.2 million lives.

Unitaid's goal is to increase the availability of the highest quality health products to those who require them the most by (i) developing and finance innovative methods to make these products affordable and accessible and (ii) encouraging and facilitating collaborative efforts with partners, countries, and communities, enabling access to the necessary tools, services, and care to achieve optimal outcomes, improve health, and address global health concerns.

The 3 goals specific goals of Unitaid are to: accelerate the introduction and adoption of key health products; create systemic conditions for sustainable and equitable access; and foster inclusive and demand-driven partnerships for innovation. To do so, Unitaid collaborates with partners, donors, countries, and grantees on 6 areas of focus: HIV and co-infections, Tuberculosis, Malaria, women and children's health, global health emergencies, as well as cross-cutting technologies and topics.

Unitaid x WHO

Unitaid is a hosted partnership of the World Health Organization. Specifically, Unitaid collaborates closely with WHO departments responsible for disease control to implement catalytic projects funded by Unitaid. These projects aim to ensure that the investments made by Unitaid in HIV, hepatitis C, tuberculosis, and malaria result in global public health policy. WHO's technical departments are well-suited for this task due to their expertise in normative policy development, strong links with member state ministries of health, and ability to bring together key stakeholders at the global level. WHO acts as a catalyst for major policy changes within countries, which have significant effects on implementing entities and markets.

WHO

WHO was established in 1948. It is a United Nations agency that brings nations, partners, and individuals together to advance global health, ensure safety, and support vulnerable populations. Its mission is to enable people worldwide to achieve the best possible health and well-being. WHO is at the forefront of the global push to extend universal health coverage. Its responsibilities include leading and organizing the world's response to health crises and promoting healthy living at all stages of life, from prenatal care to old age. Its key areas of focus are: universal health coverage, health emergencies program, access to medicines and health products, antimicrobial

resistance, science division and data for impact. Visit

Speakers' presentations

Unitaid: saving lifes, saving money, saving time, increasing effectiveness

Presentation of Unitaid's strategy (2023-2027) and impact by Vincent Bretin, director of results

To start with, Unitaid's goal is to accelerate the introduction and adoption of key health products in LMICs, through inclusive partnerships.

They focus mainly on women and children's health, global health emergencies and HIV, tuberculosis and malaria.

Mr Bretin reminded us of the highlights of Unitaid and the chronology of Unitaid's milestones and product development and focused on Unitaid core expertise : health product introduction and market creation. He focused on the example of the HIV treatment in African countries, as accelerating equitable access to optimal HIV treatment and auto tests was one of the main goal at United. Here, the innovation was not the product itself but the way to make the treatment accessible to everyone. Indeed, HIV treatment costs 10k/year in France versus 50 dollars only in Africa nowadays. Unitaid works on reassuring WHO for validation, then operates a catalytic work and try to find partnerships (NGOs, universities, funds, patient communities etc.)

Fun/surprise fact: a key source of income has been innovative financing: the solidarity levy on airline tickets implemented by France, which was later adopted by several other countries.

Focus on intellectual property by Karin Timmermans

Thanks to this presentation, we learned that patents have two main goals: reward innovation and disclose the innovation to make it publicly available. The patentability criteria for a medical innovation are the following: novelty, inventiveness and industrial applicability.

Medicine patents are an important mechanism to make treatment more accessible. That's why Unitaid created the Medicines Patent Pool to negotiate voluntary licenses with origin companies and then sublicense to several generic companies simultaneously. The only problem is that not every country nor products are concerned by voluntary licenses.

Then,Unitaid has other means to increase affordability of patented products, such as collaboration with governments : "TRIPS flexibilities", or negotiation with patent holders on prices etc.

World Health Organisation Innovation Hub

WHO innovation Hub presentation by Louise Agersnap and Alain Labrique

For WHO innovation is a moral imperative to challenge the pace of progress towards universal health, justice and equity. WHO director Dr Tedros clarified this goal by proposing «to support the scaling of at least five innovations in the next five years, that reach at least five million each ».

WHO's role in innovation scaling consists in mobilizing resources to diagnose the impact (disease treated, number of people reached, value..) and facilitate unlocking by facilitating matches between countries health demand and medicines/treatments innovations. To do so, WHO can leverage the 194 countries member states organizations that represent a great lobby power and data access, and benefits from technical expertise and curation.

We can say that innovation at WHO is "demand driven" and made of 3 categories: digital

innovation, service delivery and health products. At the innovation hub, they focus on upstream late-stage innovations that are mature, assessed and proven to hav ability to scale.

Some key achievements of the WHO innovation hub that were presented include the blue box clinics in Zimbabwe, solar piwered oxygen concentrators and facilities in Somalia and India, or friendship bench to improve mental health in Zimbabwe for instance.

To learn more:

- Podcast “Global Health matters”

- Open 3h WHO course: “Foresight approaches in Global Public Health”

Emerging technologies: WHO Global Health Foresight function perspective by Marion Laumonier

WHO Global Health Foresight team aim is to identify and connect known, new or emerging issues that could significantly impact global health within the next two decades. They pilot horizon scan exercises to identify and select topics that need further in-depth consideration, such as biosensor-based point-of-care diagnostic methods or artificial intelligence-assisted clinical reasoning support systems.

Marion Laumonier introduced us to the foresights methods and biais, and how decision can

be made thanks to a decision tree. For WHO, foresight is a way forward to build the future we want to see, accelerate gains from innovations while mitigating risks, to ensure access to the benefits of health innovations for those in need.

Givaudan

Givaudan

About Givaudan

Founded in 1895 in Zurich, Givaudan is the world's leading company in the fragrance and flavor industry with a 25% global market share. The company currently employs 16,000 people, including 150 noses, and operates in 52 countries with 79 production sites.
In 2022, the company achieved a turnover of €7 billion, with a profit of €850 million and invested €536 million in R&D.
The production of flavors for the food and detergent industries accounts for 54% of sales, with the remainder being fragrances for the perfume and beauty industry. Fine fragrances represent 20% of sales. Givaudan is a B2B player and therefore does not package perfume in bottles. Thus, its business is to manufacture "juice". Among their recent creations, we can count J'adore by Dior or Idôle by Lancôme.

The perfume creation process at Givaudan

The process can be broken down into several steps:
First, a pure chemistry step: the search for new molecules. By developing its own molecules, Givaudan can distinguish itself from the competition.
Then, the creation stage, i.e. the assembly of raw materials (more than 2500 different raw materials). The creation time of a perfume is short and the range is rapidly renewed.
The challenge is then to win the brief, by managing to differentiate oneself and to put oneself in the place of the clients, because only 25% of the briefs are won.
Finally, the production phase revolves around three issues: quality, cost and deadlines. It is important to know that production is done on a "make to order" basis: there is no stock.

Products and innovation

The visit took place at the company's headquarters in Vernier, Switzerland.
It was divided into two parts: a visit of the industrial site by Olivier Rostand, Director of Innovation Operations, and a presentation of innovation management within the group.

During the visit of the industrial site, we discovered the flavour and fragrance mixing plant as well as the different processes used to mix the raw materials.

Then, in a second step, several speakers presented the innovation process at Givaudan.
The first presentation by Quentin Gouedard, Head of Digital Strategy and Innovation, focused on digital innovation within the group.
Givaudan has a digital innovation team, created in 2015, with 40 people and 2 campuses in Paris and Shanghai, dedicated to digital innovation. In 2019, they opened a Digital Factory in the heart of Paris, near Station F, to continue driving the company's digital transformation. It acts as a catalyst for projects that bring together Givaudan experts and customers to explore new ways to transform the business in a thriving innovation ecosystem.
Among the projects presented to us:
- SmellViz: an MVP application in the process of industrialization that allows you to digitally visualize the notes present in a fragrance by scanning a QR code. It is a channel to bring the product to customers.
- Carto : a perfume creation tool that includes a very intuitive and sensory experience. By assembling the aromas, the creator can immediately smell the formula. Everyone feels like a perfumer with Carto. Carto can be used by the perfumer to test new ingredients and immediately project the result. It can also be used for a co-creation experience with the client.
- Seeds: an artificial intelligence tool that reinvents the perfumers' creation process by making it

"digitally augmented". It saves time for the perfumers who are in charge of finding the 5 essential and characteristic ingredients of the perfume, while the AI completes with the 500 remaining ingredients that are present only for physico-chemical issues.

- Myrissi: acquisition of a startup that translates smells and colors into perfume

For these innovation projects, Givaudan uses about 10% open innovation, sharing knowledge and information about problems and looking to people outside the business for solutions and suggestions.

The second part of the presentation was given by Bouchra Chevalier, Director of Innovation for Operations, and part of the Factory 2.0 team. It combines open innovation, design thinking and Agile methods to create and implement new products and services to improve perfume manufacturing processes in factories. By adopting a Test & Learn method, she presented us their successes, but also their failures from which they have learned lessons to better innovate later on.

Conclusion

To conclude, we were all very impressed by this visit to Givaudan and learned a lot.

We realize that if Givaudan is not known by the general public because it is a BtoB company, its products are present in our daily life: every day we are necessarily exposed to at least one of their products (detergent, beverage, perfume, etc).

We had the chance to realize a live olfactory experience. We had to recognize the 3 aromas of vanilla, cinnamon and lime in turn, then by assembling them, we reconstitute the scent of Coca-Cola.

We were especially impressed by the importance of innovation at Givaudan. Digital innovation, in particular, is at the heart of fragrance creation and facilitates co-creation experiences. Digital innovation is also used to enhance the user experience, for example to transmit and communicate the aromas, universe and emotions associated with the fragrances.

We warmly thank all the team for their welcome and their exciting presentations.

Cartier

Cartier

For the last day of our visit, we were fortunate enough to be received by Mr. Croisier Nicolas, who is the HR projects manager, and one of his colleagues at the Cartier Horology manufacture site in La Chaux-de-Fonds. This site is one of five manufactures in Switzerland that are spread across three cantons, and it is the only one that focuses solely on horology since all watches are manufactured in Switzerland and are certified as Swiss-made. Over 1,300 employees from more than 30 different nationalities work at these sites. La Chaux-deFonds site was built in 2001 and brings together most of the professions that are involved in the creation of watches, from design to production, including support functions.

The two-hour visit to the Cartier manufacture allowed us to discover both the wax models (which are used for prototyping: made in one day and allowing for several iterations) and the machines and manufacturing processes for bracelets and hands. The standout features of their models are the blue hands and Roman numerals. Cartier doesn't release many new models, but the brand remains highly creative. Their historical heritage is rich enough to be reinvented year after year, century after century. As a result, they release over 80 new models each year, based on historical models with slight modifications. The smartwatch segment has not been a priority because it doesn't align with Cartier's spirit. The brand creates models that are timeless and durable (they are committed to lifelong repairability!).

A non-stock logic is applied, and four years ago, a digital transformation of the company was launched, notably to create the "Factory 4.0" and to accentuate the customer-centered product development and experience. We also discussed the internal processes put in place, which allowed them to cut their time to market in half (from 2-4 years to 1-2 years). Before 2001, their production line was organized by trades, resulting in a lead time of over 250 days. In 2001, a reorganization of the production line by product was carried out, reducing the lead time to just over 100 days. In 2004, a new organization by multi-product module was introduced, reducing the lead time by two, increasing product diversity and production volume, and reducing workin-progress inventory. Finally, in 2020, the organization was focused on technological families, achieving a lead time slightly over 20 days. We also discussed their CSR commitment, their desire to certify their buildings and to develop more environmentally-friendly products, including the presentation of an alternative leather bracelet.

We finished our morning with a visit to the Maison des Métiers d'Arts located next to the manufacture. It is a renovated old farmhouse dedicated to the crafts of high watchmaking and jewelry. At Cartier, technique is at the service of aesthetics, and this really came to life during this last part of the visit. We were able to discover unique pieces, sometimes equipped with patented technology or a unique expertise in setting, enameling, or marquetry.

Several points particularly struck us:

• One aspect that stood out to us was the strong focus on the

customer experience, which is not something typically emphasized by major luxury brands. In the luxury industry, it's common for brands to release their models without much consideration for the customer, assuming that people will buy them regardless. However, Cartier's philosophy is quite different, with a clear emphasis on putting the customer at the center of everything they do. The most striking example of this is the construction of a fake boutique near the manufacturing site, entirely dedicated to improving the customer experience. This is where they test out designs, furniture, service, and more.

• Next, we noticed that despite a strong traditionalism in the aesthetics of some pieces (such as the Tank sold since 1917) and in the brand's spirit, technology has taken its place in the manufacturing process with, for example, gigantic machines capable of producing steel links at a prodigious speed. Despite this, Cartier strives to maintain ancient techniques for certain stages of its value chain, such as blowing the glass dial of watches with a flame by a craftsman. Even more interestingly, the blue tint of the hands intentionally remains uneven, as these slight imperfections in their colors are proof of their artisanal manufacture. Is it a necessary step that could not be replaced by a machine or a marketing argument to maintain a part of traditional and artisanal manufacturing? Mystery.

• Finally, what perhaps impressed me the most was the role of technological innovation in the manufacture we visited. The watches produced by Cartier are a concentration of technology, in both their manufacturing process and their composition. However, this technology always aims at aesthetics and preserving the image of a very luxurious and refined brand, which does not produce smartwatches. To cite a few examples from the manufacturing process, tools such as 3D printing, used to easily produce wax prototypes, have allowed Cartier to halve their time-to-market. The creation of 4.0 labs to work on AI, robotics, and autonomous conveyors allows them to always use technology to optimize their manufacturing processes. Even at the heart of the watches, technologies collide: techniques for mobile gemstone setting from the medical industry, photovoltaic recharging, 3D metal printing, and more. A concentration of technology at the service of aesthetics, durability, and the environment.

Conclusion

We take away from this visit that Cartier is, despite a very traditional front with flagship models dating back decades and certain artisanal parts of the production chain, has successfully embraced technological innovation to optimize its manufacturing processes, customer experience, and most importantly, the aesthetics of its pieces. We also remember our group's amazement at the Maison des Métiers d'Arts, in front of the brand's most luxurious pieces, which are both works of art and engineering.

SP80

En 2016, Mayeul, Xavier & Benoît se rencontrent en participant à l'Hydrocontest : un concours universitaire dans lequel des bateaux radiocommandés sont testés pour leur vitesse et leur efficience énergétique. Tous les trois décident de suivre leurs rêves de vitesse et de voile et se lancent dans l'aventure SP80 : construire le voilier le plus rapide du monde. Ainsi, ils se lancent avec l'équipe SP80 dans la construction d'un bateau capable de naviguer à 80 noeuds (150km/h) uniquement à la force du vent. Les objectifs de ce projet sont sportifs, mais aussi scientifiques : casser les codes pour inventer les bateaux de demain. Ce projet est également un tremplin pour les étudiants impliqués espérant travailler le milieu sélectif de la course au large.

SP80 est une équipe qui regroupe une cinquantaine de personnes autour du même objectif : atteindre 80 noeuds (150 km/h) à la voile. L'équipe est composée de 11 salariés et d'environ 40 étudiants de l'EPFL. Le projet est financé essentiellement par du sponsoring, notamment Richard Mille qui rejoint l'aventure en 2021 en tant que sponsor titre. Ce sponsoring implique de la part des équipes SP80 un travail de communication.

Le record à battre est de 65.45 noeuds (121,21km/h), et est détenu par Paul Larsen et son équipe depuis 2012 à bord de Vestas Sailrocket II, premier voilier de l'histoire équipé d'un foil spécial, dit super-ventilant. Trouvant ce concept intéressant, les trois co-fondateurs commencent par essayer des planches de kitesurf avec des ailerons super-ventilants en fibre de carbone NTPT® pour analyser leurs potentiels. En 2018, après 3 campagnes d'essais dans le sud de la France, Benoit atteint 41 nœuds (75,9 km/h) et confirme que ces profils ont un potentiel d'accélération inexploité qui peut être débloqué en utilisant une voile de kite. Suite à ces résultats prometteurs, les trois amis font rapidement un constat : la vitesse d'un kitesurfeur est limitée par la charge maximale que le corps humain peut supporter. Il n'est donc pas possible d'envisager l'utilisation d'une immense aile de kite dans une configuration où un homme fait le lien entre le foil et le kite. Remplacer ce lien par un corps rigide, comme un bateau, augmentera considérablement le potentiel de vitesse.

=L'équipe en place s'attaque alors à une étape clé de la conception du bateau : tester un modèle réduit pour valider les derniers détails techniques avant de lancer la construction du bateau pour le record. Après de nombreuses heures passées dans les laboratoires de l'EPFL à faire des itérations, imaginer des prototypes et tester différentes formes de kites et d'ailerons super-ventilants, un premier modèle réduit, fabriqué notamment à partir d'anciens mâts de catamarans, est mis à l'eau sur le lac Léman. Testé et amélioré pendant plusieurs mois, le concept est finalement approuvé en 2020 et l'équipe se concentre sur la construction du bateau pour le record.

Le voilier est donc composé d'un cockpit qui protège les pilotes et centralise toutes les commandes nécessaires au contrôle du kite et du bateau. A 80 nœuds (150 km/h) sur l'eau, les mesures de sécurité nécessaires pour les pilotes deviennent proches de celles d'un avion de chasse. Le cockpit est donc conçu pour garantir leur sécurité tout en conservant une bonne ergonomie et une bonne vision sur le plan d'eau. Le voilier est également composé d'une aile de kite, qui est le moteur du bateau. Le kite capte la puissance du vent et la transforme en force

propulsive pour le bateau avec l'aide du foil principal. La véritable innovation se trouve dans la forme des foils et le module de puissance. C'est l'élément le plus important du voilier. Ce système mécanique assure de manière optimale la transmission des forces entre le kite, les foils et le bateau tout en assurant une parfaite stabilité à haute vitesse.

Une fois le bateau terminé, l'équipe n'aura plus qu'un seul objectif : l'optimiser au maximum avant de se jeter à l'eau et battre le record du monde de vitesse à la voile en 2023 !

Hitachi

Hitachi Energy

Hitachi Energy is the result of the acquisition of ABB's Power Grids division by the Japanese conglomerate Hitachi. The Power Grids division focused on the production of power transformers and large electrical equipment. The company has nearly 40,000 employees in 90 countries. The site we visited is located in Satigny, Switzerland, near Geneva.

ABB is a Swiss-Swedish group specialized in low and medium voltage electrical equipment and automation activities. Its roots lie in the late 19th century, when two electrical engineering companies, ASEA and BBC (Brown Boveri & Cie), were founded during the European industrial revolution. After launching power transmission, railway and industrial technologies, these two pioneering companies merged in 1988 to create ABB. Over the following three decades, the company continued its development of energy and automation technologies.

Hitachi is a Japanese conglomerate active in a multitude of sectors (industry, energy, building materials, mining, IT, mobility). Founded in 1910, the company first developed an electric motor, enabling it to quickly become the national leader in the sector and to expand its activities to other sectors and internationally. One of the company's major strengths is the number of patents it holds. In addition, Hitachi has become the world leader in semiconductors since the acquisition of ABB Power Grids.

The site we visited specializes in railways, and in particular in the production of traction transformers, a part that acts as an intermediary between the vehicle and the electrical network, adapting the current received via the catenaries to the vehicle's needs. Almost every train in Europe is equipped with a traction transformer from this factory. In addition to the railways, Hitachi Energy's products also support the electrification of mobility. For example, an articulated arm system allows an electric bus to partially recharge its batteries during stops in about 20 seconds.

The visit

Hitachi Energy has focused its efforts in Sustainable Development Goals. In particular, through attending the Goals 7 (Affordable and Clean Energy), 9 (Industry, Innovation and Infrastructure) and 12 (Responsible Consumption and Production) they aim at the total decarbonation of their production site, making it carbon neutral by 2030. Not only do they have this ambition but they have developed a strategy with specific goals towards the coming years up to 2050. One main point of the plan is to reach energy autonomy through the installation of a solar power plant and a P2P (Power to Power) system. The objective is to produce hydrogen with the excess electricity produced by the PV plant, store it, and re-transform it into electricity when there is no sun.

The group has a great diversity of products within their assembly line. The traction transformers are adapted to the customer's needs. The engineer's job at this stage is to produce a traction transformer adapted to the customer's needs while optimizing the production line, in which traction transformers are manufactured for several customers at the same time.

A traction transformer is classically composed of two main elements: a tank and an active part.
Overall, there are three essential stages for the finished product to be validated: a first stage of drying of the parts that make

it up, a tightening of the bolts following the superposition of the tank and the active part, and finally a last stage of drying the ensamble to ensure that the humidity level is controlled. Once the traction transformer is assembled, it goes through a charging test, and if passed, it's followed by a painting stage.

With a production capacity of 20 traction transformers per week, Hitachi Energy's assembly lines do not look like what one would expect. Regardless of the model produced, the workers have exactly 4 hours to get the traction transformer throughout the whole assembly line. The timing is displayed by a clock placed high up in the factory.

Assembling the tank with the active part, tightening the bolts and painting the finished product would seem to be automatable, but it is surprisingly not the case at this Hitachi Energy factory. The surprise goes even further, because the processes to be followed by the workers are not digitized either.

This lack of digitalization means that the steps that make up each stage of the process are described in a paper document. The workers have to check each step on that paper sheet. And what if a worker misses a bolt, or if a bolt is not tightened enough ? It's a risk that Hitachi Energy is nowadays willing to take, and that is pretty much under control.

The visit was mainly focused on the traction transformer assembly line, but as presented earlier, this Hitachi Energy factory also manufactures the system that allows electric buses to get a powerful and very short charge in bus stops.

Highlights

It is impressive to see how this factory has such a small error rate, around 1%, when the processes are neither automated nor digitized.

A turn towards the digitalization of the assembly line is in their short term objectives, although these first steps of digitalization still look conservative regarding the size of the company and the type of product that they manufacture, compared to other similar industries.

The company keeps its objective of manufacturing around 20 traction transformers per week with a very low error rate. Nevertheless, these planned improvements could significantly improve production performance.

EPFLRT

EPFL Racing Team

Company overview

Formula Student is a student automotive competition founded in 1981 by the Society of Automotive Engineers (SAE). It is one of the most prestigious student engineering competitions, managed by the Institution of Mechanical Engineers and widely supported by the automotive industry which sees it as a real breeding ground for future talent.

The EPFL Racing Team is the Formula Student team of the EPFL. It was founded by students in 2017, who have been designing and developing a new electric car every year to compete in various competitions across Europe and to compete with other student teams.

Visit description

For the visit we were welcomed in the technical quarters of the association on the EPFL campus, by Louis Gounot - CTO of the Racing Team. We were able to see the car they are actively preparing for the next season and we receive details on their preparation and the modalities of the competition.

The EPFL Racing Team has historically competed in the "electric vehicle" category of the competition, but this year plans to add a driverless option. To try to beat the record held by ETH Zurich students who managed to accelerate their vehicle from 0 to 100 km/h in 1.513 seconds, a team of about 100 EPFL students is involved in the project. Among them, about 80 are involved in the design and technical development of the different elements of the vehicle, while the remaining 20 are dedicated to research and sponsor management. This aspect is indeed essential to the project which requires no less than 230 000€ of budget, of which only 40 000€ come from the EPFL. On the other hand, this is not much when you know that some top teams like Stuggart have a budget of around 600 000€...

Before entering the competition, the team must first qualify through a quiz designed to question them on the engineering aspects and their good knowledge of the specifications and terms of the competition. Only once they have passed this test, they will be able to compete in the various "Events" which will evaluate the performance of their vehicle on different aspects.

First of all, there are the "Static Events" which aim to evaluate the technologies implemented, the engineering design, the cost management and the Business Plan of the vehicle. The Dynamic Events are designed to evaluate the physical capabilities of the vehicle such as acceleration, fuel efficiency during the race, endurance, handling, and overall performance.
Last year, the EPFL Racing Team regularly placed in the top third of the biggest competitions in Europe, with excellent results in the 2WD category and in the design review event. From now on, the team would like to move to 4 wheel drive to improve its performance even further.

In the end, the competition does not directly bring new funds for the team but it does allow them to have a considerable visibility with car manufacturers while learning a lot about the field during the project. Some manufacturers are looking for students involved in the Formula Student team at their schools to recruit them. The competition can therefore be a real professional springboard for students.

Astonishment report

About the design and development of the vehicle, it was very interesting to see that the team was really concerned about bringing an

eco-design approach to the project. While the terms of the competition require them to make a new car every year, the team is trying to salvage as many parts as possible from the old cars they have made, and they hope to change the competition by lobbying to revise certain elements of the specifications.

It was also impressive to see that almost the entire car was designed at EPFL and only by students. Indeed, the professors are not allowed to intervene in the design of the vehicle and can only bring some advices. Obviously, such a realization implies a considerable investment on behalf of the students who spend up to 30 hours per week on the project... in addition to their courses! The recruitment of the team is therefore essentially based on the motivation of the students and the time they are willing to devote to the project, beyond their technical skills.

Generally speaking, we came away from this visit sincerely impressed by the students' achievements, but especially by the motivation and passion behind this project.

Rubis Control

Rubis Control is a midcap company founded by a French entrepreneur in Vernier, close to Geneva. It is a leading provider of metrology, tomography, and microscopy services for a wide variety of customers, including watch manufacturers such as Omega and Richard Mille, and aircraft manufacturers such as Dassault Aviation.

(i) Metrology is the science of measurement, involving tools and techniques to accurately measure physical dimensions, properties, and characteristics of objects.

(ii) Microscopy uses lenses to magnify images of small objects to study their structure and properties.

Metrology and Microscopy are mainly used to ensure that components are made to the correct specifications and tolerances

(iii) Tomography creates 3D images of objects or structures by taking multiple 2D images from different angles and using a computer to reconstruct a 3D model.

Tomography, thanks to its capacity to reconstruct the internal structure of objects without disassembling them, is used to identify any defects or weaknesses in components that may not be visible with other inspection methods. Understanding the problem origin is indeed a lot easier when a broken object is kept under constraints.

The founder François Melnotte established the company after successfully negotiating an exclusive distribution and maintenance agreement with Carl Zeiss, a German precision machine manufacturer. The company is employing 50 people and has now a network of four agencies, three in Switzerland and one in France. Its ability to provide fast and high-quality services has enabled it to experience rapid growth.

The sales of machines and maintenance services to large corporations are driving the business's top line. Furthermore, the company is developing a program to help customers train their employees to use the machines. According to the founder, this additional revenue source seems very promising. Ultimately, the company leverages the machines presented in its various showrooms by offering microscopy, tomography, and metrology services for smaller customers who cannot afford their own machines.

In short, the company targets the premium segment of the market and is striving to succeed. However, Rubis Control is overly reliant on its partnership with Zeiss. If Zeiss decides to stop working with the company, its business would come to a halt.

Presentation of the visit

During our visit to Rubis Control, the founder presented a detailed history of the company, market, product mix, customer segmentation, vision, and next big projects.

The founder explained how Rubis Control was founded and how it had grown over the years. He discussed the company's position in the

market and the different products and services offered, including metrology, tomography, and microscopy. The founder highlighted the importance of customer segmentation, explaining how the company served different industries and customers with unique needs.

The founder then explained the company's vision and mission, detailing how Rubis Control was committed to providing high-quality solutions that meet customer needs while adhering to the highest standards of quality and precision. He also discussed the company's next big projects and initiatives, highlighting the latest innovations and developments in the field of metrology, tomography, and microscopy.

During the showroom tour, we were able to see a demonstration of one tomography machine and two metrology machines. The tour showcased the company's state-of-the-art tools and equipment, highlighting their capabilities and features. We had the opportunity to see the machines in action and learn more about how they were used in various applications, such as medical imaging or industrial inspection.

The demonstration was led by a knowledgeable expert who was able to answer any questions that we had. They discussed the features and benefits of each machine, providing insights into how they could be used to solve specific problems and meet customer needs. Overall, the showroom tour provided us with a firsthand look at the company's tools and expertise.

Debriefing

The outcome of this visit was very positive for the two groups that participated in the visit. There are three reasons for this success.

Firstly, the students were received by the managing director and founder of the company Rubis Control. The founder François Melnotte was keen to pass on his knowledge and expertise, both as an expert in his sector and as a former student and junior in the company. This willingness to share is very rich for the PIC Master students who can put themselves in the shoes of the entrepreneur who is innovating and launching himself. Also, students could feel that innovation was deeply rooted in the everyday life of the founder, but also the rest of the team.

Secondly, the success of this visit came from the will to make us discover the company in its entirety. The students had a privileged time in the meeting room to learn more about the history of the company, the conditions of the contract with Zeiss, but also about the global market of these machines. Also, time was given to touch the products that the company was measuring and checking. This business approach to the company allowed us to better understand the ecosystem in which Rubis Control interacts.

Lastly, the success of the visit is brought by the technical depth of the visit. A lot of time was given to technical knowledge. The students had a privileged time to visit the showroom with the project manager Benjamin Bizon, in order to understand the functioning of the different machines. The technical approach allowed them to better understand Rubis Control's value proposition in the context of its collaboration with Zeiss, but also to better interpret the different problems addressed: tomography, metrology and microscopy.

UEFA

The UEFA (Union of European Football Associations) is the organization that manages European football. Founded in 1954, UEFA is responsible for organizing major national and club competitions such as the Champions League and the EURO, as well as promoting and developing football across the continent. These competitions are highly popular among football fans worldwide and generate significant revenues for UEFA and participants clubs.

UEFA consists of 55 national association members and is led by an executive committee, in which the president is currently Alexander Ceferin. The football organization employs approximately 400 people, mostly in Switzerland. Initially, 31 national federations were constituting UEFA including France and many countries have joined the organization since 1954, the latest being Kosovo in 2016.

Initially based in Paris, the organization's headquarters were moved to Bern and then to Nyon in 1995.

The UEFA has several missions including:

- Promoting fair play and ethics in football. The organization is involved in many initiatives: for example, UEFA has created a Children's Foundation, which aims to help disadvantaged children through football.

- Managing the rules of the game: UEFA works closely with UEFA to ensure that the rules of the game are consistent globally and is responsible for training referees and match officials throughout Europe.

- Managing player transfers: the organization establishes rules for player transfers between clubs and ensure that these transfers and conducted fairly and transparently.

- Developing football worldwide: UEFA works closely with FIFA and national football associations to promote the development of football in developing countries, supporting the creation of football infrastructures.

In 2020, the UEFA had a revenue of 3,25 billion €. Most of the UEFA's revenue is coming from broadcasting rights, which represent 78, % of UEFA's total revenue. Sponsorship, licensing deals and ticket sales are other major sources of revenue. UEFA distributes a significant portion of its revenue to its member association and clubs. During the 2019-2020 season, UEFA distributed 3,25 billion € to its 55 national federations and clubs.

Visit description

Context

The visit took place on Thursday, March 2 and was aimed at meeting the team working within the UEFA Innovation Hub. It lasted two hours and took the form of a presentation and then interactions with three members of the Hub:

- Charles Frémont, UEFA Innovation Hub Manager
- Eliott Castille, Innovation Projects Specialist
- Kalea Sunderland, Innovation Hub Analyst

Presentation of the Hub

UEFA's Innovation Hub is a platform that was launched by the Union of European Football Associations (UEFA) in 2019 to drive innovation and promote the use of new technologies in football.

The Innovation Hub serves as a collaborative space where UEFA, football clubs, startups, and other stakeholders can work together to develop and implement new ideas and solutions that can improve the game of football. The Hub focuses on several key areas, including:

1. Fan engagement: The Hub works to develop new ways to engage with football fans, using technologies such as virtual reality, augmented reality, and social media.

2. Performance optimization: The Hub seeks to identify and develop new technologies and data analytics tools that can help players, coaches, and clubs optimize their performance and make better decisions on the pitch.

3. Sustainability: The Hub is committed to promoting sustainable practices in football, from reducing the carbon footprint of stadiums to promoting sustainable travel for teams and fans.

4. Health and safety: The Hub works to develop new technologies and protocols to promote the health and safety of players and fans, from concussion protocols to COVID-19 safety measures.

The Innovation Hub also provides a platform for startups and entrepreneurs to showcase their innovations and connect with potential partners and investors. UEFA runs regular events and challenges, such as the UEFA Innovation Challenge, to encourage innovation and collaboration in the football industry.

Overall, the UEFA Innovation Hub is an important initiative that is helping to drive innovation and promote sustainable growth in the football industry and is poised to play an important role in shaping the future of the game.

Highlights and key learnings:

The presentation of the UEFA Innovation Hub that we attended reasoned with the characteristics of the entities in which some of the PIC Master students work. Often employed in innovation cells of large groups, there is a strong similarity between the UEFA Hub and other such "labs":

- A fairly clear separation from operations. The UEFA Hub is not involved in the organization of competitions at all. Its temporality is therefore completely different since it does not respond to annual deadlines.

- The objective of the Hub is above all to inculcate a culture of innovation internally. In other words, it is a mission of influence that is carried out among employees: workshops, presentations, contacts with start-ups, etc.

- Measuring the effectiveness of these actions is not always easy. While certain KPIs can

be used (workshop participation rates, number of views on social networks, etc.), it is difficult to clearly distinguish the impact of such a Hub in operational actions.

- In addition, the Hub's staff is quite small and functions as an almost independent unit.

This visit was therefore enriching in order to better understand the functioning of independent innovation cells within large groups with an internal influence vocation. It should be noted that the Hub also has an external focus, notably by supporting various innovative start-ups (such as MoveAI, a start-up specialized in motion detection).

We would like to thank the UEFA Innovation Hub teams for their warm welcome and for the quality of the exchanges we had the chance to have with them. It was a very pleasant and instructive visit in a sector that is not well known for many students.

Conclusion

To conclude, this Learning Expedition was an incredible human adventure. Through the exchanges with the professionals, we learned a lot about their industry, their job and the challenges they have to face, especially the ecological transition. We also discovered a territory. From Munich to Geneva, we were able to learn about the rich cultural and natural heritage of this beautiful region. So once again, thank you!

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