



Mobility. Transfer. Society.

*Germany – Brazil 2017–2019
The strategic partnership AWARE*

Motivation	7	2. Presentation of AWARE Network Partners	30
Greetings		2.1 AWARE – interviewed	30
<i>Dr. Dorothea Rüländ</i> DAAD	8	2.2 Universities	
<i>Prof. Dr. Eduardo Salles de Oliveira Barra</i> UFPR	9	<i>THI – Technische Hochschule Ingolstadt</i> Prof. Dr. Walter Schober, President	36
<i>Luiz Quinalha</i> LATAM Renault Nissan Mitsubishi Alliance	10	<i>UFPR – Federal University of Paraná</i> Prof. Dr. Ricardo Marcelo Fonseca, Rector	38
<i>Dr.-Ing. Lutz Kühnke</i> Continental AG	11	<i>UFSC – Federal University of Santa Catarina</i> Prof. Dr. Ubaldo Cesar Balthazar, Rector	40
1. Introduction		2.3 Foundations	
1.1 Scientific Cooperation Between <i>Bavaria and Latin America</i> Dr. Irma de Melo, BAYLAT	14	<i>Bavarian Research Foundation</i> Prof. Dr. Dr. h.c. (NAS RA) Arndt Bode, President	42
1.2 The Strategic Partnership AWARE Anne-Sophie Lohmeier, THI	16	<i>FA – Araucária Foundation for Scientific and</i> <i>Technological Development of Paraná State</i> Prof. Dr. Paulo Roberto Brofman, President	44
1.3 “Nothing happens, it’s mere movement”: <i>Europe and Latin America in Alfred Döblin’s</i> <i>Epic Novel “Amazonas”</i> Georg Overbeck, THI	22	<i>FAPESC – Research and Innovation Support</i> <i>Foundation of Santa Catarina State</i> Prof. Dr. Sérgio Luiz Gargioni, President	46
		2.4 Research and Educational Institutes	
		<i>Lactec – Research Institute in Paraná</i> Luis Vianna, President	48
		<i>CERTI – Reference Centers</i> <i>in Innovative Technologies</i> Prof. Dr. Carlos Alberto Schneider, President	50
		<i>Senac – National Service of Commercial</i> <i>Apprenticeship in Santa Catarina</i> Marcus V. de Azevedo Tutui e Silva, Coordinator of Master’s Programs	52
		2.5 Industry Partners	
		<i>AUDI AG</i> Dr. Henning Löser, Head of Audi Production Lab	54
		<i>Airbus Defence and Space GmbH</i> Rainer Ackermann, Manager Global R&T	56
		<i>Continental AG</i> Dr.-Ing. Lutz Kühnke, Head of Occupant Safety & Safety Division	58
		<i>arculus GmbH</i> Witold Kopytynski, Co-Founder & COO	60
		<i>SPARKS GmbH</i> Benedikt Häring, Head of Marketing and Sales	62
		<i>Pixida GmbH</i> Maria Lohwasser, Head of Recruiting	64

3. Entrepreneurial Infrastructures & Ecosystems		5. Innovation & Transfer to Economy	
3.1 In Germany		5.1 In Germany	
3.1.1 Overview	68	5.1.1 Overview	142
<i>Prof. Dr. Martin Bader</i>		<i>Georg Overbeck & Prof. Dr. Christian Facchi</i>	
3.1.2 Center of Entrepreneurship at THI	72	5.1.2 The Research Partnership SAFIR	146
3.1.3 brigk – Business Incubator for Digital <i>Entrepreneurship of the Ingolstadt Region</i>	74	5.2 In Brazil	
3.1.4 The National Start-Up Program EXIST	76	5.2.1 Overview	150
3.2 In Brazil		<i>Prof. Dr. Ewaldo Luiz de Mattos Mehl,</i> <i>Prof. Dr. Alessandro Zimmer &</i> <i>Cláudia Raisa Tavares Romano</i>	
3.2.1 Overview	78	5.2.2 Innovation and Transfer at UFPR	154
<i>Prof. Dr. Cleverson Renan da Cunha</i>		 <i>Binational Research on Material Sciences:</i> <i>Laser Cladding for Disk Brakes</i>	158
3.2.2 The Ecosystem of Innovation at UFPR	84	 <i>Field Study in Brazil: Comparing Marketing,</i> <i>Sales and Media in Germany and Brazil</i>	160
3.2.3 Entrepreneurial Universities Index	88	 <i>Brazilian Consumer Behavior</i> <i>in a Comparative Perspective</i>	162
3.2.4 Junior Enterprise Movement	90	 <i>Expanding the AWARE Network to Colombia</i>	164
3.2.5 Entrepreneurship and Start-Up Acceleration: <i>Inovativa Brasil and Sinapse da Inovação</i>	96	 <i>Expanding the AWARE Network to Argentina</i>	166
 <i>Transferring Applied Teaching to Brazil: Project AIM</i>	98	6. Innovation & Transfer to Society	
 <i>Brazilian Mentoring Program</i> <i>with Airbus Defence and Space</i>	100	6.1 In Germany	
 <i>Internships in Research and Development</i> <i>in Santa Catarina</i>	102	6.1.1 Overview	170
 <i>Senac Entrepreneurship Course at THI</i>	104	<i>Georg Overbeck</i>	
 <i>German-Brazilian Double Degree</i> <i>in “International Automotive Engineering”</i>	106	6.1.2 Third Mission Project: <i>“Mensch in Bewegung” at THI</i>	174
 <i>Brazilian Spin-Off Mobilis: Start-Up for Electric</i> <i>Vehicles produced in Santa Catarina</i>	108	6.2 In Brazil	
4. Internationalization & Organizational Innovation in Universities		6.2.1 Overview	178
4.1 In Germany		<i>Prof. Dr. Leandro Gorsdorf</i>	
4.1.1 Overview	112	6.2.2 Third Mission Success Stories at UFPR	184
<i>Prof. Dr. Georg Krücken & Sören Magerkort</i>		 <i>Joint Project SAFE Nominated</i> <i>for Hermes Award 2018</i>	188
4.1.2 AWARE from an Organizational <i>Innovation Perspective</i>	118	 <i>Berlin – Brussels – Riga: AWARE Joining</i> <i>Pan-European Network Conferences</i>	190
4.2 In Brazil		 <i>eMobility Forum: Working on</i> <i>Joint Challenges in Mixed Formula</i> <i>Student Teams</i>	192
4.2.1 Overview	122	 <i>Transferring Knowledge to Society:</i> <i>CARISSMA at SEPEX Week in Brazil</i>	194
<i>Guilherme de Rosso Maños</i>		 <i>Brazilian Guest Lecture</i> <i>“Social Corporate Responsibility</i> <i>from a Brazilian Perspective”</i>	196
4.2.2 Internationalization Strategy at UFPR	128	List of Abbreviations	198
 <i>Brazilian Researcher on Sensor Technologies</i> <i>at Research and Test Center CARISSMA</i>	130	Authors and Others Involved	200
 <i>Cooperative PhD in Applied Automotive Projects</i>	132	Imprint	202
 <i>Transfer via Minds: Scientific Staff Members</i> <i>from Brazil at THI</i>	134		
 <i>International Automotive Engineering</i> <i>Spring School at UFPR</i>	136		
 <i>Binational Research on Renewable Energies:</i> <i>Accelerated Aging Test of Li-ion Batteries</i>	138		

Motivation

Dear Readers,

By the end of 2018, the Applied NetWork on Automotive Research and Education AWARE will have spanned an entire decade of exchange activities. In the meantime, we have also won further selected strategic partners from Argentina and Colombia alongside those from Brazil and Germany. In addition to expansion within Latin America as part of developing a larger Mercosur network, AWARE has also attracted considerable interest within the European university community. Inspired by this interest, its organizational structure and performance results were the subject of several conference lectures throughout Europe in locations such as Berlin, Brussels, and Riga.

As the title of this book suggests, the extension of our network is not merely understood in terms of geography but also in relation to our mission. The new, second title of our AWARE publication series "Mobility. Transfer. Society" gives way to a novel approach: The assessing and developing of higher education activities, not just from the sole university perspective, but also from the perspective of a broader social relevance.

Along these lines, the book emphasizes relevant fields such as entrepreneurship, organizational innovation, internationalization, university activities and event formats, allowing wide participation by civil society. Due to the high practical relevance, we largely forego footnotes, in the same manner as our last AWARE publication in 2016. By reviewing crucial activities and projects that occurred throughout the second AWARE funding period from 2017 onwards, this book sees itself as a continuation of our strategic partnership, and we are looking forward to the years to come.

We have always regarded the funding provided by the Federal Ministry of Education and Research (BMBF) and the German Academic Exchange Service (DAAD) as something given on a temporary basis. As such, we made use of this time to build up our network and solidify its organizational structure. From 2019 onward, AWARE will be able to stand and perform on its own. We are already eagerly awaiting the years ahead, the future commitment of those involved, and even further fresh inspiration from both the New and Old World.

Curitiba, Florianópolis and Ingolstadt, December 2018



Prof. Dr. Walter Schober, President (THI)

Georg Overbeck, Administrative Director Research Center ZAF (THI)

Anne-Sophie Lohmeier, Operative Director of AWARE (THI)

Prof. Dr. Sérgio Luiz Gargioni, President (FAPESC)

Prof. Dr. Horacio Tertuliano dos Santos Filho, Head of Technology Sector (UFPR)

*Greeting of the DAAD Secretary General,
Dr. Dorothea Rüländ*



In the course of globalization, the topic internationalization is constantly gaining more and more importance. Nowadays, it is a central element for universities in their positioning in the worldwide competition on teaching and research. Each university continues differentiating itself and pursues its own internationalization strategy, which corresponds to its institutional goals and strengths. This has also changed the handling of university partnerships. As for a long time it was mainly about individual exchange and individual-related cooperation, partnership management became much more structured and differentiated.

In university-wide procedures, concrete partnerships are deliberately identified, which have priority in being extended and intensified as strategic partnerships at university level. The intention is to thereby increase the international visibility of both partners, to do joint research more successfully, to build up sustainable networks, to recruit promising young professionals together, to train and to exchange, to learn hand in hand and from each other – in short: to strengthen each other. The jointly established structures and strategically strengthened research cooperation with well-respected partners are used as profiling elements in the global higher education market.

In order to support this process, the German Academic Exchange Service DAAD with funds from the Federal Ministry of Education and Research BMBWF started a new funding program in 2012, “Strategic Partnerships and Thematic Networks”, which has already been announced twice.

The most important characteristic of strategic partnerships is their sustainable expansion of cooperation to all institutional levels of the partner universities. With regard to the strategic partnership AWARE, from the first funding phase on the exchange focused on the traditional fields of teaching, research and technology transfer. In order to expand its network with further stakeholders in the region, the partner universities now reinforce the inclusion of the “Third Mission” into their exchange. The Third Mission “transfer and innovation”, defined as reciprocal exchange of universities with stakeholders from economy, culture and society, is already tradition at Latin-American universities for many years and has recently gained importance as motor for innovation also in Germany.

Herein lies the benefit of AWARE: as strategic network, it connects core and complementary competencies with each other in an international context and can serve as “living lab” where topics can jointly be analyzed and tested to be replicable or not at their home university. While Technische Hochschule Ingolstadt was able to transfer its experience in cooperation with regional industry partners to the Brazilian universities within the past six years, now it is time to benefit from the acquired decade-long expertise of the Brazilian partner universities and their specially established departments for University Extension.

With this in mind, I am looking forward to this publication, which is as a result devoted to the interesting topic of “Third Mission” and shows through practical examples how one can learn from international partners in AWARE in order to transfer this experience eventually into a benefit for the region. I wish everyone a stimulating read!

Dr. Dorothea Rüländ
DAAD Secretary General

*Greeting of the Director of Undergraduation and Professional Education
Affairs of UFPR, Prof. Dr. Eduardo Salles de Oliveira Barra*



With almost a decade of enhanced and excellent cooperation behind us, AWARE has steadily grown to become our most important international networking project. I want to stress that it is application-oriented programs such as AWARE that are of particular strategic importance for the Federal University of the State of Paraná (UFPR) as they pursue the exchange of teaching and research not as mere end in themselves, but also as a voluntary commitment, bringing together academia with the world outside. Thus, in Brazil we call this engagement simply “Outreach”, while in Germany the technical term “Third Mission” appeared, summarizing the need for activities not only centered within the other two missions research and teaching. Please let me briefly illustrate our engagement through the Program of Tutorial Education (PET), which became an important bridge between UFPR and its community.

PET emerged as a training program for future researchers to the emerging Brazilian postgraduate education system. It was designed in the late 1970s by the economist Cláudio de Moura Castro, at that time the President of CAPES (Coordination for Improvement of Higher Education Personnel) – a governmental department attached to the Ministry of Education –, which was inspired by the Honors Programs of the North American universities. According to its founder, PET should promote the formation of an intellectual elite. In his convictions, it would require the best schools for the “most gifted”, with the best professors and resources. At the time, school equality for all was a daydream for only a handful of idealists.

PET was extremely important to bring together young undergraduates who were able to continue their training in programs dedicated to advanced researches. Nonetheless, alongside the consolidation of research and postgraduate programs, the Brazilian universities have experienced another renewal movement throughout the last decade. It could be considered that this movement began with the political actions that granted the access to public universities for a segment of the society traditionally ignored in these formative spaces. These segments often constitute students from low-income families or which attended public schools or who are self-identified as ethnical or racial minorities or with physical disabilities. By law, they had their enrolment guaranteed for undergraduate courses in Federal Universities countrywide (Law 12.711/2012).

The Program, however, did not fail to continue to prepare eminent leaders. Such students are now led to exercise their leadership much more as a service to the general benefit of the whole society instead of granting only to themselves this leadership as a class privilege. In order to train these young people with this world view, PET develops a pedagogy of tutorial and collective formation, which, in short, consists of facing students with challenges and real problems which interfere directly in the lives of people and communities.

In this way, PET has contributed immensely to broaden the experiences in the formation of socially responsible professionals that the country demands, in a time in which social inclusion and income distribution become national ethical imperatives. I am certain that PET, or parts thereof, might also serve as a role model for German academia and for Technische Hochschule Ingolstadt (THI) to cope with some aspects of today’s and tomorrow’s societal challenges, particularly when it comes to social cohesion and sustainable societies. I would be delighted if the lessons learned from UFPR could find their place in THI’s initiative “Mensch in Bewegung” – as future bridge within society and between our two institutions.

Prof. Dr. Eduardo Salles de Oliveira Barra
Director of Undergraduation and Professional Education Affairs of UFPR

Greeting of the Director of Production, Process Engineering and Supply Chain LATAM Renault Nissan Mitsubishi Alliance, Luiz Quinalha



The Renault Group has a long history with the academic community. Being highly convinced that our proximity to educational institutions benefits both our R&D-outcome and our technology transfer activities, today we look back on multiple pillars of joint activities.

Different pillars of activities were designed in a way that these synergies strengthen the liaison between the academic community and the organization. For example, highly qualified professionals have been headhunted from top universities, in direct collaboration between masters' degree, extension and specialization courses and the company's open innovation and academic entrepreneurship programs led by the Renault Institute, together with the engineering and manufacturing areas.

Especially at the São José dos Pinhais site, the manufacturing area is continuously developing collaboration programs, such as:

- The Manufacturing Intern Program offers opportunities to the best senior students, who are trained to lead productive and technical teams
- Collaboration with universities to update curriculums in order to better meet industry requirements; company professionals are later trained at the same educational institutions
- Collaboration with Araucária Foundation for Scientific and Technological Development of the State of Paraná (FA), which enables students across different levels to work on solutions that contribute to improve processes and reduce costs
- Creative LAB, a fab lab that encourages research on new tools applicable to manufacturing activities, such as virtual reality, 3D printing and others
- Celebrating 10 years in 2018, the Renault Experience program is channeled into fostering university students' innovation and entrepreneurship following the incubator-type business model. After the all-digital enrollment process, from ideation to prototyping, the most promising startups are mentored by company executives and entrepreneurs. In the end, they may have Renault as their partner in their recently created business

Within the scope of the AIM project – Automotive. Innovation. Momentum. – funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), Renault is partnering with Germany's Technische Hochschule Ingolstadt (THI) in the development of the Professional Science Master Program in Automotive Engineering at the Federal University of the State of Paraná (UFPR), which will be essential in promoting skill development and intercultural interaction between both countries. This partnership aims at encouraging R&D initiatives by the academia in the industrial world. Furthermore, Renault has already participated in numerous AWARE events such as the yearly eMobility Forum, for outreach and knowledge transfer.

We aim at stimulating and supporting innovation in the supply chain by embedding innovation and transferring knowledge from academia to industry. The academia must in turn be integrated into the industrial world to promote a better understanding of the needs and potential of the automotive industry.

Luiz Quinalha

Director of Production, Process Engineering and Supply Chain LATAM Renault Nissan Mitsubishi Alliance

Greeting of the Head of Occupant Safety & Inertial Sensors Segment, Passive Safety & Sensorics Business Unit, Chassis & Safety Division, Continental AG, Dr.-Ing. Lutz Kühnke



Continental and Technische Hochschule Ingolstadt (THI) have been conducting research as strategic partners for years already, especially on traffic and vehicle security. In this regard, Continental played a significant role in initiating the foundation of the Research Center (ZAF) at THI in 2004 and has been supporting its activities at the new research and test center CARISSMA since 2016.

The first big milestone in our cooperation marked the year 2008, when a research group composed of THI and the safety departments of the companies Continental, Audi and Volkswagen received the Bavarian Innovation Award (Bayerischer Innovationspreis) for the structure-borne noise airbag CISS. This airbag detects an accident and the severity of it through the structure-borne noise that characteristically emerges directly at the crash and thereby identifies crash situations in an even faster and more reliable way. The last highlight of our partnership for this year was the solemn nomination of our joint research project SAFE for the Hermes Award of the Deutsche Messe AG, one of the most important German industry awards.

Nevertheless, there is still a lot to do: The Global Status Report on Road Safety shows that in the course of growing wealth and corresponding motorization the number of traffic fatalities will rise. To face this societal challenge, both partners, Continental and THI, are also active in Latin America, and through the AWARE network especially in Brazil. For us as global players, it is a combination between problem-solving orientation, complementary profiles of the diverse network partners and the openness and flexibility, which makes the benefit of AWARE.

In this sense, we look forward to jointly developing new solutions, which will be implemented on the market. And that is in the end the biggest award for THI and Continental. Our goal is to fill our cooperation with life and projects. On the spot in the frame of CARISSMA and in Latin America with AWARE.

Dr.-Ing. Lutz Kühnke

Head of Occupant Safety & Inertial Sensors Segment, Passive Safety & Sensorics Business Unit, Chassis & Safety Division, Continental AG

1. *Introduction*



1.1 Scientific Cooperation Between Bavaria and Latin America

Dr. Irma de Melo

Executive Director, Bavarian Academic Center for Latin America (BAYLAT)

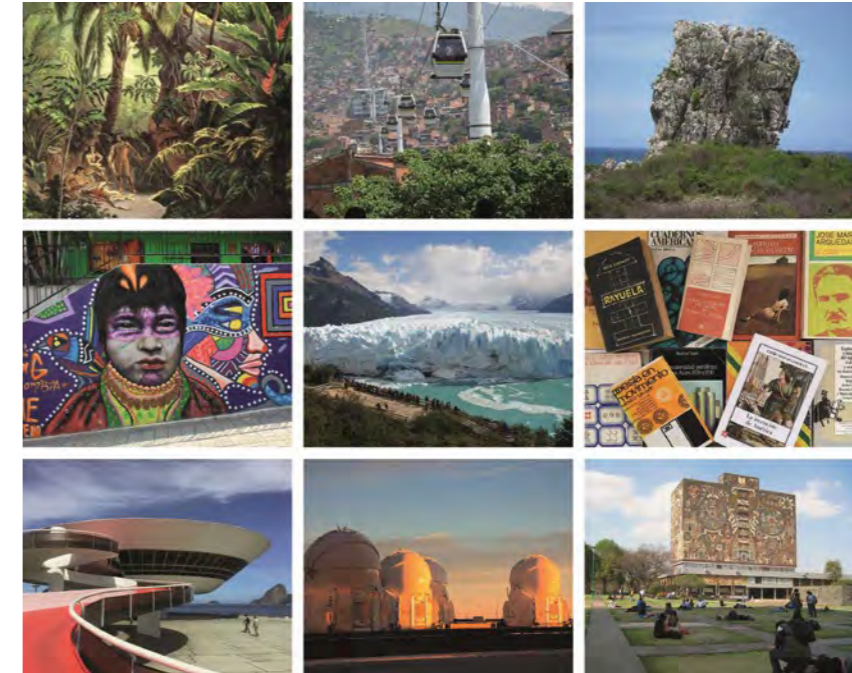
The Bavarian Academic Center for Latin America (BAYLAT) is a state-run service institution with activities throughout Bavaria, dependent on the Bavarian State Ministry for Science and the Arts (StMWK). BAYLAT covers 20 Latin American countries: Brazil as well as the entire Spanish-speaking region in Latin America. Bavaria has long been aware of the importance of scientific cooperation with Latin America. It has been recognized that the key to success lies especially in collaborating with targeted strategic partners. The AWARE network is a positive example of the relevance and impact of strategic partnerships.

BAYLAT's objectives are directly linked to the internationalization strategy of Bavaria's universities. In order to fulfill these objectives, BAYLAT plans its activities and conducts them according to the concept of science, cooperation and university diplomacy. Since its founding in 2007, BAYLAT has promoted the sustainable networking of all Bavarian and Latin American universities as well as research institutions. BAYLAT strengthens and expands existing collaborations, and initiates and establishes new contacts between Bavarian and Latin American universities and research institutions. It gains strategic partners for the Bavarian state and supports research alliances.

One major competence of BAYLAT is identifying potential new partnerships, supporting and establishing them, and particularly understanding the intercultural uniqueness and diversity of the target countries. BAYLAT successfully coordinates and communicates with governments, the counterparts to the German Rectors' Conference, universities and research institutions in order to develop the Bavarian-Latin American cooperation. Eye-to-eye collaboration is essential here, and BAYLAT's success confirms its approach.

BAYLAT is a competence center that has wide-ranging knowledge about the Bavarian university and research landscape as well as current tendencies and potentials in the areas of teaching, science and research. In 2018, BAYLAT founded LATinBAY, a Latin American research network in Bavaria. Its main objective is to provide targeted support for inter- and transdisciplinary scientific cooperation and to promote the formation of quality networks and consortia, in order to prepare joint research applications.

BAYLAT's work as an interface between Bavarian and Latin American institutions naturally has its challenges. In particular, political power shifts and some economic fluctuations in the Latin American countries can create these challenges. To some extent, the university and research sector is influenced by political and economic developments. This can mean, that scientific funding programs must be temporarily suspended or can no longer be financed. Nonetheless, especially in times of political and economic upheaval, it is important to maintain the partnership and exchange with Latin American scientists.



In 2018, BAYLAT founded LATinBAY, a Latin American research network in Bavaria. Its main objective is to provide targeted support for inter- and transdisciplinary scientific cooperation and to promote the formation of quality networks and consortia, in order to prepare joint research applications
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8. © Prof. Dr. Godehard Ruppert; 9. © BAYLAT

BAYLAT must work with these challenges, and has developed a variety of solutions for them. The BAYLAT start-up financing program is one such solution strategy. It allows Bavarian scientists to invite their partners from Latin America to Bavaria for a research and/or teaching project, and to travel to Latin America themselves. BAYLAT also helps establish sustainable research alliances and strategic networks such as AWARE at Technische Hochschule Ingolstadt (THI).

BAYLAT has a strong network of contacts that guarantee its success. Before AWARE was founded, BAYLAT helped identify complementary institutions and contact partners for the AWARE project, and helped to convince them to join the AWARE network. That includes the following research support institutions: Research and Innovation Support Foundation of Santa Catarina State FAPESC, Araucária Foundation for Scientific and Technological Development of Paraná State FA and National Service of Commercial Apprenticeship Senac in Santa Catarina. As an associated partner of AWARE, BAYLAT provided support in the form of travel subsidies, which promoted a direct exchange between German and Brazilian partners. BAYLAT helped the AWARE network expand to Argentina, Colombia and Mexico. For instance, BAYLAT established contact between THI and EAFIT, a Colombian university. During the official visit to Colombia and Peru organized by BAYLAT and led by former Secretary of State Mr. Sibling, the President of THI, Prof. Dr. Schober, was able to sign an agreement with EAFIT. BAYLAT is also in constant communication and contact with the THI-university administration, the AWARE coordinators, THI's scientists and the Latin American AWARE partners.

All of BAYLAT's activities strengthen specialized and scientific cooperation, advance the internationalization of Bavarian and Latin American institutions, and provide stimulus for international research, teaching and science. We are always available in an advisory capacity to support direct, active communication with contact partners and institutions in Bavaria and Latin America.

1.2 The Strategic Partnership AWARE

Anne-Sophie Lohmeier

Operative Director of AWARE, THI

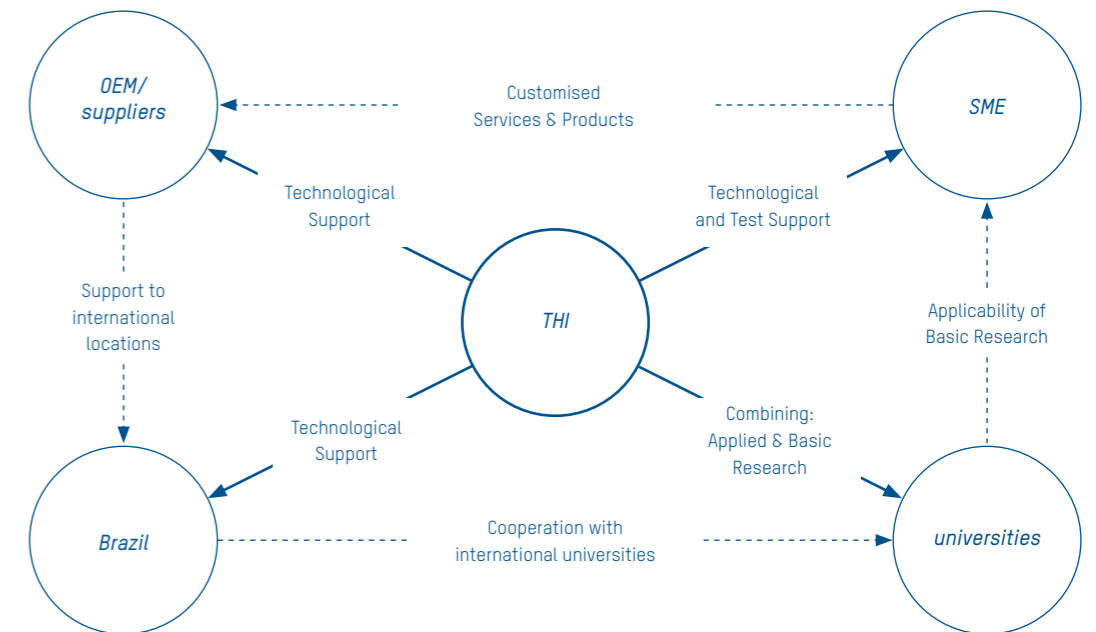
The current necessity of defining high-profile internationalization strategies in higher education institutes has become an opportunity at the same time. Especially smaller universities such as the German Universities of Applied Sciences now are obliged to sharpen their profile, define the competencies they can offer and niches to be occupied in order to position themselves within an increasingly competitive global educational market. Instead of building partnerships along personal contacts and individual initiatives with randomly selected partners, international cooperation is now being established and defined along overarching objectives, with partners and regions selected through a strong university leadership.

German-Brazilian network AWARE: Strategic background

For over ten years now, Technische Hochschule Ingolstadt (THI) has been establishing cooperations with the BRICS countries Brazil, China and South Africa. This is not least due to the fact that these countries are considered as so-called emerging markets, known for their high demand for applied research, interdisciplinary approaches and industry-related research and teaching. With a strong focus on automotive technologies, vehicle safety and mobility management THI provides the necessary knowledge to face challenges characteristic for emerging markets: high death quotes in traffic, growing demand for individual mobility and innovative mobility concepts for mega cities. It is therefore not surprising that THI identified huge potential in cooperating with those countries: traditional engineering solutions, digitalization and smart mobility solutions, sharing economy and smart city solutions are only some of multiple joint topics of interest.

Against this background, THI has been establishing and intensifying cooperation with several Brazilian universities since 2009, further research institutions and industry partners in the field of automotive engineering and management. It was no coincidence that THI's profiling as a university dedicated to mobility technologies came along with the official recommendation of the German Science Council ("Wissenschaftsrat") to establish its novel Center of Automotive Research on Integrated Safety Systems and Measurement Area CARISSMA¹. The foundation of this center – the first research facility of its kind at a university of applied sciences – continued progress and firmly strengthened the main strategic focus of THI: innovative mobility technologies and vehicle safety with the aim to meet the demands of the market. AWARE mirrors this focus: It consists of its academic core partners UFPR and UFSC, the federal universities of the Brazilian states of Paraná and Santa Catarina, as well as multiple extramural partners both from Brazil and from Germany. Building up this holistic network of partners from science, politics and economy alike was the crucial base of the whole network, being considered as an essential prerequisite for a network that considers itself as highly application and technology-oriented with strong transfer potential between academia and industry. A further motivation for strategic networking is the fact that it is getting more and more important for universities to be involved in big and complex consortia, to gain certain resilience and international visibility within the global markets especially in terms of research. This explains why intensifying cooperation with Brazil was

¹ <https://www.thi.de/forschung/carissma/>, accessed on 23/08/2018.



AWARE network strategy ©THI

² <https://www.daad.de/hochschulen/programme-weltweit/hochschulpartnerschaften/strategie/en/23489-strategic-partnerships-andthematic-networks/>, accessed on 23/08/2018.

directly linked to the strategic decision in 2010 to establish the future test and research center CARISSMA as an academic center of reference in vehicle safety on an international level. It was clearly understood that THI as a relatively small university could not reach this ambitious goal without strong international partners. Thus, THI took the opportunity of the new call "Strategic Partnerships and Thematic Networks"² at approximately the same time, in 2012, and AWARE was finally launched with CARISSMA at the same time, getting the approval by the German Academic Exchange Service DAAD and a start-up financing of approx. EUR 1.3 million from the Federal Ministry for Education and Research (BMBF) for six years to come.

Goals and implementation of AWARE

- On a contentual level: developing and exchanging knowhow in innovative mobility technologies and vehicle safety
- On a structural level: international networking in research and teaching
- On a strategic level: establishing a project-oriented, self-sustaining network of automotive engineering

The overall goal of all involved partners is international research and teaching through mobility programs, international study programs with double degree options, joint research and publications and summer schools. All network activities serve to foster exchange of staff, knowledge, best practice and expertise on all levels and exchange can happen through transfer via minds on the one hand, or transfer of technologies on the other.

Review: Six years of AWARE

After six years of close cooperation, AWARE can look back on highly satisfying results and exemplary project implementation:

- Four double degree master programs in “International Automotive Engineering” (see page 106)
- The eMobility Forum established once a year in Germany or Brazil as an event for networking and technical exchange in mobility technologies
- A structured exchange program for guest-lecturers (3-4 per year) with specific funding resources
- Close cooperation between academia and industry in Paraná and Santa Catarina through joint research and established internship programs in R&D departments of the AWARE partners (SMEs, start-ups, etc.)
- A yearly automotive summer school with lectures, laboratory projects and network activities in Germany and Brazil
- Four German-Brazilian research groups:
 - Electric Mobility and Battery Safety Systems
 - Passive Vehicle Safety
 - Material Sciences and Automotive Composites
 - Retail Management and Corporate Social Responsibility Strategies exchanging master and PhD students, hiring scientific research assistants (currently 4 Brazilian research assistants and 1 professor at THI) and writing joint papers

Since 2013, 180 incomings and 210 outgoings have been part of the AWARE network, among them bachelor, master and PhD students, researchers, professors and administrative staff. 24 thesis projects (bachelor, master and PhD) have been jointly supervised and published and joint research results have been presented on 16 international conferences. Since 2016, AWARE has been invited to international higher education conferences in Europe (see page 190) and South America alike, serving as best-practice network in terms of network governance and management as well as sustainability of cooperation.

Transfer project AIM – Automotive. Innovation. Momentum. (2018-2021)

In 2017, the AWARE consortium successfully submitted the new transfer project AIM. Funded by DAAD and the Federal Ministry for Economic Cooperation and Development (BMZ), its basic mission consists in transferring application-oriented teaching modules and expertise in establishing study



Racing car of UFSC Ampere Racing team, participants of the eMobility Forum © Ampere Racing

programs with industry to Brazil. This new project will run for four years and aims to transfer knowledge and structures of THI to the two Brazilian Federal Universities UFSC and UFPR in order to prepare Brazilian engineering students better to start working at car manufacturers and suppliers located in Santa Catarina and Paraná. The main strategy of AIM focuses on three core areas: Vehicle Technologies, Automotive Production and Development of Automotive Systems. Apart from developing special applied modules, all AIM partners work on the transfer and exchange of study program structures, cooperation with industry within teaching activities and establishing international short-term activities together such as Automotive Summer Schools. Furthermore, internationalization and digitalization of teaching is a central issue in order to prepare all three partners to become open-minded universities prepared to receive even more students from all over the world. Due to the lack of industry-related study programs in public universities in Brazil, AIM counts with important financial support from the automotive industry and further institutions located in Paraná and Santa Catarina, such as Audi, BMW, Renault, Volvo and Senai Institute of Paraná.

Preview and perspectives: AWARE 2019+

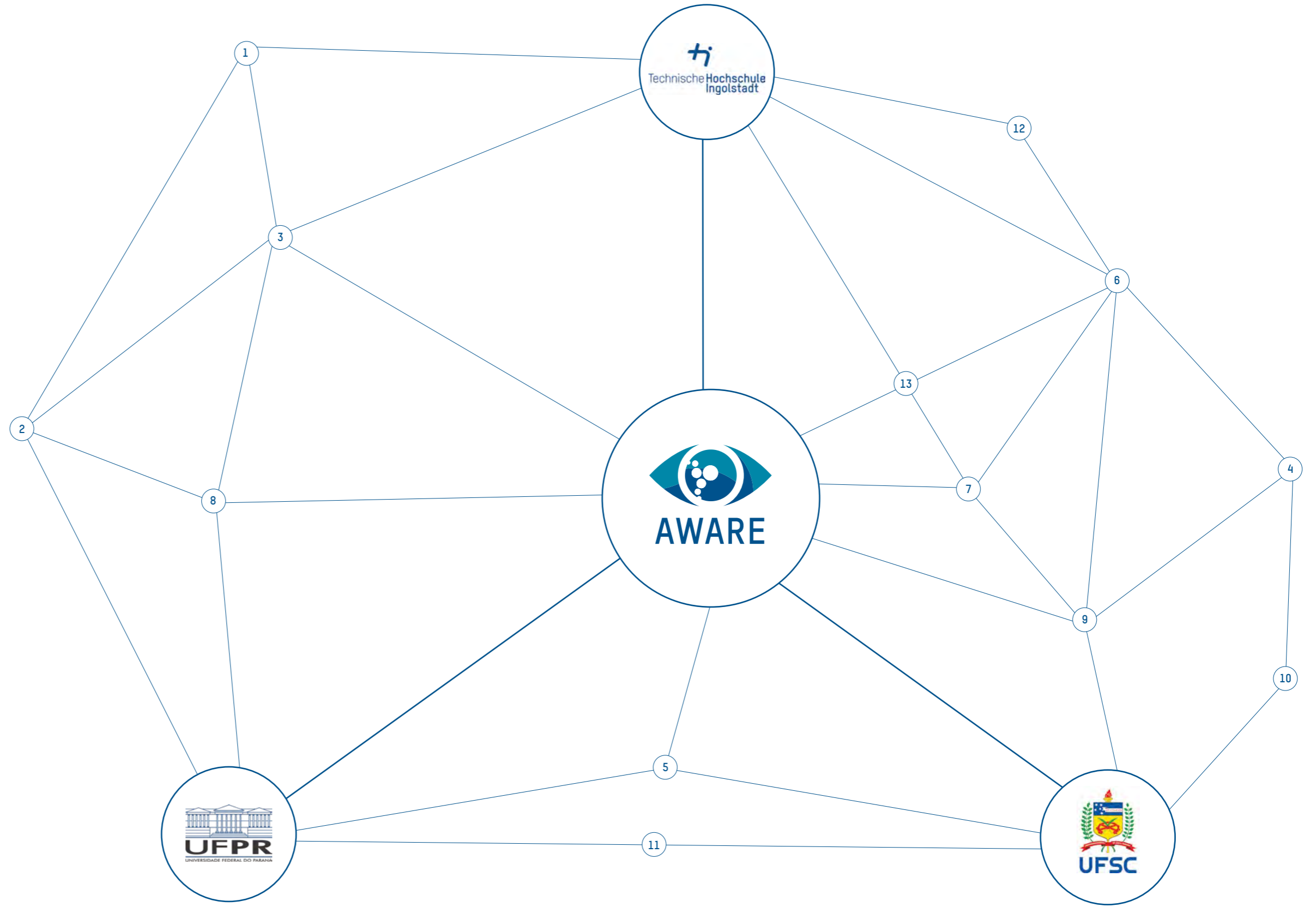
AWARE is a true win-win situation for all partners involved: firstly, due to complementary partner profiles and secondly, promoting internationalization of all partner universities, which nowadays is considered a must for all higher education institutes in order to survive in the global educational market. Whereas the network was funded basically by the German Government in the last six years, AWARE has now diversified its funding resources basing itself on a multitude of public programs, industrial support and further resources by network partners. All this is possible only thanks to the generous initial funding of DAAD, which allowed the partners to start and test first cooperation experience and build up trusting relationships.

Furthermore, the university partners are specially satisfied that CAPES, the correspondent funding agency for research and education in Brazil, has recently approved the internationalization strategies of both UFPR and UFSC within their national call PrInt (Programa Institucional de Internacionalização). Out of 108 institutions who submitted their international strategies, only 25 have been approved to receive funds for the next four years (2019-2022). This program will definitely accelerate further internationalization of teaching, research, structures and procedures within UFSC and UFPR and thus, will serve as impetus for further AWARE activities as well.

Looking into the near future, AWARE is currently in the process of gradual expansion. Based on the long-lasting practice in cooperation with the Mercosur region, the strategic partnership is now successively expanding to further Latin-American countries, such as Argentina, Colombia and Mexico; furthermore, in the past AWARE focused on research and education. In the next years, the intention is to exchange as well best practice and expertise in university administration and so called Third Mission projects that address broader society. The latter is of particular value due to the fact that THI – together with Katholische Universität Eichstätt-Ingolstadt (KU) – has recently received funding of up to EUR 15 million within the German Federal and States government funding measure “Innovative Hochschule” (Innovative University). In the following five years, the Third Mission project MiB aims to support a mutual exchange between universities and representatives of politics, economics, culture and society (see page 174 ff.). Whereas Third Mission is a relatively new mission for German universities, Latin-American educational institutions have stressed their social responsibility since its beginnings. This is why Third Mission was finally included in Agenda 2019+ of AWARE, thus constituting another positive spillover effect between Brazil and Germany. Last but not least, after serving as best-practice-model on several international higher education conferences, AWARE recently submitted a new proposal in the German national program “DIES – Dialogue on Innovative Higher Education Strategies”, focusing on exchange of university governance and administrative practice from 2019 on.

AWARE: Active Stakeholders

- 1  **BAYLAT**
see page 14/15
- 2  Bayerische
Forschungsstiftung
see page 42/43
- 3  **Audi**
see page 54/55
- 4  **Senac**
see page 52/53
- 5  **institutos lactec**
see page 48/49
- 6  **AIRBUS**
DEFENCE & SPACE
see page 56/57
- 7  **certi**
see page 50/51
- 8  **FUNDAÇÃO ARAUCARIA**
see page 44/45
- 9  **FAPESC**
see page 46/47
- 10  **[Circular Logo]**
see page 108/109
- 11  **SPARKS**
see page 62/63
- 12  **PIXIDA**
see page 64/65
- 13  **arculus**
see page 60/61





Ruins of Jesuit reduction São Miguel das Missões in Southern Brazil © IPHAN/RS (Rio Grande do Sul State) – Instituto do Patrimônio Histórico e Artístico Nacional (National Institute of Historic and Artistic Heritage)

1.3 *“Nothing happens, it’s mere movement” : Europe and Latin America in Alfred Döblin’s Epic Novel “Amazonas”*

World theater, self-determination and encounter with the unknown. Europe and Latin America in Alfred Döblin’s epic novel “Amazonas”

Georg Overbeck

Administrative Director Research Center (ZAF), THI

Eight decades have passed since Alfred Döblin (1878–1957) published his extraordinary epic trilogy “Amazonas” written during his exile in France. These days, its literary topoi seem to be more relevant than ever before: speed and globalization, the encounter with an alien culture, culture vs. nature, creative destruction and the destruction of creation itself. It’s not hard to imagine that this instant familiarity sensed by many of today’s readers might be the result of Döblin’s own experience – not to be mixed up with the narrator of the novel himself. In the late 1920s, all of Europe was stricken by crisis and turmoil and increasingly affected by rising totalitarian movements, eventually forcing the author to flee Nazi-Germany. He also witnessed Franco’s unleashing of the Spanish Civil War and leaderships such as National-Catholic Spain, Mussolini’s fascist Italy and Salazar’s “Estado Novo”, the corporatist authoritarian government in Portugal. The ruling ideologies, which provided the foundations of these systems, could quite often be very clearly associated with the Social-Darwinist “survival of the fittest”, partially accompanied by a crude materialism. Following this train of thought within the Amazonas trilogy, it was the European Enlightenment that sparked the individual’s drive to greatest possible freedom, which in the end proved to be a path into darkness. The spirit of Enlightenment, a view of the world in which the individual is the measure and center of all things, is contrasted with the native Indians’ all-embracing cosmic conception of a world in which all living creatures and events stand in relationship with each other by means of some invisible system. However, this conception of the world can no longer provide an explanatory pattern for the sudden and destructive invasion of the conquistadors, which the indigenous population regarded as ghosts or demons. The silence of their gods and the decay of their conception of their world let them fall into fatalism and fear. The brutal conquest takes its course. Thus even within the deepest pristine forest or on the high plains of New Grenada, the reader is deeply disturbed by the destructiveness deriving from Europe. This deep grief reflects the novel’s actual belonging to German exile literature since the guiding theme is not baroque Latin America throughout space and time but in fact deals with the situation in the Europe of the 1930s.

³ All quotations taken from Alfred Döblin; Amazonas, Frankfurt a.M: Fischer Taschenbuch Verlag; 2014. The novel has hitherto not been translated from German into English, thus it has been translated to the best of my knowledge.

⁴ p. 113.

⁵ p. 98.

⁶ p. 92.

⁷ p. 150.

⁸ p. 91.

*The trilogy's first volume: "The Journey into the Place without Death"*³

Within the world view of the people of the Amazon, the "place without death" is a mythical land of purity where no one starves, where there is no room for evil or death. This is where the natives try to flee away from the advancing conquistadors, "the stranglers and defilers passing through" making (...) "all suffer. And the deer and the huge birds (...) dreadful, dumbfounded world"⁴. Here again the reader detects a great sadness with regard to this pan-European catastrophe because the conquistadors at that time include not merely Spaniards but also Swiss, Italians and Germans, the latter embodied through real historical figures such as Georg von Speyer, Nicolaus Federmann and Ambrosius Alfinger, who is described as follows: "a man, a white man, a huntsman, no worse than the others. Belligerence was his backbone, he felt good when he could crush someone; glory, power and gold were his heart and blood. The dark-skinned were the sand he trod upon"⁵. Even though the narrator describes the conquerors despite their greed, brutality and destructive rage in a differentiated manner and as "no bad fellows"⁶, destruction of the native civilization is fateful and, in the end, inevitable. This fate is depicted, among other things, by comparing the conquest with a volcano relentlessly emitting new European conquistadors⁷. Unlike the native population, the European "pale people"⁸ were raised in cold and dark Europe, a dim and deficient place, thus their daily struggle for survival, producing greed and belligerence directed against defenseless natives even after their surrender. These, on the other hand, benefit from a warm climate and fertile nature. They cannot understand the Europeans' unquenchable thirst for gold which appears to be their very source of food.

The trilogy's second volume: "The Blue Tiger"

Just as the "Place without Death", "The Blue Tiger" also derives from the imagination of the natives. It is the Blue Tiger that is set on mankind as punishment by the "Great Father", bringing death and destruction. However, the ones which are punished are not only the native Indian tribes but the Europeans as well. An example is the devastating earthquake of Lisbon that took place in the middle of the 18th century and decimated the entire city, to this day considered one of the biggest natural disasters in European history. "[...] this world is not going to last. It is governed by violent criminals and free thinkers, the Blue Tiger, as the story goes in the South, the Blue Tiger, this evil beast, the messenger of destruction, has come down from heaven, tearing apart the world, the large dreadful earthquake was his first sign, others are to follow, [...]"⁹. Rationalism, secularization and Enlightenment, here personified through the enlightened despotism of the Marquis de Pombal, at that time Portuguese Secretary of the State of Internal Affairs, are the main reasons for this European misery. However, the destructive forces are no longer embodied by the conquistadors but through "[...] advancing "vigorous forces" [...] across the vast continent South America [...], coffee, sugar cane, cotton, tobacco, cocoa, corn, timber." In this second part of the trilogy, this early capitalism along with the slave trade is juxtaposed to the utopian idea of an experimental "Christian Republic", largely the achievement of the Jesuits, nowadays fallen into oblivion: In the beginning of the 17th century, the Jesuits began to settle a whole people, the Guarani, in an area that today encompasses parts of what are now Paraguay, Brazil and Argentina where the Jesuits built so-called "reductions", Christian villages of native peoples gathered together under Jesuit control, thus protected from slave hunting Europeans, the Paolists. Within these reductions the natives learned various trades and crafts, and also music played an important part of everyday life within Jesuit mission and education. Surely enough, one can presume that the natives had to adopt the Jesuit philosophy and everyday life, in the terminology of the first part of the novel one can interpret this easily as a "conquest of the soul". But in fact, especially against the background of the first part of the novel, a more differentiated view of the Jesuit mission has to be taken if one bears in mind the atrocities against the natives. For instance, conquistador Alfinger had set bloodhounds on defenseless natives, and all the clerics of his entourage could manage was to baptize quickly an infant wrestled out of the dogs' mouth before dying. Thus, it becomes quite clear that the Jesuit "reductions" are a shelter for humanity, seen as an "Indian Canaan"¹⁰ in the novel, flowing with

⁹ p. 653.

¹⁰ pp. 381-466.



Group of students from UFPR, UFSC and EAFIT visiting Ingolstadt's baroque Asam Church with its ceiling fresco depicting the arrival of Jesuit missionaries on the American continent © Lucas Baesso Guimarães

¹¹ pp. 467-585.

milk and honey. This cheerful community is portrayed as an incorruptible, simple church yet untouched by the malignant power politics on the European continent, therefore characterized as "Noah's Ark"¹¹. However, the plot describes a corrupt Vatican, regarding the Jesuit Republic as a mere almshouse: [...] "The names of the kings changed, but all of them loved the Jesuits. The kings, whether lustful or chaste, peaceful or belligerent, they all felt drenched with sin and guilt [...]. Over the coat of the royal honors and pleasures lay the coat of sin and guilt [...]. And the Jesuit Fathers, they were a sheer delight, their need for help was endless"¹². Ultimately, the Jesuits became victims of European political intrigue and were expelled from South America. Consequently, the setting of the last dramatic act within this second part, the end of the Jesuits in Portugal, is the prison in San Julian castle near Lisbon, once more pointing to an ailing Europe as the actual location of the plot.

¹² pp. 493-494.

The trilogy's third volume: "The New Jungle"

"The New Jungle" is nothing else than Germany during the years between the Weimar Republic and the Nazis' seizure of power. On the surface, things might appear civilized, but underneath, lurking in the shadow, the crude laws of the jungle prevail. "What bloodhounds and firearms did to naked natives armed with bow and arrow in the past, was now done with speeches, newspapers, radio, the police and prison"¹³. And it shows that, against the backdrop of the first part of the novel, protagonists and people of the third do not differ in any way from the conquistadors of the past. "And if a king or captain would give the sign now, they would unite, to war and adventure, to robbery and murder and storm their ships to destroy and to be destroyed"¹⁴. Taking for example the group headed by Nicolaus Federmann from Ulm. This had been a cheerful crowd with a passion to risk everything [...] a journey into blissful doom"¹⁵. The same thrill seeking applies to the third part of the novel, set in the Weimar years of the 1920s. Thus, beau and nihilist Jagna fills his inner emptiness by seducing women and ruining them, with one of them even committing suicide. This third part of the novel deals with the main character Klinkert, who in the beginning embodies a radical rationalism. However, this rationalism is all about the survival of the fittest. Instead of wearing a crucifix round his neck like the Jesuits do in the second part of the novel, Klinkert wears a small pair of scissors, symbolizing strength and sharpness. "One should not become involved in debates concerning the advantages and disadvantages of money, property, poverty or reforms. The one waiting for justice, humanity and the Bible has already lost"¹⁶. One of the key passages in this third part is a scene when young Klinkert gathers his Freiburg friends around him: "He had the hammer in his hand, used by commander Quesadas, the first viceroy of Cundinamarca, to smash the cacique's head because the latter hadn't delivered the right amount of gold. How do the words murder, destruction, doom, suffering [...] sound to the one swinging the hatchet, sitting on the airplane, with a flick of the switch releasing the lethal bomb? Hollow, lyrical"¹⁷. This again proves that the past is not really gone but ever present, as a destructive force turning against life itself. Finally, "the lethal bomb" within the novel seems to anticipate historic events such as the Spanish Civil War. It therefore comes as no surprise that subsequently another young man declares: "[...] Hanging around, always hanging around. Once in a while I would fancy a war as a break. What do you think?"¹⁸

¹³ p. 794.¹⁴ p. 723.¹⁵ p. 151.¹⁶ p. 718.¹⁷ p. 723.¹⁸ p. 787.

Subtext and message

"The jungle cries and shouts, it is speechless"¹⁹. In a nutshell, the novel particularly mourns the total victory of science over the natural order, nature's complete rationalization and absolute faith in modern technology with permanent movement as one of its main characteristics. The frightening "humming of unknown drums"²⁰ unsettling the natives in the first part of the novel, resonates in the alienating, never ceasing movement and humming of today's metropolis within the third²¹. In this world there is no place for secrets and miracles as Klinkert clarifies: "We are facing an era, in which the creature outmatches its creator in everyday life. We have created the machines, and they are our teachers destined to go

¹⁹ p. 724.²⁰ p. 149.²¹ pp. 759-760.

German zeppelin LZ 129 "Hindenburg" floating over the historic UFPR building in 1936 © UFPR

²² p. 719.²³ p. 791.

forward"²². The parallels to technological achievements on the turn of the 21st century are apparent, bearing in mind future developments such as autonomous driving, digital transformation or the so-called "DNA scissors" for gene editing, the latter evoking Klinkert's pair of scissors dangling from his neck. Against this backdrop, Goethe's *Sorcerer's Apprentice*, read by an increasingly disillusioned Klinkert, seems to give bad forebodings: "Now for the old sorcerer has left me on my own at last, I can make his forces labor just exactly as I ask"²³. The ghosts evoked, these are the machines and air strikes that would only a few years after the completion of part two of the novel raze whole Europe to the ground, just as the Lisbon earthquake on a much more dramatic scale. At that time, the German Luftwaffe had also turned the tide in the Spanish Civil War through massive and ruthless bombing. The intervention of further foreign powers such as the Soviet Union or Italy transferred this armed conflict into a European war that in many ways nowadays seems to be a first round of World War II. Despite this inescapable cruel war machinery, the novel offers some comfort in the end. Both Klinkert und Jagna go through some kind of transformation. At home in Germany, Klinkert, a former advocate of the survival of the fittest, increasingly regards National Socialism with a critical eye. Jagna, on the other hand, flees to South America. In the finale, the Amazon serves as a setting one last time. This is where the dying Jagna has, at least in his imagination, a spiritual encounter with a deer in the jungle talking to him, thus becoming one with Mother Nature. This interpretation might seem bold, however it might be a first step to the reconciliation between isolation and nature, the rational and the mythical, the familiar and the strange. Even within the baroque world theater, where everybody plays a predetermined role following the analogy of God as a watchmaker observing events unfolding, there seems to be a way out by simply turning away or actually leaving the stage such as Jagna and Klinkert. This is one of exile literature's big motifs.

2. *Presentation of AWARE Network Partners*



2.1 AWARE – interviewed

6 Years of AWARE: Review and Forecast

The DAAD start-up financing in order to develop the strategic AWARE network expired in 2018. Local AWARE coordinators and supporters review essential measures and steps taken within the last six years and give some insights into the various perspectives, needs and stock of experience that make the AWARE network unique and why it is worth to be supported in the future.

Short presentation of the dialogue partners:



Anne-Sophie Lohmeier
Operative director of AWARE at Technische Hochschule Ingolstadt (THI); especially responsible for the financial management, project management, funding acquisition, event management and marketing, as well as for building up business cooperation with companies



Rainer Ackermann
Manager of Global R&T Cooperations (Airbus Defence and Space); AWARE Advisory Board Member since 2016; in 2014 he successfully established the mentoring program with Airbus and AWARE



Prof. Dr. André de Macedo Duarte
Head of the UFPR International Agency; responsible for further public diffusion of the AWARE activities at Federal University of Paraná (UFPR); in charge of all institutional agreements deriving from the project's academic interactions, such as the master's double degree between UFPR and THI



Prof. Dr. Sérgio Luiz Gargioni
President of FAPESC from 2011 until 2018 (Research and Innovation Support Foundation of Santa Catarina State); AWARE Advisory Board Member since 2013; since the agreement of the double degree between THI and the Federal University of Santa Catarina UFSC, Gargioni has been supporting the program through a generous scholarship program for Brazilian students from Santa Catarina

Review

Which measures and activities during the last years turned out to be most successful and which of them do have the potential to last in the future even without the DAAD funding?

Lohmeier From a strategic point of view, the annually organized eMobility Forum as an interdisciplinary exchange platform for academia, industry and politics turned out to be an extremely valuable cooperative experience. On the one hand, we hereby established an important channel for the exchange of knowhow and expertise in mobility technologies; on the other hand, participation of external partners was free of charge or any further obligations, which made it relatively easy to attract partners from all sectors. Furthermore, especially the cyclical nature of our forum helped us to consolidate the event and our partner network. Speaking of consolidation, we are currently facing a huge challenge regarding the sustainability of our activities. International exchange and mobility are an expensive business and our budget currently can't guarantee the continuity of annual personal meetings. Here, I'd like to take the opportunity to thank especially to FAPESC and FA for their constant financial support regarding their scholarship program for the Brazilian double degree student at THI. Nevertheless, we are currently evaluating which digital methods might support us to keep this unique exchange platform alive: joint student projects via Moodle or multiple digital communication channels and social networks through which our formula student teams stay permanently updated, only to name some. Besides, we are in touch with our THI Learning Lab, our experimental space for digital teaching and learning methodologies. We are quite optimistic that together with our Learning Lab we can effectively implement such joint digitalization processes to the benefit of AWARE and its partners. It goes without saying that digitalization cannot replace face-to-face-meetings and personal exchange, which is why our formula student electric teams are looking for sponsors to realize further eMobility Forums at least every once a while in Germany and Brazil. And on a national level, UFSC has already achieved to establish an annual eMobility week in Brazil. In short, joint event formats as hubs for academia, industry and politics turned out to be our most successful ones. Actually, we have already received first requests from further universities in Brazil to copy the eMobility Forum in other states of Brazil.

Gargioni The consistent application-oriented approach of THI (as the name "AWARE" already indicates), which is fairly new at federal universities, has found fertile ground in Brazil and could soon run on its own, especially regarding the established contacts with local industry partners in the last six years. Many industrial projects with reference to teaching and research showed us a model of suitable structures of cooperation. Let's take the AIM project as an example: here UFPR and UFSC develop together with the experience of THI professors study courses in close cooperation with the local industry. Once these channels are opened up and mutual trust is established, further cooperation in research projects is not far away. Furthermore, by gaining support from industry or DAAD, we hereby diversify our financial basis and break up with our strong dependency from public funding, which – in turn – makes them particularly sustainable. Depending less from public financing programs is an important aspect, mainly during the current crisis in Brazil.

Duarte The approval of the AWARE project by DAAD and the resulting interactions with THI brought to UFPR a number of interesting possibilities. From the standpoint of UFPR, the opening of possible internships in Germany for UFPR students was a great achievement, since they could start tightening a relationship with German industry. Also, THI fostered the opportunity for undergraduate UFPR students to do their research during their period abroad, and in some cases even their undergraduate final works were done in THI laboratories. In 2016, the Spring School in Automotive Engineering at Curitiba drew a number of skilled researchers from THI to our institution who gave important lectures on advanced topics. That particular event included the participation of Brazilian students and engineers, but also of a high number of applicants from other countries, including Germany, India and Malaysia. But the most important outcome of our collaboration was definitely the master's double-degree in

Automotive Engineering at THI with the UFPR Departments of Electrical and Mechanical Engineering. Of course, funding is always crucial to the maintenance of those collaborations, but we think that even without DAAD grants many of those activities shall remain active. Most particularly, I think that the master's double-degree in Automotive Engineering is strategic for us and will remain active even in the absence of DAAD funding. As a matter of fact, so far student mobility has been financed in Brazil by the Araucária Foundation, abbreviated FA, and sometimes by the student's personal resources.

Ackermann In the last four years, I have supported the establishment of our Airbus Mentoring Program. As a part of this program, we offer students in the AWARE network the opportunity to take part in an international meeting to discuss experience and practices at our Manching site close to Ingolstadt. This enables us to introduce new perspectives and ways of thinking into our departments and to make our teams more international – factors that are indispensable for a company committed to creating innovative products with cutting-edge technology. In tandem with this “brain-to-brain knowledge transfer”, we are currently beginning our initial research activities with an industrial partner. It is my hope, or even my expectation, that our joint mentoring program and joint research will have a mutually beneficial effect and contribute towards consolidating further joint activities. Furthermore, Brazil is of particular interest to us because it is in the process of becoming an emerging economic power and achieving a high level of added value. We also very much appreciate our close cultural ties with Brazil.

Where do you see the benefit from a network such as AWARE?

Lohmeier Social capital. From my point of view, it is the mutual trust that helps us to implement project ideas extremely fast. We try to combine professional knowledge, know-how, short communication channels and helpful contacts between our partners with a particularly strong emphasis on personal communication, openness and flexibility. In short, our collaboration built upon mutual trust: We believe strongly in the recommendations, suggestions, and also complaints expressed by our partners. Thus, we waste no time in building confidence or persuasion. This trust is a result of a long-standing collaborative experience. During this time, errors were tolerated and risks had to be taken. At this point, the generous promotion provided by DAAD has to be mentioned, as this cooperation would not have been possible without this reliable financial planning security.

Gargioni As former president of CONFAP, the Brazilian National Council of State Research Support Foundations, and in the name of FAPESC, I can assure that the mission of our foundation is to contribute to macrosocial value or rather welfare in Santa Catarina through problem-oriented research. AWARE, especially the recently launched project AIM, serves as an important basis for Southern Brazil to become a place where automotive companies can not only produce cars, but also conduct research and development on cars and further high-technology products. Apart from political regulations, this is only possible if we prepare our students to leave university as high-professional engineers. So, from my perspective, each Real invested in an AWARE-scholarship for Brazilian students by our foundation becomes an important long-term investment in our society's future.

Ackermann AWARE offers us easy and relatively direct access to talented and ambitious students and scientists in Brazil, who give us long-term support in expanding our high-tech strategy throughout Germany, Europe and beyond. We are creating an untapped pool of resources while at the same time building an international network that will allow us to respond effectively and efficiently to future personnel requirements and increasing competition, both strategically and on an operational level.

Duarte Since the beginning of the collaboration between UFPR and THI researchers, the partnership has been based on trust and good-spirit, always respecting each other's own identity and thus fostering an ethos that emphasized commonality. This shared common intention greatly facilitated the development of projects and even enabled our professors to reach achievements that seemed to be

impossible before, such as the possibility of doing research with German companies. These aspects left their mark on our network, resulting in the mixture of German planning and Brazilian creativity, a combination that perfectly matched. Those good results have been achieved especially because THI brought together German expertise and excellence in the automotive field, and that also opened new opportunities with the Brazilian automotive sector. The globalization of research topics favors international partnerships and these can provide an increased interaction between Brazil's industrial sector and UFPR researchers.

To our German partners: What did you learn from the Brazilian partners? What would you like to learn from them in the future?

Lohmeier It is the Brazilian stamina and their tenacity that maintained our network even under the most adverse circumstances. Prof. Dr. Alessandro Zimmer is an excellent example, our “man of the first hour”. He played an important part in initiating the AWARE network in Brazil. And he now lives in Ingolstadt with his family in order to build up a small German-Brazilian research group working on the topics sensors, lasers and radar at the research and test center CARISSMA. The established group is made up of four Brazilian scientists and of improvisation and the risk appetite to achieve the highest scientific output even though the money has not always been sufficient and students had to take some risks to come to Germany without any financial security. So, what the safety-oriented German partners have definitely learned is: Where there is a will, there is a way.

Ackermann I have been working in mixed international teams for some years now. I can only agree with Ms. Lohmeier – Brazilians are hard-working, particularly those from the southern metropolitan areas around São Paulo, Paraná and Santa Catarina, where our AWARE network is also firmly established. Personally, I can say – and this has always been the case for AWARE – that the Brazilians can teach us a great deal when it comes to improvisation. Change and unpredictable situations are perfectly routine – both in people's private lives and on a day-to-day basis at work. In order to be able to improvise quickly and flexibly, you also need to have a relationship based on trust, or at least tend to build informal rather than formal relationships, which isn't always the case in Germany. I very much appreciate the mutual trust in the AWARE network where there is no pressure from one side to deliver results, and we mainly have to thank our Brazilian colleagues, the AWARE organization and THI for that.

To our Brazilian partners: What did you learn from the German counterpart? What would you like to learn from them in the future?

Duarte I can surely testify that the partnership with THI has helped us to closely collaborate with the industrial sector, since in Brazil there is a historical gap between universities and the automotive sector, one we have to overcome as soon as possible. In short, the partnership with THI helped us to open new research frontiers and opportunities, favoring lasting and mutual collaboration in applied research with foreign and national industries. Without this network, that particular challenge would certainly have been almost impossible to overcome. But we still have to get more insight in how to closely work with local industry, above all when speaking about research in technological areas like mechanical and electrical engineering. So, from our German partners we would like to keep learning in the future how to establish lasting connections with the industrial sector, how to incorporate industry staff into university's academic programs, and how to strengthen the links between universities and automotive industries.

Gargioni There were many lessons taught on both sides. When we had the first opportunity to work with the AWARE network, the challenge allowed us to have great insights into automotive research and to get in touch with high-level institutions in this field. We hope that the Brazilian scholars in Germany will use their experience to broaden the cooperation, eventually extend it to other areas and transfer it to Brazil. They could be our future “ambassadors” to help Brazil to approach research and development differently.

Forecast

What are the biggest challenges and chances for AWARE in order to succeed in the future?

Lohmeier An excellent chance is, in my opinion, the opportunity to connect AWARE, as one of the most extensive strategic partnership at THI until now, with further research and network projects in order to use synergies. Regarding our recently started Third-Mission-project “Mensch in Bewegung”, we could establish, as part of AWARE, a comprehensive empirical knowledge regarding governance of complex networks between university and extramural organizations. However, what counts most, we especially learned a lot of research for and with the society from the Brazilian university partners that are, with their “extension” departments, a huge step ahead of the German universities which lack behind some decades. As we will not have a comprehensive funding like the one from DAAD in 2019, it will be challenging to continue with these multiple facets, AWARE's main characteristic. Therefore, we have to adjust our extensive project ideas to funding programs that often only target a determined facet of exchange such as research or doctrine. In contrast to other exchange programs, mobility has never been an end in itself but has always served a certain project or academic mission.

Gargioni In my opinion, the biggest challenge is the rapid flux these days. AWARE requires an extremely agile management in order to master upcoming challenges and necessary impulses. In dynamic times, one risks to grow old very fast, that applies to dynamic networks, too. In my view, AWARE has huge potential, thanks to its social network of young, talented and highly motivated students on the one hand; on the other hand, AWARE – as a scientific network – counts on the support of many highly and voluntarily engaged people who are driven by curiosity and have the guts to try new ways of doing things. Innovation comes up with questioning established ways of thinking and working. We should definitely keep this rare combination of young and curious people as well as politics, scientists and economists. If we keep going as we have, I am more than confident that AWARE can make a difference.

Ackermann I attended an AWARE conference in Curitiba in 2016 myself, and was very impressed by what the professors and students, the managers of tomorrow, had established, and how their enthusiasm and efforts had translated into solid engineering skills. I believe that the challenge now is to keep the flames of enthusiasm burning as time goes on and not to allow other, outside forces to overshadow what has been achieved here. For me, a model like AWARE should not only remain oriented towards Brazil; it can also open up opportunities to establish a long-term institutional exchange between international universities, international students and Airbus as a universal model of cooperation.

Duarte Since the beginning of our interactions with our German partners, one of our main challenges was not being able to assign a dedicated institutional-administrative staff at UFPR. And this is most necessary when it comes to helping our professors and researchers with the organization of all the work and activities that should happen after the signing of a formal agreement between institutions located in very different countries such as THI and UFPR. At THI, the DAAD funding for AWARE provided financial resources to hire a local coordinator, with exclusive duties towards the project's success. Such arrangement was not possible at UFPR, so the administrative activities of AWARE and all the interactions with THI and the German industries had to be absorbed by some members of the professor's staff in a voluntary manner – on top of their regular teaching and research responsibilities. As a result, on many occasions the response time to administrative issues and problems on the Brazilian side was definitively longer than on the side of the German partner. We are working towards the possibility of having more efficient institutional support for international projects – especially those as important as AWARE – but unfortunately, federal universities in Brazil suffer from a longstanding shortage of administrative personnel.

In your opinion, how important is AWARE nowadays and what should it offer in the future in order to be a network worth supporting? Which potential do you see in AWARE for the near future?

Duarte As Head of the UFPR International Agency, I can assure that the AWARE network is strategic and considered our most important academic collaboration concerning engineering and mobility. UFPR coordinates many networks with other universities around the world, but since AWARE is an application-oriented network, inspired by common research and economic interests from both countries, I think it is unique and therefore a partnership of high importance for us. Regarding its potential, I believe that UFPR has not yet fully exploited it. One way to do so is to fully integrate it into different departments and faculties. So far, only the faculties of electrical and mechanical engineering have been involved, but there are many others that could easily participate and add different contributions. Regarding the research and test center of THI, CARISSMA, and the safety operation of electric vehicles, chemistry comes to mind in particular. But what about working on something with Humanities? Recently I heard about your project “Mensch in Bewegung”. I can imagine that THI could cover the topic “motion”, whereas UFPR could cover the topic “human”. That would mean connecting technology philosophy with technology impact assessment. In this sense, the Psychology Graduate Program at UFPR has an interesting research field on traffic psychology, human mobility and risk prevention that definitely should be integrated into these research activities.

Gargioni I can only agree with Mr. Duarte regarding the importance of AWARE. I also think, and at this point I guess I speak as a representative for all Brazilian participants, that AWARE's success is due to its application-orientation, building a bridge between universities and industry. In Brazil, we definitely lack this kind of bridges and they are even more challenges due to very different cultures and cooperation traditions in academia and industry. So, we consider AWARE as a showcase for Brazil to establish similar network projects between Brazil and other foreign countries. So, looking to the near future, I would strongly welcome more exchange between researching professors through longer stays abroad, the German model of a “Forschungssemester”, an exclusive research semester for professors, is only an example. This would bring a multiplier effect encouraging more and more young students to dare a study semester abroad. My personal interest lies in getting into a stronger exchange with German research foundations in order to understand better – and possibly learn from each other – how public research can be stimulated and supported by reducing bureaucratic obstacles at the same time.

Ackermann As an industry representative, AWARE is an ideal network, since we can bring together a variety of interests and unleash their potential without having to make any commitments. This relaxed discourse in a more or less protected area allows us to identify potential topics and projects exactly as we see fit. AWARE therefore is of great importance to me, not only professionally, but also personally. This is mainly because I appreciate AWARE's informal, trust-based atmosphere and realize time and time again that I also benefit personally from the network's positive momentum.

2.2 Universities

Technische Hochschule Ingolstadt (THI)



Prof. Dr. Walter Schober
President

With its strong focus on technology and economy, Technische Hochschule Ingolstadt, a university of applied sciences, has developed dynamically since its foundation in 1994. Today, THI counts about 5,500 students and is considered as one of the strongest universities in research among the approximately 200 German universities for applied sciences. Around 50 professors and 140 researchers currently work together in research projects financed by third party funds on a research budget of EUR 14 million, which represents one third of the entire university budget. The Graduate Center of THI takes care of 90 PhD students who are supervised in cooperative doctorate programs. The highly dynamic development of the university is expected to be continued within the upcoming years. The extension to 10,000 students with a new location in Neuburg, located 23km next to Ingolstadt, was recently approved by the government and more initiatives are currently in progress: A Center for Artificial Intelligence, the affiliated Institute for Applied Sustainability, a Fraunhofer Applied Research Center, a Center of Entrepreneurship in close cooperation with brigk (the Digital Start-Up Center of the Ingolstadt region) and finally the Audi Konfuzius-Institut Ingolstadt.

For around ten years now, THI has been establishing transfer of knowledge and technology to Brazil: In the initial years, the major impetus was the international integration of our research and test center CARISSMA, which is the first ever research center at a German university of applied sciences. This first phase was strongly characterized by the acquisition of Brazilian partners in the university sector with complementary competences in the field of basic research, traffic psychology and in the sequel also trading. In this stage, academic double degrees in combination with our master's course International Automotive Engineering were established. The second phase was marked by networking with further partners from politics, science and industry, a characteristic feature of universities of applied sciences. While the engineering sciences attracted several companies from the automotive sector in the state of Paraná, not least through the annual eMobility Forum, THI Business School benefited from several joint workshops with the industry on retailing serving as a focal point for getting in contact with partners from the contiguous state of Santa Catarina.



Technische Hochschule Ingolstadt (THI) ©THI

In the current third phase, after intense networking with further universities and industry partners, we now drive forward a closer cooperation with civil society actors in Germany and Brazil: As a strategic partnership, the concept of AWARE was to be a comprehensive network from the very beginning reaching far beyond a traditional exchange between teaching and mobility. Thus, exchange is not an end in itself; we rather aim to face the challenges of a globalized world together by generating knowledge, new technologies and innovation through joint projects.

For AWARE, however, globalization also means a globalized society. We currently observe a need for a certain paradigm shift, according to which teaching and research are more and more assessed in terms of their societal impact. Already in 2012, we started fruitful discussions with our Brazilian university partners UFPR and UFSC exchanging different views on social responsibility of academia. We started with first outreach initiatives, such as seminars on road safety at public schools in Curitiba and Joinville. In addition, we opened up our German-Brazilian eMobility Forum to a wider public. With regard to the engagement for civil society, Brazilian universities can look back on a long tradition. Thus, THI and the entire AWARE network are looking forward to learning from this Brazilian expertise in the future.

More than ever, universities need to change their passive role as knowledge mediator to a more active role as self-determined, organizational actors, who take responsibility for their respective region(s). From this year onwards, THI faces up to its responsibility together with Katholische Universität Eichstätt-Ingolstadt. Both universities were able to prevail with their project "Mensch in Bewegung" in the firstly announced BMBF funding program "Innovative Hochschule". Now they will receive up to EUR 15 million for the upcoming years to develop ideas and solutions with actors particularly from civil society for the big future challenges mobility, digitalization, sustainability and civic involvement. What on the one hand represents the mentioned paradigm shift is on the other hand just the consistent development of the universal concept of "Universitas" – the community of teachers and learners – on which Ingolstadt can look back since the foundation of the first state university in 1472.

Federal University of Paraná

(UFPR – Universidade Federal do Paraná)



Prof. Dr. Ricardo Marcelo Fonseca
Rector

Founded in 1912, Federal University of Paraná UFPR is considered the oldest university in Brazil. Since its very beginning, UFPR has remained one of the most prestigious comprehensive universities in the country, standing out both nationally and internationally. In Undergraduate and Graduate instruction, research, service and culture, UFPR is in a privileged position among Brazilian higher education institutions, with considerable international recognition. UFPR has currently 56,035 students, of whom 40,591 are undergraduate students, 9,126 are graduate students on master's or doctoral programs, and 6,318 graduate students on professional certificate programs. We have a total of 2,570 faculty members, of whom nearly 20% are supported by research funding by CNPq (National Council for Scientific and Technological Development) and Araucária Foundation for Scientific and Technological Development of Paraná State (FA), the main research funding body of the state of Paraná (see page 44/45). The total number of administrative staff comprises 1,945 employees, of whom 20% also possess a master's or doctoral degree, and yet another 38% hold a terminal degree or certification in their respective professional fields.

A clear sign of UFPR's international profile stems from partnerships with the productive and innovation sectors. Those partnerships have been established with many foreign companies based in the Curitiba region, but they also comprise relations with companies and research laboratories based abroad, as well as academic interactions with foreign universities. Innovation is said to occur only when scientific and technological production, or a new invention, are transformed into new products and processes, resulting in the increasing of the people's incomes, the widening of work opportunities, the construction of new forms of housing, rendering public health better, fostering well-being, sustainability, among other social accomplishments. All these achievements, however, depend on overcoming an important barrier, i.e., the Brazilian gap between scientific production and the private sector. In order to do so, many strategic decisions are decisive if we want to take full advantage of a closer relationship between Brazilian public universities and the private sector. Research projects developed in partnership with other institutions abroad are very important in order for us to learn how to overcome this gap. In this sense, AWARE in partnership with THI, and financed by DAAD since 2013, has represented a very important action. It has proven to be a very important example of an international mutual collaboration, and it has opened many new academic and economic opportunities with the automotive sector both in Brazil and in Germany.



UFPR building by night © UFPR

In addition, we are all very proud of the good academic results of this automotive network, most especially the double-degree program, which we were able to establish with THI in the fields of Mechanical, Electrical and Automotive Engineering.

Besides research and teaching, as a comprehensive university, we have dedicated special attention and resources to our Third Mission, our service to society since our beginnings. UFPR is highly committed to serving our social community through the actions of a special organizational unit, our PROEC (Pro-Vice-Chancellor's Office for Extension and Culture, see page 178 ff.). PROEC's mission is to foster innovative and transformative social spaces through actions based on the creativity derived from cultural and service-oriented practices and policies, grounding its actions in the production of knowledge in interaction with the social community outside the university. Thanks to our long tradition in service to society, we have a variety of success stories, such as: K-12 initiatives to promote culture and science; technical support for the social and economic development of small farmers, indigenous and quilombola communities, as well as to poor peripheral urban communities concerning health-related issues (find more examples in chapter 6.2).

Federal University of Santa Catarina

(UFSC – Universidade Federal de Santa Catarina)



Prof. Dr. Ubaldo Cesar Balthazar
Rector

The Federal University of Santa Catarina UFSC is a public university located in Florianópolis city, capital of the state of Santa Catarina – Brazil. Founded in 1960, it aims to promote teaching, research and extension, the Brazilian term for Third Mission. Besides the Main Campus, UFSC, as called in Portuguese, has also campus in four other cities: Araranguá, Curitiba, Joinville and Blumenau. In the 1980s, there was an expansion of graduate and research programs, a decisive participation in the strengthening of technological centers in the state of Santa Catarina, and an increasing engagement in extension projects to meet the society needs.

UFSC has 15 centers that cover a wide spectrum in the field of professional formation, offering 118 undergraduate courses and 131 graduate courses that currently serve a universe of more than 46 thousand students. To meet this demand, the University has the collaboration of 2,300 teaching staff and 3,200 technical administrative staff in education.

UFSC offers more than 7,000 places for graduate courses: 76 masters, and 55 PhD courses. It has a high level of qualification, recognized as one of the best universities in Brazil. Times Higher Education survey placed our institution as the 12th in Latin America and 3rd among the federal universities of Brazil. This position increases the commitment of our staff to maintain the excellence in research and extension. In the technological domain, one of the most advanced of the institution, UFSC offers 31 undergraduate courses; most of them are nationally recognized as one of the best.

Our university is also aligned to international cooperation. We have more than 300 cooperation agreements with prestigious institutions around the world, exchanging students and lectures, or joining researchers from different areas, working under a scientific and technological collaboration.

Regarding Technische Hochschule Ingolstadt, UFSC – together with Federal University of Paraná (UFPR) – has established the strategic automotive network called AWARE, fostering the development of research and education programs in the automotive field, involving the creation of an international graduate program, besides some projects addressed to road and transportation security.

The results achieved by this cooperation have been important for all institutions involved, which can be proved by the number of exchanges of researchers and students and by the work developed at undergraduate and graduate levels. The edition of this book is also proof of the success of this collaboration between our institutions.

Finally, I emphasize the potential of UFSC for technological research and internationalization, while thanking the responsible teams for their great efforts and efficient work.



Rectory of UFSC © UFSC

2.3 Foundations

Bavarian Research Foundation

(Bayerische Forschungsstiftung)



Prof. Dr. Dr. h.c. (NAS RA) Arndt Bode
President



CARISSMA Researchers Prof. Dr. Zimmer (Brazil) and Dr. Marta Pereira Cocron (Portugal) analyzing a computer vision simulated environment © THI



Prof. Dr. Dr. h.c. (NAS RA) Arndt Bode
© Bayerische Forschungsstiftung

The Bavarian Research Foundation is a foundation of the Free State of Bavaria, which was founded 28 years ago in order to sponsor innovative and application-oriented research and pre-competitive development projects, which are of strategic importance for the development of science and technology in Bavaria. The projects funded by the Bavarian Research Foundation have to be supported jointly by science and economy and primarily conducted in Bavaria. Projects in the fields of life science, information and communication technology, microsystems technology, materials science, energy and environment, mechatronics, nanotechnology as well as process and production technology can receive funding.

Having a broad spectrum of defined key fields, interdisciplinary approaches can be reached and interfaces can be covered allowing the applicant from science and economy to generate and conduct crosscutting projects. Thereby, the Foundation sponsors maximum 50% of the entire costs of the respective projects with a grant, the involved industry partners usually bear the other 50%.

New ideas are born through research and when different perspectives come together. This is why the Bavarian Research Foundation also sponsors PhD and postdoc scholarships as well as short-term mutual stays of scientists in partner labs in close connection to the projects.

A broad international networking strengthens the visibility. In Bavaria, the strategic partnership AWARE of Technische Hochschule Ingolstadt (THI) is an excellent example for that. During its 6-years funding by the Federal Ministry of Education and Research (BMBF), it has become especially visible, that regional anchoring and international engagement are not contradictory. On the contrary, they can bring benefits to everybody involved if well cross-linked: It is almost ten years ago when two professors of the Federal University of Paraná UFPR visited the Bavarian Research Foundation with their colleagues from Ingolstadt and presented their research activities. Topic of the talks was also the public-law foundation system in Bavaria and in the Southern Brazilian Federal State of Paraná.

We are glad, that one of these professors of UFPR returned to Bavaria in the frame of a longer-term stay and is doing his research at THI: He will be establishing a German-Brazilian research group within the next years at the research and test center CARISSMA. The group will be dealing with questions of environment sensing via radar, Lidar and other sensors (see page 130/131).

The Bavarian Research Foundation, too, benefits from the networking. In 2016, an exchange on prioritization and impact control of regional innovation promotion took place with the Brazilian Institute for Applied Economic Research Ipea.

Araucária Foundation for Scientific and Technological Development of Paraná State

(FA – Fundação Araucária de Apoio ao Desenvolvimento Científico e Tecnológico do Estado do Paraná)



Prof. Dr. Paulo Roberto Brofman
President



Left: Prof. Dr. Paulo Roberto Brofman, president of FA © FA / Right: Fundação Araucária Building, located between the building of the "Federation of Industries from the State of Paraná (FIEP)" and the "Campus of Industry" © Gelson Bampi – FIEP

Countries, and consequently states such as Paraná, which have an interest in investing in science, technology and innovation, invest their main resources in improvements of health, housing, transportation and education sectors, among others. That is why the Araucária Foundation for Scientific and Technological Development of Paraná State (FA) launched 153 public calls and 12 processes of unreasonableness totaling the amount of BRL 407,812,999.95 in invested funds from 2011 until July 2018. This shows our prioritization of the areas mentioned above.

Furthermore, the internationalization process of Paraná's universities has been another big priority of FA. The international recognition of research developed in higher education institutions contributed to this process, resulting in the consolidation of agreements with several countries: the cooperation with CONFAP: Newton Fund (UK); Horizon2020 (European Community); Italy (University of Bologna); Ministry of Industry, Foreign Trade and Services (MDIC) and Germany; France (INRIA – Institut National de Recherche en Informatique et Automatique; CNRS – Centre National de la Recherche Scientifique; INS2i – Institut des Sciences de l'Information et de leur Interactions) and European Research Council (ERC). FA has also issued a cooperation in conjunction with Victoria University (Australia) and has signed a cooperation agreement with the Netherlands.

Through FA, the partnership between the Government of Paraná and Technische Hochschule Ingolstadt (THI) has direct repercussions on the quality and evaluation of the Postgraduate Programs *Stricto Sensu* of the universities of Paraná.

In addition, the exchange of experiences and information with higher education institutions in strategic areas, such as THI, also means that students from the programs of the universities of Paraná have the possibility to accomplish the qualification within their own institution. This partnership already has results: In 2016, several public calls between FA and THI were launched, which provided a total amount of BRL 300,000.00. The main objective of this cooperation agreement is to promote the professional qualification in automotive and mechatronics engineering, which is partnered with the AWARE network developed in Germany.

The promotion of scientific and technological cooperation between THI and the State of Paraná strengthens the existing links between the scientific communities of both countries. It is therefore fundamental to create new forms of collaboration between these research institutions.

Research and Innovation Support Foundation of Santa Catarina State

(FAPESC – Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina)



*Prof. Dr. Sérgio Luiz Gargioni
President (2011-2018)*

The Research and Innovation Support Foundation of Santa Catarina State FAPESC is a public institution providing support for research, innovation, human resources development and knowledge transfer in the state of Santa Catarina. Apart from special support for events and publications, the foundation also offers financial support through public calls and in exceptional cases on individual request. In addition to its main funding provided by the Federal State of Santa Catarina, the budget of FAPESC is complemented by further partnerships with federal and international agencies promoting scientific development, such as CONFAP, the National Council of all Brazilian State Foundations for Research Support.

FAPESC looks back on long-lasting and trustful cultural and business relations between Germany and the State of Santa Catarina. Multiple successful research projects were only possibly thanks to a joint funding, such as research on optical components like lasers, photo sensors, optical fibers and light emitters, as well as the analysis, production and application of these technologies. Within the scope of this binational cooperation, two business missions were successfully realized in the area of photonics with Berlin Partners.

Furthermore, we are very proud to maintain close relations to the network AWARE since its early beginnings in 2013. Firstly, I was invited to be a member of the Advisory Board AWARE, a steering board of members from science, politics and industry from both countries, that meets once a year to evaluate the project's progress, give advice where needed and promote greater visibility of the network in all three sectors. Secondly, FAPESC supports the double degree master program in International Automotive Engineering and Electrical or Mechanical Engineering since 2015, a very important study program for Santa Catarina. Thanks to scholarships provided by FAPESC, students of the Federal State of Santa Catarina (UFSC) get the possibility to study partly at UFSC and partly at Technische Hochschule Ingolstadt (THI) in order to get two master titles at the end of three to four semesters. This master program with two degrees is unique in our state, combining applied lectures and projects at THI on the one hand, and basic research at UFSC on the other.



*Left: Prof. Dr. h. c. Sérgio Luiz Gargioni, President of Fundação de Apoio à Pesquisa e Inovação do Estado de Santa Catarina
© FAPESC / Right: Building of FAPESC © FAPESC*

We also participated in numerous events in Ingolstadt, reinforcing this partnership. We were present at the inauguration of THI's research and test center CARISSMA in 2016, an impressive new institution to foster academic research on vehicle safety. Besides, FAPESC participated at tone of the yearly research and education workshops at THI, where I could get an impression of the multiple laboratories and multinational research projects at THI.

Financial support is crucial for a network such as AWARE and its long-term strategic planning. In order to get further funding by DAAD, our next joint step was to sign a new agreement on mutual financial support with THI and UFSC in 2016. In consequence, AWARE got further two years of DAAD funding and could dedicate time and resources in order to consolidate what has been successfully established in the former four years. Nevertheless, the generous funding by DAAD will expire at the end of 2018 and it will be challenging, though not impossible, to continue with these initiated projects between THI, UFSC and the Federal University of Paraná (UFPR). It is extremely challenging for multi-dimensional university networks to survive without a stable funding for network infrastructure and management.

It is all the more gratifying that the AWARE consortium submitted a new project called AIM – Automotive Innovation. Momentum. successfully to the Federal Ministry for Economic Cooperation and Development and got a new four-year funding for the transfer of application-oriented automotive lectures to UFSC and UFPR. Once again, AWARE kicked down doors that were already open: due to the lack of automotive lectures at UFSC and UFPR, the AIM consortium easily got very strong regional industry partners on board, such as BMW, Renault, Volvo and Audi. In order to survive, it will be crucial for the network coordinators and researchers to invest time and recourses to identify matching public funding programs and industry partners. Finally, as public funding agencies, it is also our duty to work on more flexibility and find ways how to support unique university partnerships that maybe do not fit into the regular public calls by our ministries.

2.4 Research and Educational Institutes

Research Institute Lactec in Paraná



Luiz Fernando Vianna
President



Test of emissions of a motorcycle realized at one of the Lactec laboratories © Lactec



Luiz Fernando Vianna, President of Lactec
© Lactec

Being one of the largest science and technology centers in Brazil, Lactec works with the market offering innovative solutions that benefit all the society in several segments, such as automotive, energy, oil and gas, infrastructure and electronics. The company owns six units – five located in Curitiba and one in Salvador – and offers technological services, laboratory tests and analysis, RD&I projects as well as consulting and training. With more than 550 employees, it counts on approximately 110 researchers with master's or doctor's degrees. Lactec encourages the entrepreneurial spirit among its employees through calls for projects, exclusively directed to internal staff, in order to deal with innovative ideas developed by its technical team and funded by the institution.

Lactec recognizes the benefit of national and international strategic partnerships, such as AWARE, because we are aware of their stimulating effect on the creation of new ideas, concepts and knowledge, which is essential for an innovative culture as part of the daily life of our company. The exchange of managers, researchers and technicians focused on the generation of technological products and solutions applied to the needs of the market fosters mutual learning, broadens horizons and generates new opportunities for all partners involved.

Partnership Lactec – AWARE

Through the AWARE network, Lactec has the opportunity to receive German interns and researchers in the fields of mechanics, electrics and information technology, and to participate in the formation of those interns through the double degree program offered by the Federal University of Paraná (UFPR) jointly with Technische Hochschule Ingolstadt (THI). Furthermore, important contacts with the Fraunhofer Institute, Audi/VW, BMW, and Airbus Defence and Space and further partnerships with German small and medium-sized companies were established thanks to the AWARE network.

Reference Centers in Innovative Technologies (CERTI)



Prof. Dr.-Ing. Carlos Alberto Schneider
President

The Reference Centers in Innovative Technologies (CERTI) is an organization that supports companies in the development of innovative solutions, with special emphasis on advanced technologies through projects (products, processes, systems, businesses, enterprises, etc.), technological services, training and consulting. Its Reference Centers in Digital Convergence, Mechatronics, Metrology & Instrumentation, Productive Processes, Energy, Green Economy and Innovate Entrepreneurship develop innovative solutions in comprehensive teams involving the clients in all phases of the project and thus guarantee an effective technology transfer. In this innovation process we usually also collaborate with other C&T-institutions and international partners.

For 32 years, we have been closely cooperating with Germany and important partnerships have been developed with the Physikalisch-Technische Bundesanstalt, Fraunhofer Gesellschaft, Berlin Partner, as well as with the Universities of Applied Sciences Aachen, the Technical Universities of Erlangen and Dresden, and more recently with Technische Hochschule Ingolstadt (THI).



CERTI area © Bruno Berretta



CERTI entrance © Bruno Berretta

Partnership CERTI – AWARE

THI and CERTI Foundation identified multiple interfaces and joint topics of research that are jointly enhanced within the framework of the AWARE network. Particularly in the area of traffic and vehicle safety and with the use of simulators for data collection and training purposes to contribute to safer roads and vehicles in the future, CERTI Foundation and THI with their research and test center CARISSMA see great potential in joint research. The key technology of electric vehicles represents another interface of our cooperation. With an emphasis on academic exchange, the AWARE network provides, through the cooperation agreement with CERTI, internships for studies and R&D work in its reference centers. Working in international teams, our interns focus on innovative solutions for technical problems and challenges in the most diverse areas. Solving real problems and improving real products is a motivating challenge fostering at the same time significant, professional skills, such as international teamwork, interdisciplinary approach and project management. Formally included in a structured internship program at UFSC, our interns have access to all disciplines of the university and can thus complement their practical work with theoretical input.

National Service of Commercial Apprenticeship Senac in Santa Catarina



Marcus Tutui e Silva

Coordinator of Management and Business Development Programs

Senac, a private non-profit institution, was founded in 1946, since the creation of the National Confederation of Commerce (CNC). Senac has nationwide representation and its main objective is to promote actions focused on the development of retail services and tourism through the professionalization and training of individuals and organizations. Senac, hosted by the CNC, provides educational service acting in State Federations in the economic interest of the trade sector, whereas SESC (Social Service of Commerce) is responsible for all kind of actions of social development for commercial collaborators and civil society. Senac is located in all regions of Santa Catarina, with regional administrative units and 28 fixed service points, with 16 technology colleges, two specialized centers, as well as professional education centers and mobile facilities that can easily be relocated. Our main goal is to offer a solid career to Brazilian citizens with a wide range of undergraduate and postgraduate programs, MBAs and executive trainings, both face-to-face or via distance learning. Besides training individuals, we also offer customized services, innovation and development programs, consultancies and benchmarking missions for whole organizations. Thus, Senac provides to both business and society opportunities for professional development, serving through education and training to economic and social development of Santa Catarina.



Educational Unity Palhoça © Senac



From the left to the right: Prof. Dr. Marc Knoppe (THI), Mr. Bruno Breithaupt (President of Group and Commerce Federation of Santa Catarina) and Prof. Thomas Vogler (THI), members of the AWARE/RITUSS-Consortium © Senac

Partnership Senac (Santa Catarina) – AWARE

In all our trainings and educational programs, our main goal is to teach how to offer high quality products and innovative solutions for any kind of social or technical program. Within the frame of the AWARE network, Senac, together with Business School of Technische Hochschule Ingolstadt (THI) and the Federal University of Santa Catarina (UFSC) established in 2014 an exchange group called RITUSS (Retail – Responsibility – Industry – Innovation – Technology – Sustainability) with the goal to promote the exchange of technological knowhow and expertise regarding different markets and to share research projects. RITUSS researchers found out that the German market is quite comparable to the market in Santa Catarina, however there is a certain delay in trends and technologies in Southern Brazil in terms of adjustments to reality of “first world” economies.

Through AWARE our students get access to high-quality and innovative training and our member organizations access to knowledge necessary to sharpen their profile and differentiate themselves from other competitors in the market. Apart from student and professor exchange, our cooperation encompasses a variety of activities: joint events such as Technology Forums, development of joint international MBA programs in Retail Management, technical supervision and support for students in market research. Further programs and technical missions are focused on the executive development such as the International Executive Program in Ingolstadt and the International Technical Mission NY that promotes technical visits to great American retail brands, international workshops and participation in the Retail’s Big Show from NRF in New York, USA where the THI had been joint Senac in the last few years.

2.5 Industry Partners

AUDI AG – Vorsprung durch Technik



Dr. Henning Löser
Head of Audi Production Lab



Concept Car Audi Elaine © AUDI AG



Human-robot cooperation © AUDI AG

The Audi Group, with its brands Audi, Ducati and Lamborghini, is one of the most successful manufacturers of automobiles and motorcycles in the premium segment. It is present in more than 100 markets worldwide and produces at 16 locations in twelve countries. 100 percent subsidiaries of AUDI AG include Audi Sport GmbH (Neckarsulm), Automobili Lamborghini S.p.A. (Sant'Agata Bolognese, Italy) and Ducati Motor Holding S.p.A. (Bologna, Italy).

In 2017, the Audi Group delivered to customers about 1.878 million automobiles of the Audi brand, 3,815 sports cars of the Lamborghini brand and 55,900 motorcycles of the Ducati brand. In the 2017 fiscal year, AUDI AG achieved total revenue of EUR 60.1 billion and an operating profit of EUR 5.1 billion. At present, approximately 90,000 people work for the company all over the world, more than 60,000 of them in Germany. Audi focuses on sustainable products and technologies for the future of mobility.

Strategic partnership AUDI AG – AWARE

Being an internationally positioned company with automobile production in Brazil, Audi supports the cooperation of Technische Hochschule Ingolstadt (THI) with the Brazilian universities. Within the traditionally very close collaboration with THI in Ingolstadt in the areas of production technologies and vehicle safety, we focus on the development of in car intelligent safety technology, mobile robotics and the digitalization of our products. The Brazilian students are welcome to apply for our announced vacancies that you can find on our website.

In very important research fields of car manufacturing, THI professors offer thesis topics to graduate and PhD students, which are also open for students of the partner universities. These theses are jointly supervised by the department at Audi who accompany the student in the practical part of the research project and the THI. This network of international professors and universities and our globally positioned company provides an ideal environment for successful research projects expanding the limits and at the same time securing the international education of tomorrow's engineers.

Airbus Defence and Space GmbH – Pioneering the future together



Rainer Ackermann
Manager Global R&T Cooperations

Airbus Defence and Space is one of three divisions within the Airbus Group and is Europe's number one defence and space company. The division is also the second-largest space company worldwide and, with revenues of approximately EUR 13 billion and some 33,500 employees, is among the top ten global defence companies. Airbus Defence and Space focuses in particular on the following key business areas: space, military aircraft, guided missiles and related systems and services.

Airbus Defence and Space develops and manufactures state-of-the-art defence and space products that boast unparalleled reliability. Governments and institutions use its defence and space technologies to protect natural resources, the community and individual freedom. Aircraft, satellites and services can be used to monitor climate change and arable land, as well as for border protection purposes. Airbus Defence and Space's solutions guarantee sovereignty when it comes to foreign and defence policy. In addition, its portfolio ensures communication, mobility and the furthering of knowledge, as well as environmental protection.



Airbus Defence and Space Business Lines © Airbus Defence and Space

Airbus is committed to promoting responsible business conduct and contributing to the UN Sustainable Development Goals (SDGs).

In 2017, Airbus reviewed, redefined and formalized its approach to responsibility and sustainability (R&S), which is embedded in its strategy and culture. The company is seeking to improve coordination of R&S, as well as monitoring its impact through key performance indicators (KPIs).

Airbus is determined to conduct its business responsibility and with integrity, from ensuring its business practices conform to applicable laws and regulations, and championing product safety improvements, to integrating the high standards of responsibility and human rights across the company and throughout its supply chain. At the same time, Airbus is committed to applying its resources and energies to seeking solutions for societal challenges.

The aviation industry is already a driver of sustainable development, bringing together people, businesses and communities, and supporting trade and tourism. Airbus' aircraft, satellite and defence solutions facilitate countries' integration into the global economy, providing direct benefits to users. The industry supports 58.1 million jobs worldwide and it is growing: The Airbus Global Market Forecast for 2017-2036 anticipates that air traffic will increase at a rate of 3.2% per year in mature markets such as North America and Western Europe, while growth in emerging markets like China and India will be almost double that.

The company is also focusing on complying with the EU Directive on disclosure of Non-Financial information and the French "Devoir de vigilance" law (see the 2017 Registration Document), as well as other regulations. Yet, Airbus often goes beyond what is required by regulations, entrenching R&S more formally throughout the businesses.

Strategic partnership Airbus Defence and Space – AWARE

Airbus Defence and Space works together with AWARE to conduct research and development activities in German-Brazilian teams. It is primarily interested in increasing the number of international students and in getting international students involved at an early stage. A mentoring program with Airbus Defence and Space was developed with the help of the AWARE network; this program sees Brazilian AWARE bachelor, master and PhD students from the partner universities invited to Ingolstadt to work part-time in a specialist department at the Airbus Defence and Space site in Manching. At the same time, they would be attending Technische Hochschule Ingolstadt to write their dissertations and theses on state-of-the-art technology fields that are relevant to product development at Airbus Defence and Space (see page 100/101).

Continental AG



Dr.-Ing. Lutz Kühnke

Head of Occupant Safety & Inertial Sensors Segment, Passive Safety & Sensorics Business Unit, Chassis & Safety Division

Continental develops pioneering technologies and services for sustainable and connected mobility of people and their goods. Founded in 1871, the technology company offers safe, efficient, intelligent and affordable solutions for vehicles, machines, traffic and transport. In 2017, Continental generated sales of EUR 44 billion and currently employs more than 243,000 people in 60 countries.

The Chassis & Safety division develops and produces integrated active and passive driving safety technologies as well as products that support vehicle dynamics. The product portfolio ranges from electronic and hydraulic brake and chassis control systems to sensors, advanced driver assistance systems, airbag electronics and sensorics as well as electronic air suspension systems all the way to windscreen washer systems and headlight cleaning nozzles. The focus lies on a high level of system competence and the networking of individual components. Thus, products and system functions are developed along the SensePlanAct chain of effects. They form the foundation for automated driving. Chassis & Safety employs more than 47,700 people worldwide and generated sales of approximately EUR 9.8 billion in 2017.



Safe and Dynamic Driving towards Vision Zero © Continental AG

Partnership Continental – AWARE

Continental can already look back to a long history in Southern America. Currently, we have 32 locations in seven different countries in total: Brazil, Argentina, Venezuela, Ecuador, Chile, Colombia and Peru. The operation in Brazil started in 1959 in the Guarulhos plant (city of São Paulo).

While Continental has been already active in Brazil for decades, the main impulse for Technische Hochschule Ingolstadt (THI) to expand its network to Brazil through AWARE came especially through its research and test center CARISSMA. It should be mentioned here that the German-Brazilian network of THI is not a unilateral engagement, but a transfer of technology and knowledge in both directions.

Around five years ago, the Brazilian universities UNICAMP (Campinas, São Paulo State) and Federal University of Paraná (UFPR) conducted a cooperative project with THI, which was dealing with the detection of drivers' attention in diverse distraction scenarios. For the implementation of a corresponding study with test persons (attention analysis) a hazardous Brazilian coastal road was reconstructed. Thereby, the Brazilian competences on traffic psychology and the German engineering expertise perfectly complemented each other. Based on this experience, Continental started a new follow-up project with a further partner from the industry, which is supervised again by a German-Brazilian research group at THI. All parties involved see the international cooperation AWARE likewise as enrichment for both economy and science.

arculus GmbH – Modular Production



Witold Kopytynski
Co-Founder & COO

arculus, a German high-tech SME, has developed a new integrated solution (Information and Communications Technology) to streamline production processes and replace the 100-year-old assembly line industry standard. It consists of arculee – a proprietary Autonomous Guided Vehicle (AGV) to transport both products and materials – and arcOS – a software to optimize production workflow and workstations operations. The solution enables cost-effective processes in factories manufacturing products with a high number of variants, increasing their productivity.

arculus was founded in 2016 by Fabian Rusitschka, Witold Kopytynski, Frank Hempel, and Marius Leffler, and got initial support by EXIST, a support program of the German Federal Ministry for Economic Affairs and Energy (BMWi) which aims at improving the entrepreneurial environment at universities and research institutes (see page 42 ff.). Currently with 25 employees, they are working on different projects together with AUDI AG, Porsche, and SIEMENS. Throughout its two and a half years of history, arculus has been awarded several recognitions, grants and prizes for their innovative work in Industry 4.0: Ausgezeichnete Orte im Land der Ideen 2017, Ingolstadt Gründerpreis 2017, Hello Tomorrow Industry 4.0 2017, amongst others. arculus' current development topics range from production and logistics flow automation and optimization, to sensor based Autonomous Guided Vehicle free navigation, to low latency wireless swarm communication.

Most recently, Co-Founder & COO Witold Kopytynski, former student of Technische Hochschule Ingolstadt (THI), has been awarded the Innovators Under 35 Europe 2018 award from MIT Technology Review.

Partnership arculus – AWARE

The cooperation with THI started with the jointly and successfully submitted EXIST-project, and has been intensified with the AWARE network since 2016. Through it, arculus got in contact with research and development institutes, universities, and international corporates with presence in Brazil.

Through AWARE, arculus has taken an active role in introducing Brazilian and German students to a first-hand professional experience, working alongside experienced professionals in Robotics and IoT development projects (Internet of Things), in a highly dynamic start-up environment. Thanks to the AWARE network, arculus gets direct access to talented and ambitious students from Brazil and Germany, which is of particular value for a growing SME with an international team. Furthermore, this cooperation supports arculus in establishing an international network to enable innovation know-how exchange, and respond effectively and efficiently to future personnel requirements and increasing competition. For the AWARE community in Brazil, in return, the cooperation with arculus offers unique opportunities for students and researchers to experience work and life in an extremely dynamic setting working on cutting-edge technologies.

arculus offers different opportunities for students during and after their studies: internships, semester exchanges, bachelor or master thesis and employments as working student: <https://www.arculus.de/>.



Integrated hardware and software solutions streamlining production and logistic processes © AUDI AG

SPARKS GmbH – AUTOMOTIVE ENGINEERING



Benedikt Häring
Head of Marketing and Sales

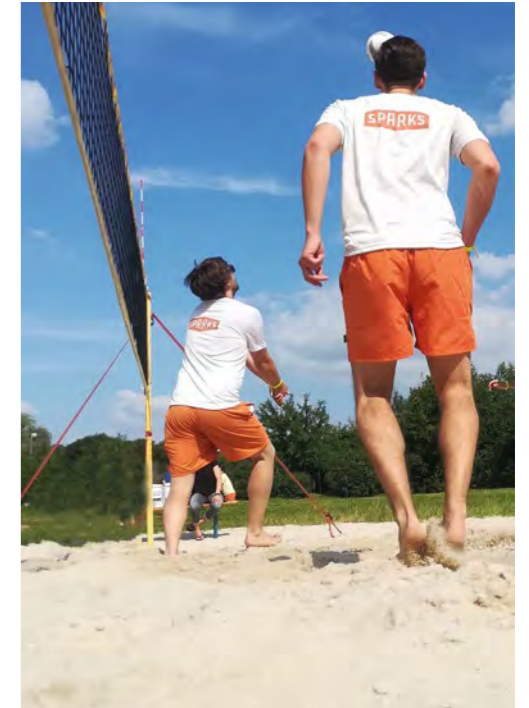
We are SPARKS GmbH from Ingolstadt and a development partner of leading premium automobile manufacturers. As an infotainment specialist with many years of experience, we offer a wide range of services. From the very first start of planning an infotainment system until it is finally ready for production, we thoroughly support our customers. We owe our success to our specialized teams who apply their individual skills in all our divisions and thus contribute to the future of infotainment. With our innovative products and solutions, we not only improve the efficiency and quality of our own work, but also the outcome of our customers and cooperation partners.

It all started in 2012 when we joined the testing business. From a three-person operation to the 100-member team we represent today, our ambition has not changed: to persistently improve the world of infotainment systems. We are proud that our team members are from various educational backgrounds and from different cultures and we are on the road of success.

We consider it very important that our employees can develop professionally and personally. With the help of internal training programs, we offer opportunities to gain key qualifications and deepen specialist knowledge. To strengthen the sense of being part of a hardworking, yet fun-loving team, we love playing table football or challenging colleagues to an exciting tournament of Tekken or SingStar. At our legendary Christmas and summer parties, the whole company gets together to boost the SPARKS team spirit across locations.



Test drive © SPARKS GmbH



SPARKS summer celebration © SPARKS GmbH

Partnership SPARKS GmbH – AWARE

SPARKS is getting more and more international and therefore supports cooperation with Technische Hochschule Ingolstadt (THI) and international universities as official partners.

It is our great pleasure to offer internships for international students in different areas, for example in hardware and software development, testing of speech dialogue systems or human-machine interfaces. Students do not only gain exciting insights into the world of infotainment development, but also experience the start-up feeling at first hand.

We are very proud that this year, a student from the THI partner Federal University of Paraná UFPR in Brazil will support us during her internship for one year as a system analyst in the team "Overall System Testing".

SPARKS offers different opportunities for students and young professionals:
<https://www.sparks-gmbh.de/home/>.

Pixida GmbH



Maria Lohwasser
Head of Recruiting

Pixida is an innovative technology consulting company with focus on digitalization and mobility solutions. We are over 200 passionate technology consultants and developers with expertise in the Internet of Things, Telematics, Location Based Services, Multimedia, Driver Assistance Systems, Embedded Systems, Full Stack Software Development, Cloud Solutions, Data Analytics, Project Management and Agile Processes & Methods. With more than 500 successful projects, our experts design and develop tailor-made solutions for highly challenging technical environments and applications. We offer complex product developments, for different industries such as Automobile, Commercial Vehicles, Public Transport, IT, Insurance, Energy, Rail, Environmental Data Science, Industrial IoT, and Motorcycle.

Pixida is international. Our cooperation and knowledge exchange transcend national borders beyond Germany, USA, Brazil and China. Pixida's unique corporate culture is based on an employee-oriented leadership. This led to eight employer and economic awards for Pixida.



Pixida office in Munich © Pixida



Engineering consultants working at Pixida © Pixida

Partnership Pixida – AWARE

Being proud to cooperate with AWARE, Pixida intends to exchange expertise and to constantly open different positions for professionals, graduates and students in Germany and Brazil for the benefit of both institutions. Looking forward to the long-term cooperation, we offer individual master and bachelor theses in innovative and technical areas. Furthermore, Pixida operates an EMC/EMI Test Center for Electromagnetic Compatibility and Electromagnetic Interference in Santa Catarina, Brazil. The Test Center can perform electromagnetic radiation pattern tests where students and engineers can learn and exchange knowledge with our experts. Our partners in this cooperation can benefit from ten years of expertise with excellent results and trusted cooperation with customers and partners worldwide. We constantly strive to identify talents and to promote the development of people helping them to realize their innovative ideas and career goals. Our colleagues can experience from the attractive work environment, individual and personalized support and work-life balance.

Pixida offers different opportunities for international students and young professionals:
<https://www.pixida.de/>.

3. *Entrepreneurial Infrastructures & Ecosystems*



Overview

3.1.1 Entrepreneurial Infrastructures & Ecosystems in Germany

Prof. Dr. Martin Bader
Director Center of Entrepreneurship, CoE / THI

The business location Ingolstadt has a pronouncing industrial and economic structure. This region is characterized by its mobility industry, represented by AUDI AG and Airbus Defence and Space as well as by their local supply industry and many other efficient medium-sized companies. Sectors such as retail (Media Saturn Holding) and other corporate business providers, too, are well represented in this region. Besides these well-established industry and trading companies, the region is currently working on a founder friendly infrastructure. An important milestone was the funding for brigk, the Digital Start-Up Center of the Ingolstadt region, that is planned to be directly located at the THI campus (see page 74/75).

The focus of 1994 founded THI lays in the technology and economy sector. Around two thirds of its approx. 5,500 students study in the technology sector, one third in the economic sciences sector. Corresponding to the local economic structure, around one third of the study programs are directly mobility-connected. This connection also dominates in the field of applied research. Prevailing in a competitive procedure in 2013, THI achieved the title of a "Technical University of Applied Sciences" and therefore set the strategical aim of becoming one of the leading mobility universities of Germany. Currently, THI is implementing several important elements of its future concept: With the research and test center CARISSMA (see page 16), the first scientific building that the German Council of Science and Humanities (Wissenschaftsrat) has ever assigned to a university of applied sciences, a leading scientific center for vehicle safety in Germany is establishing at THI. Flanking to safety topics, vehicle research is largely pursued at the Institute of Innovative Mobility (IIMO). With the establishment of the promotion network "Mobility and Traffic", THI cooperates with Technische Universität München (TUM) on the joint educational training of young professionals.

According to its strategy 2018+, THI is planning an expansion to up to 10,000 students from 2018 until 2030 in the megatrend topics mobility and traffic as well as urbanization. The topics of the future, digitalization and entrepreneurship, will shape the planned expand as guiding themes. Besides the participation at brigk, the establishment of THI's Center of Entrepreneurship (CoE) as a central instance for the entrepreneurship doctrine and start-up aid laid important foundations for the encouragement of a start-up culture at THI. Professor Bader leads the CoE as scientific head at THI Business School. At the other faculties of THI as well as the Institute of Executive Education (IAW) and the Research Center (ZAF), a central representative for questions on entrepreneurship is linked to the CoE. A further cooperation exists with the student start-up association NEWEXIST.

For years, THI has been active in the teaching and qualification on entrepreneurship, particularly at Business School (BS). In 1999, THI and IFG (Association of Economy Development Ingolstadt) started a business plan competition that, from 2012 on was called "Start-Up Price of Ingolstadt". Since then, this competition has been taken place annually and in cooperation with other local network partners. Within the event's framework, until today, over 300 founders and founder teams have received support.

Furthermore, for a few years already, entrepreneurship qualification offers have been part of the curriculum at THI. However, this is still limited and almost exclusively concentrated on the economic study program. The Faculty of Mechanical Engineering has already started with the introduction of several entrepreneurship workshops in parts of their study programs. The Faculty for Electrical Engineering and Computer Science does not offer entrepreneurship modules yet, but has a focus on it in the field of digitalization. At the Graduate Center of ZAF and the IAW, for now, no or only very limited elements of entrepreneurship teaching have been implemented. Regarding fundamental methods training for the development of ideas as well as of products and services, seminars are offered in nearly every study program. However, there is a need for development in the range of start-up-specific teaching offers such as business planning and business modelling as well as entrepreneurship coaching and business competitions at cross-faculty and interdisciplinary events. Additionally, except at THI Business School, there is no dedicated teaching staff for the entrepreneurship topic available.

Many study programs have already interdisciplinary connections with the topic of digitalization. Besides Computer Science, Business Information Systems, and Aircraft and Vehicle Informatics, a new study program "Digital Business" was developed which focuses on the challenges of digitalization, particularly on digital business models. Moreover, at THI, digitalization is an integral part of research. CARISSMA does intensive research on sensor technology and data networking in vehicles with its infrastructure. Furthermore, linked to the center "Zentrum Digitalisierung.Bayern (ZD.B)", a platform for cooperation, funding and founding support, a professorship for vehicle safety and Car2X communication is currently establishing at THI. THI is also involved in different organizations and associations that focus on digitalization, such as "VI-Forum" with whom they organize a supra-regional two-day congress on the topic of virtual innovation at THI every second year. Currently, THI offers around 50 modern laboratories with a machine investment volume of approx. EUR 25 million, among them a virtual Pity laboratory with a five-side CAVE for a three-dimensional projection of different virtual and augmented reality systems.

The partnership between the recently established CoE and brigk should reach the following goals in the entrepreneurship doctrine with focus on digitalization:

THI's goals regarding entrepreneurship education
Involvement of entrepreneurship education in THI's strategy
Establishing of a cross-faculty curricular offer on entrepreneurship training focused on digital technologies for all study programs at THI
Integration of this curricular offer into the compulsory program, alternatively compulsory optional subject or alternatively elective subject of the study programs (priority level)
Establishing of cross-study program module blocks on entrepreneurship training for the qualification in innovative competence, foundress, entrepreneurship as well as digital literacy sectors on different qualification levels
Establishing of a university-wide, extra-curricular offer of entrepreneurship stimulating framework conditions, connected with brigk (Pitch-Day, business plan competitions, start-up coaching, mentoring, etc.)
Establishing of entrepreneurship certificates based on different levels (standard and extra-occupational / accompanying to start-ups) for students
Increase in the number of students that completed an entrepreneurship training at THI to up to 30 % in each graduation year
Significant increase of the number of start-ups from THI students regarding the topic of digital technologies and business models in close cooperation with brigk

Through TH-INception, both future issues, digitalization and entrepreneurship, will be embedded structurally and sustainably at THI. With the comprehensive implementation of the mentioned curricular measures, at least one third of its each-year graduates will receive the TH-INception BASIC certificate additionally to their standard diploma. Herewith, THI graduates will have gained skills of entrepreneurial thinking and acting next to their regular degree. This large-scale support of entrepreneurial trainings in all study programs as well as an innovation scouting to identify digital business ideas and further extra-curricular offers eventually will lead to a significant increase in start-ups in the Ingolstadt region in cooperation with brigk. At the end of the project period, THI is expected to be among the best medium-sized universities regarding start-ups according to the so called "Gründungsradar" (entrepreneurship radar).

Cooperation

The local cooperation partner of TH-INception is the Digital Start-Up Center of the Ingolstadt region brigk, which is under construction next to THI campus as a new hotspot for the digital start-up scene. Together with the head of brigk, who also became a professor for entrepreneurship at THI, all measures and activities envisaged are jointly planned and implemented. Furthermore, the close cooperation with the already existing start-up center EGZ, which is located in the north of Ingolstadt and focuses on business foundations in the production sector, will continue.

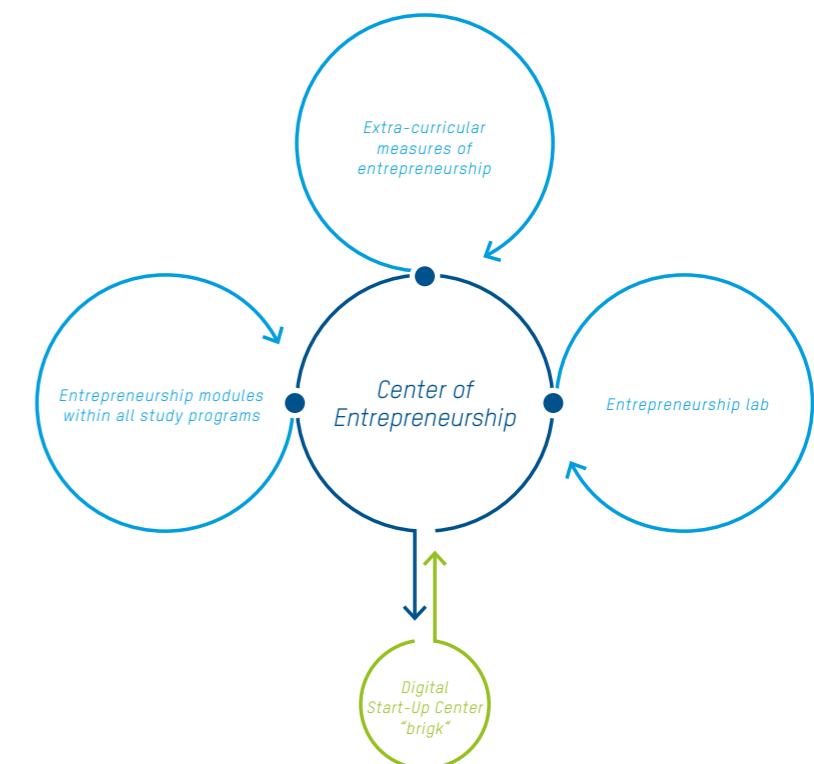
Regarding business competitions, THI currently has four partners. Besides the cooperation as an associated strategic partner of BayStartUP, a public support institution for start-ups financed by the Bavarian State Ministry for Economic Affairs and Media, Energy and Technology, THI collaborates with

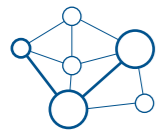
"Bildungswerk der bayerischen Wirtschaft e.V." organizing the 5-euro-business competition and with the German bank "Sparkasse Ingolstadt" implementing the "Start-Up Price Ingolstadt" (mentioned above). The fourth partner is the university "FAU Erlangen-Nuremberg" in the organization of the "Startup Challenge Bayern".

Moreover, THI works with partners of the economy, science and civil society to support their teaching and research. The range of these 200 partner companies includes regional small and medium-sized enterprises as well as international companies. The cooperation with the industry is shaped by the dual study model, of which THI is the leader in Bavaria with its approximately 80 partner companies. Additionally, numerous theses are written in cooperation with a company (around 80%). These close relations and contacts are planned to be used even more for the entrepreneurship field. Within the (extra-)curricular offers, innovation projects and events are implemented with regional partners. Moreover, a practitioners' network of lecturers and guest lecturers with know-how in cooperate venture capital, business foundations, born globals, business development and innovation management will be established.

Sustainability and long-term orientation

With brigk, the Ingolstadt region can rely on excellent support for digital start-ups. In order to fully reach the start-up potential, however, profound training and support on entrepreneurship at THI, that uses this infrastructure, is necessary. Therefore, there is a need for developing new entrepreneurship modules and implementing them into the study programs and, in addition, for establishing superior, cross-faculty entrepreneurship structures. To sum up, TH-INception is a sustainable concept for a large-scale start-up training and support in close cooperation with the external brigk.





Example

3.1.2 Center of Entrepreneurship at THI

Prof. Dr. Martin Bader
Director Center of Entrepreneurship, CoE / THI

The entrepreneurial activities of THI are centrally coordinated by the Center of Entrepreneurship (CoE), which is within the THI Business School and coordinated by the scientific director Professor Bader. One of the main aims of THI's 2018+ is to support young entrepreneurs. In order to focus on these foundation activities, the Center of Entrepreneurship was established at THI. THI thus has a central coordination center for current and future measures in connection with start-ups.

Organization and contact representatives

In each of the three faculties of THI as well as at the Institute for Executive Education and at the Research Center, there is at least one professor with the function of a start-up representative as well as an entrepreneurship manager from the CoE as a contact and implementation partner.

Broadly based entrepreneurs training

The topic of entrepreneurship has already become a stable part of doctrine at THI Business School. Research master students and doctoral students of the graduate center have the opportunity to take part in the entrepreneurship block module. It includes two weekly semester hours. The aim is to support the students in finding answers to all questions regarding business plan, financing as well as product-market fit. At the end of the course, they present their start-up ideas in an elevator pitch. Afterwards they receive feedback. Furthermore, all THI students have the opportunity to participate in an in-session start-up coaching in the frame of a compulsory optional subject (two weekly semester hours). The aim is to develop a business idea and to present a well-differentiated business plan by means of concrete start-up plans.



5-euro-business competition at THI © CoE, THI

THI student foundation activities

The CoE cooperates closely with the student start-up association NEWEXIST. To give an example: They organize the start-up competition called 5-euro-business as well as other thematic events such as "Ideas and Beers" that takes place on a monthly basis.

Advice and support for start-up companies

Students and graduates that want to connect technology and scientific-oriented approaches with a start-up, get support with their application for an EXIST start-up scholarship funded by the Federal Ministry for Economic Affairs and Energy, both in the application process and in the professional support and start-up consulting (see page 76/77).

Interfaces and Cooperation

The Digital Start-Up Center of the Ingolstadt region brigk, the central extern cooperation partner of THI's entrepreneurial activities, connects as "accelerator" with the THI intern "incubator" activities and completes them.

Another interface is the cooperative THI-professorship within the center "Zentrum Digitalisierung. Bayern (ZD.B)", a platform for cooperation, funding and founding support, on Car2X-communication as well as the constant support in the further development of brigk by THI. THI is also a traditional partner of the "Start-Up Price Ingolstadt" which offers the opportunity to receive a start-up coaching.

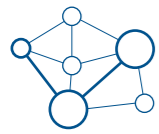
Expanding growth of entrepreneurship doctrine at THI

In 2017, THI received EUR1.1 million from the Bavarian Government in order to continue to develop their entrepreneurship doctrine with a focus on digitalization. By strengthening the topic of company foundation, all students should have the opportunity to qualify themselves for the subject of entrepreneurship during their studies at THI. The sponsored entrepreneurship concept includes start-up modules within the study programs. Herein start-up knowledge is taught in addition to the usual course offer in order to give students the opportunity to acquire sequential entrepreneurship certificates encompassing both theoretical topics, such as ideas and innovation management and digital business models, and practical implementation e.g. in a business contest.

Furthermore, THI also creates entrepreneurship measures beyond the curriculum. To that end, THI establishes, for example, a mentoring system for student start-up companies, start-up competitions for digital innovations in cooperation with brigk, coaching-days for student start-ups as well as a scouting for identifying digital business ideas out of the scientific environment. Moreover, THI is offering new jobs, which support the entrepreneurship topic particularly in the faculties and institutes.

THI will also create a foundation lab where students and young scientists can work on innovative questions concerning digitalization and prototypically develop solutions. As "Open Space", the lab is meant to offer space for the development of creative ideas.

The funding of the entrepreneurs training that focuses on digitalization is a measure within the platform "Zentrum Digitalisierung.Bayern" of the Bavarian government. The aim of the funding program is to strengthen and to expand the interdisciplinary entrepreneurship education focused on digitalization on the basis of the already existing offers of the respective university.



Example

3.1.3 brigk – Business Incubator for Digital Entrepreneurship of the Ingolstadt Region

Marc Erras

Operations Manager, brigk

Here, smart minds become entrepreneurs and good ideas digital reality. brigk was founded in October 2017 and serves entrepreneurs, creative people and those interested in start-ups, digital nomads, students and start-ups as ideal growth medium for digital projects of all sorts. Here, direct contact with coaches, investors, experts, service providers and cooperation partners create perfect conditions for the own success.

Entrepreneur support is support of the economy

Through close cooperation with reputable regional economic partners, both local universities and the support of the network, brigk thereby strengthens the Ingolstadt region as an innovation location in a sustainable way. Whether it is about blockchain, smart mirror or bride's fashion – the first digital start-up center of Ingolstadt is home of numerous start-ups with digital business models, among others also some student start-ups of the THI. The reason for that is certainly not least the good cooperation of THI with brigk on a strategic, content and organizational level. Especially for young entrepreneurs, access to a network like the digital start-up center is the best way to first contracts, new employees or a bigger reach. Effective founders' and start-up support without a good and reliable network with companies and educational institutions is not conceivable at all.

Events in brigk: Networking meets education

Also, in the digital era, people need motivation, an occasion and a location to get together and exchange on special topics. Through a variety of event formats on different topics a location in this sense for interested and like-minded people is created and a community is formed, in which people from different fields can meet, create synergies and put ideas into practice. Beginning with info events and specialist lectures to expert round tables and workshops – brigk can offer something interesting to everyone.

Coworking: Collaboration instead of concurrence

Thanks to the coworking spaces, interested and creative people can exchange thoughts with experts of various fields and share experiences at any time. The basic function: Here, you can rent your workplace for some period, receive necessary workplace structures and become part of a unique community. What it is really about: the productive slipstream of a community of like-minded people.



brigk coworking space © brigk



brigk facade of "Koboldblock" © brigk

Living Lab: Innovation to feel and try

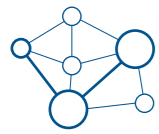
In brigk, by definition it is about innovation and progress, about new approaches and the world of tomorrow. In the Living Lab of brigk, start-ups can suitably exhibit own prototypes, product concepts and technological solutions of all sorts, and thereby make it accessible to everyone. The goal of this synergy on the one hand consists in receiving customer or user feedback on products and ideas, while at the same time on the other hand the population of Ingolstadt can experience and witness digital technology at first hand.

Brigk Makerspace: High tech and handcraft

In order to give start-ups and citizens of Ingolstadt a bigger spectrum of possibilities in the field of prototyping and handcraft, the brigk Makerspace has provided an open high-tech workshop in the region since the beginning of August. In the Makerspace with a size of 550 m² at Scholl Street close to the highway exit Ingolstadt-Nord, state-of-the-art methods and machines as well as a basic set of tools and materials for start-ups, tinkerers, inventors, artists and creative people are accessible. 3D printing, milling, laser cutting, welding, sawing, brazing, sewing, sand blasting, powder coating and a lot more is provided to the "makers" for the implementation of their projects.

"Think Big"

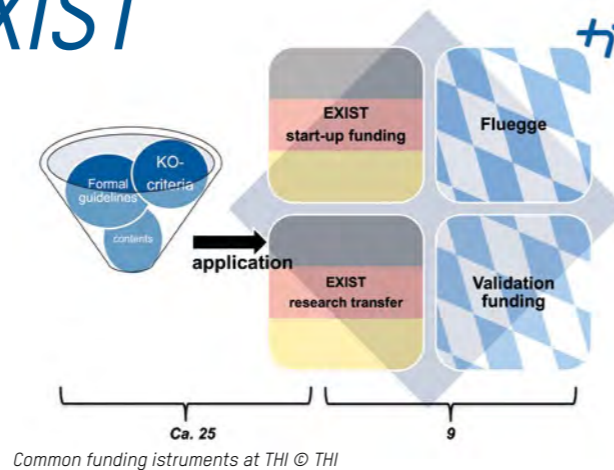
Brigk has big plans: it should not only become the main stay of the regional start-up scene, but also make Ingolstadt known for its start-up hotspot on an international level. Region 10 should also make a name for itself in the digital economy as important innovation and economy location. Especially THI sets huge standards and delivers numerous starting points for projects of the future in cooperation with the digital start-up center of the region Ingolstadt.



Example

3.1.4 National Start-Up Program EXIST

Christian Duft
Research Adviser, THI



At THI, start-up consultancy is university-wide embedded in research and teaching and – since 2016 – joined the “Center of Entrepreneurship” (CoE). A key aspect of the entrepreneurial culture is the support of professors, PhDs, students and graduates in acquisition of public funding for specific start-up projects. The following graphic shows THI’s most commonly used funding schemes. In recent years, THI handled about 25 requests of business founders, who wanted to apply for public funding. After successfully passing preliminary eligibility checks, nine applications have been prepared and submitted. Finally, seven of them (six founding teams and one validation project) were granted. Due to its general competence regarding public funding systems, the Research Center (ZAF) is deeply involved in the entire course of start-up funding projects (from concept to realization). Previous start-up projects were granted by the funding programs “FLÜGGE” and “Validation funding” (Federal Ministry for Economic Affairs and Energy BMWi) and by “EXIST start-up funding” (BMWi). Below we would like to highlight two of our recently completed EXIST start-up funding projects HRForecast and arculus.

Generally, EXIST projects may only be applied by universities or research institutes. At THI they were basically prepared by an application network of ZAF-research office, a THI-establishment coach and a professional mentor. The funding period is limited to 12 months. The public funding covers a monthly grant for up to EUR 3,000 per founder as well as start-up related material expenses up to EUR 30,000 and specific costs of foundation coaching up to EUR 5,000.

Florian Fleischmann and Christian Vetter, both graduates of THI, already dealt with their founding principle human resources and big data during their studies. After graduation and first steps in professional life, they decided to found their own company HRForecast (www.hrforecast.de/). For this purpose, they asked THI to apply jointly for the EXIST start-up funding. As regards content HRForecast aimed to develop a software tool to maximize the potential of human resources. This technology should provide the transformation of large human resource data volumes to strategic and operational knowledge. The core approach was to build an IT-platform to link the technology of big data analytics with economic methods. The developed method should be first transferred to a business model and then developed and commercialized within a start-up company.

HRForecast technology can be used everywhere, where complex HR-decisions will be taken. Basically, the generic approach answers each question around the topic of HR. Typical HR-decision making processes are strategic human resource planning, acquisition and sale of companies, location decisions and operational processes like career planning and training of individual employees, health management or fluctuation management. The target group comprises institutions with more than 1,000 employees because this company size requires tool-aided transparency regarding certain HR-correlations. The HRForecast approach enables a more transparent, more targeted, faster and more sustainable realization of decision-making processes and helps the HR to fulfill the role of a strategic partner in the company.

After four years on the market, the HRForecast client portfolio consists of over 50 companies from all over the world. Among them, there is a global operating company with a unit in Brazil. For this client HRForecast conducted an analysis of the employee skills. It was possible to determine which employee skills are important for the company in the future and how the company can systematically develop employee knowledge. The EXIST funding project in 2014/15 enabled HRForecast to further develop its business model and to position and to establish itself in the market. Meanwhile HRForecast is an internationally established company with about 25 employees from ten countries and headquarters in Munich and Bremen.

Two of the four founders Fabian Rusitschka, Witold Kopytynski, Frank Hempel and Marius Leffler of the company arculus (www.arculus.de/) are graduates of THI. The founders have known each other since the time they jointly worked at Audi and they connected their individual experience to their business concept. The EXIST start-up funding was applied for in 2015 and the project ran from 2016 to 2017. At THI it was located in the research area of mechatronics. Professor Armin Arnold, leader of the degree program mechatronics, was the professional mentor of the start-up team. Marius Leffler previously worked as THI scientist in a robotics research project and therefore could contribute specific know-how.

The business model is based on the development of an alternative production system with unchained production and logistic modules for multi variant serial production and logistics. The transport of goods and products is managed by a superior centrally controlled driverless transport system. The most important technological areas of the integrated hardware and software solutions are: navigation, planning, control/regulation and transport. The new production system is a real alternative to conventional assembly line production and follows the principles of industry 4.0. The approach is scalable. Important benefits for customers are increasing degrees of automation and reductions in logistics costs up to 60% and assembly costs up to 30% (see more details in presentation of arculus on page 60/61).

Today arculus is able to offer integrated hardware and software solutions to the market. Arculus is a fast-growing enterprise with 25 employees at three locations in Germany. Already at an early stage the developed production system showed significant potentials for the Brazilian market. Contacts to this market were established by the AWARE-network (<https://aware.thi.de/>). In this context, THI could acquire appropriate Brazilian students to arculus within the scope of internships or theses.

The available funding programs enable THI to suitably support start-ups around THI and thus to open THI to the outside world. A joint start-up project is an excellent basis for a long term and trusting cooperation between enterprise and university in research and teaching.

Overview

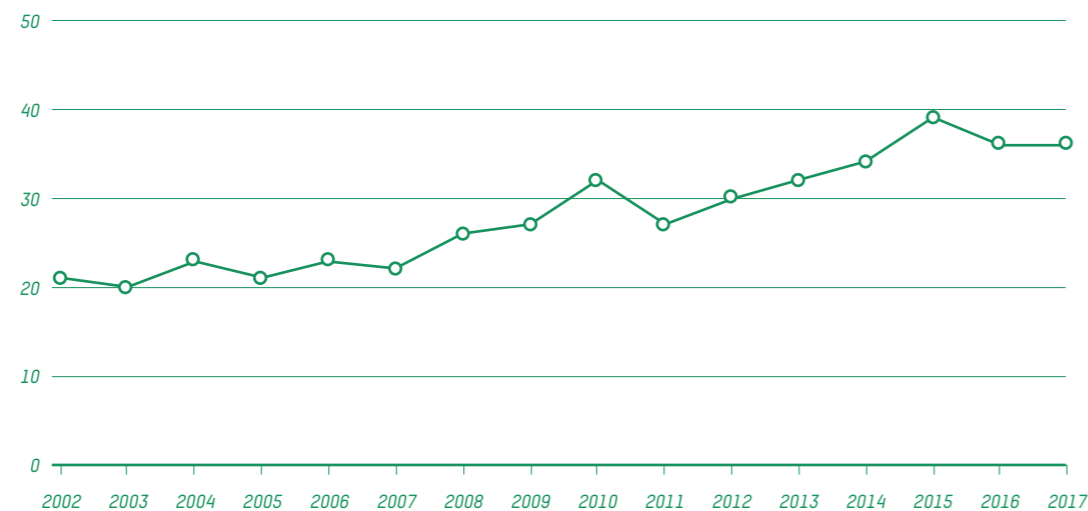
3.2.1 Entrepreneurial Infrastructures & Ecosystems in Brazil

Prof. Dr. Cleverson Renan da Cunha

Professor of the Department of General and Applied Administration & Coordinator of Entrepreneurship and Incubation, UFPR Innovation Agency

According to the Global Entrepreneurship Monitor survey (2017), Brazil is one of the most enterprising countries in the world. 40% of its economically active population reports being involved in activities related to the founding or management of businesses, and this number has been growing steadily in the last 15 years (Graph 1). According to data collected in 2016 and 2017, nearly 25% of respondents reported being interested in developing a new business in the next 3 years. Over 50% reported having the knowledge, skill and experience to start a new business.

Although the numbers are positive, the survey points out the preponderance of a specific type of entrepreneurship characterized by a small potential for innovation, being more oriented by necessity than by the will to explore new opportunities.



Rates (%) of entrepreneurship according to the stage of enterprise – Brazil – 2002: 2017 © GEM Brazil
2017- (percentage of population between 18 and 64 years of age)

Despite that, Brazil has received little attention in comparison to the 54 other countries in the survey. Brazil ranked 51st in Government Policies; 46th in entrepreneurial education at post-school stage; 47th in R&D transfer; 49th in commercial and legal infrastructure; 51st in physical infrastructures; 50th in cultural and social norms; but ranked 11th in Internal Marketing Dynamics and has the highest rate of new business emergence.

The graph shows that the entrepreneurship rate in Brazil has been growing consistently in the last 15 years and reached 36% of the economically active population in 2017.

These data demonstrate that despite all the potential and growth of entrepreneurship in recent years, several actions need to be taken to strengthen the entrepreneurial culture in the country.

The entrepreneurship theme is relatively recent in Brazil. According to Dornelas (2001), until the 1990s this theme was rarely spoken about. It was in this period that the first public and private initiatives were consolidated, starting with the pioneer initiative of Sebrae all the way until more modern initiatives focused on businesses of impact and start-ups. The following are some institutions that have contributed to the development of the entrepreneurial ecosystem in Brazil.

Historical contributions

SEBRAE – Sebrae (Brazilian National Service for Support to Micro and Small Companies) has been active in the development of micro and small companies, stimulating entrepreneurship in Brazil. It is the largest Brazilian institution in this field that supports the founding and management of small ventures. It is present in all regions of the country, and its actions involve consultancies, courses, promotion of public policies, among others. During many years, it has promoted contests and competitions in entrepreneurship. In recent years, it has intensified actions aimed at start-ups and innovative businesses. The main national programs involve the following areas:

Local Innovation Consultants – they offer personalized solutions to promote innovation and the use of technology.

Business to Business – orientation in business on basic management aimed at low-complexity enterprises, through the visit of a Business Consultant in the company.

SEBRAE Plus – this initiative is aimed at small businesses in advanced stage and offers necessary tools to improve the management.

Services in Innovation and Technology SEBRAETEC – enables the businesses to have access to subsidized services in innovation and technology.

Entrepreneurial Education – this aims to expand, promote and disseminate the entrepreneurial education in education institutions by including subjects on this theme in the curriculums.

Commodity Chain – a development program of cooperative actions to increase competitiveness of the businesses.

ANPROTEC – The National Association of Entities Promoting Innovative Enterprises has been active since 1987, bringing together around 370 members, including business incubators, technology parks, accelerators, teaching and research institutions, public agencies and other entities linked to entrepreneurship and innovation. It is the main institution that promotes technology-based ventures. It operates offering courses, programs, production and socialization of knowledge and articulation of

public policies. Among its main programs, CERNE (Center of Reference for Support to New Ventures) stands out, because it works on solutions to improve the management of incubators. CERNE is a management model designed to improve incubators' results in both quantitative and qualitative terms. The aim of the platform is to generate successful innovative companies systematically.

Endeavor – It operates in more than 30 countries and has been present in Brazil since 2000, supporting entrepreneurs of great impact. It was one of the main promoters of the entrepreneurial education, and also promotes programs to inspire the emergence of new entrepreneurs. Currently, it offers mentoring for businesses of impact, as well as other programs for small businesses and high growth companies with innovative potential, following a scalable model. In entrepreneurial education, its main program is Bota Pra Fazer (Let's do it). It acts in the dissemination of the entrepreneurial culture in the universities and helps the development of students' entrepreneurial skills. Teaching resources are offered to inspire and encourage college students to turn their ideas into high-impact businesses, besides contributing to the teachers' training.

Junior Enterprises – The Junior Enterprise Movement has been present in Brazil since 1988. Currently, there are more than 600 organizations, founded and run by students, in the most varied courses, offering consulting services to society while developing the leadership and entrepreneurial spirit of its members. This movement has been responsible for the development of several entrepreneurs who work in both private and public organizations (see page 90 ff.).

Universities – In Brazil, there is no universal entrepreneurship program for universities, but several institutions have actions aimed at strengthening the entrepreneurial attitude within them. Among these actions are the courses on entrepreneurship present in almost all major programs, such as administration and engineering, in extension programs and projects, as well as in business plan competitions. Another very strong movement in universities, especially in public ones, is the existence of business incubators and pre-incubators.

Recent contributions

New actions have been developed in recent years, involving mainly the development of start-ups. In this context, it is important to evince the impact of the implementation of co-working strategies, hackathons and innovative environments such as Cubo and Inovabra, programs of business incentive such as ICE and Artemisia, as well as the support of angel investors.

Coworking – besides being a space for collective work, coworking has also functioned to welcome and encourage the founding and maturing of new businesses. These are usually associated with Innovation technology and with the development of management skills. They are present in almost all large cities in Brazil.

Hackathons – are globally distributed initiatives that have demystified entrepreneur start-ups. They have regularly happened over the last 5 years with projects involving the public sector, class associations, social movements and large companies. They usually last from 2 to 3 days, in a workshop format, with presentations of challenges, mentoring and awards.

Innovation environments – such as CUBO, supported by Banco Itaú and Bradesco's InoBra, have been valued, mainly by Fintechs (start-ups aimed at the financial market). These spaces deprive us from support to mature businesses that are interested in expanding new markets. Networking has been the main offering of these environments, in addition to the visibility provided.

ICE – The Business Citizenship Institute brings together entrepreneurs interested in leveraging philanthropy and social impact actions. In a partnership with Sebrae and Anprotec, ICE has been responsible for an Incubation and Acceleration Impact program. Through support, consulting, advisory and training, several actions have been implemented in recent years to encourage the generation of businesses with social impact. Currently, more than 45 accelerators and incubators are part of the program.

Artemisia – Is a nonprofit organization that fosters socially impactful businesses in Brazil, through training, strengthening networks and acceleration programs. Its greater interest is to combine the generation of positive impact on society and financial business sustainability. More than 100 companies and hundreds of training programs have already been accelerated.

Angel Investors – Up until recently funding for new projects was one of the biggest bottlenecks to the development of start-ups. Several groups of angel investors have operated in Brazil, in addition to investments made by large companies, public entities and individual investors. In this context, Angels of Brazil, whose role is to foster an angel investment culture in Brazil and to support innovative entrepreneurs, deserves to be highlighted. In 2017, angel investors have contributed to approximately BRL 1 billion in new deals.

Despite the clear evolution of the Brazilian entrepreneurial ecosystem in the last decade, there are still challenges and initiatives that deserve attention, especially with regard to the role of universities.

Entrepreneurial University – In a survey on Entrepreneurial Universities in 2017 (BRAZIL JÚNIOR, 2017), more than 55% of students reported that their university has little curriculum flexibility, thus hindering their involvement in extracurricular activities. Only 36% of the interviewees affirmed that the methodologies used in the university favor the development of the entrepreneurial culture. One third of the students stated that the curriculum of their course contributes to the development of the entrepreneurial culture. These data allow us to identify several windows of opportunities for the strengthening of the entrepreneurial culture within Brazilian universities (more details on the survey: see page 88/89).

Legal Framework for Innovation – In early 2018, Brazil regulated the Legal Framework for Science, Technology and Innovation. This initiative tends to reduce the bureaucracy for research and innovation activities in the country, especially with the greater incentive for the participation of Public Universities in partnerships with private organizations, as well as facilitating the internationalization of scientific and technological institutions. It allows the diversification of financial instruments to support innovation and the construction of innovation-promoting environments.

Development of entrepreneurial education – A number of actions have taken place within the universities on entrepreneurship education, but still in a timely manner and with few results. Changes proposed by the Ministry of Education reinforce the importance of extension activities and greater flexibility in the course disciplines, thus allowing and encouraging actions related to entrepreneurship and innovation.

Innovation environments – shared work environments, incubators and pre-incubators have received attention from universities as strategy to strengthen the entrepreneurial culture.

Comparing Brazil and Germany

The Global Entrepreneurship Monitor interviewed a number of experts from 54 countries on the constraints and facilitators of entrepreneurship in each economic system. According to experts surveyed by GEM in 2017, Brazil and Germany present similarities, despite the differences.

Main recommendations for improving the entrepreneurship conditions in the country according to specialists interviewed (selected countries):

Factors	Brazil	Germany
Government policies	75.3	28.6
Education and training	49.5	47.6
Financial support	31.2	42.9
Government programs	24.7	11.9
Research and Development	14	11.9
Cultural and social norms	5.4	38.1
Information	7.5	14.3
Political, institutional and social context	4.3	16.7
Market opening / entry barriers	4.3	2.4

As the table shows, government policies were referenced by 3 out of 4 specialists interviewed in Brazil, whereas this factor in Germany was recommended by only 28.6%. The education and training factor presented similar results for both countries. For the Germans, financial support and cultural and social norms were the two most outstanding items. For Brazilians, however, the outstanding factors were financial support and government programs.

According to the experts heard by the GEM (2017), the main advantages associated with Brazil are the opening of the market to the entrance of new businesses, the great entrepreneurial capacity, the existence of some governmental programs and social norms and cultures.

While Brazil has made great strides in strengthening its entrepreneurial ecosystem, there are still several gaps that need to be fulfilled. In addition to the necessary changes in the macroeconomic, political and economic environment, in particular, strategies are urgent and necessary to intensify the role of universities and other educational institutions in the development of the entrepreneurial culture in Brazil. The path has already been built, but we may have to intensify our actions to speed up how fast we walk it.

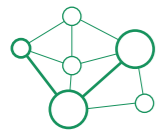
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Example

3.2.2 The Ecosystem of Innovation at UFPR

Prof. Dr. Cleverson Renan da Cunha

Professor of the Department of General and Applied Administration & Coordinator of Entrepreneurship and Incubation, UFPR Innovation Agency

The Federal University of Paraná is part of the federal system of education offering undergraduate and postgraduate courses since 1912. Traditionally Brazilian universities seek to integrate teaching, research, and extension. Recently, the innovation theme has become the fourth pillar of the central objectives of all federal universities, due to a constitutional amendment.

Although the innovation was present in several actions of the institution, the creation, in 2008, of the UFPR Innovation Agency boosted the offer of programs aimed at the conversion of scientific knowledge into products or services for the society, mainly through the transfer of technology and the creation of new businesses.

According to the Oslo Manual, innovation can be understood as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (2005:46).

In this context, marketing is an integral part of the innovation process. Given the peculiarities of the university, this is not part of the reason of the existence of these institutions. The university acts more at the frontier of knowledge, conducting state-of-the-art research, integrating knowledge through research networks, understanding demands, and designing studies to inspire the creation of public policies.

The lack of flexibility to conduct meetings and contracts is perhaps one of the most sensitive points for the development of innovation in the Brazilian universities' context. Excessive bureaucracy to approve projects, limitations on funding, and lack of a defined strategy to bring the society closer have made universities focus on the production of knowledge and not on their transfer or co-creation as the technological development. Since the innovation presupposes the provision of new solutions, and not just ideas and inventions, it is the responsibility of universities, companies, and governments to work together so that the knowledge generated is incorporated into the new proposed solutions.

Historically UFPR has been active in several areas that influence innovation, namely:

Graduation – The main role is the socialization of knowledge and some simpler extension and research actions. In recent years, there have been actions aimed at the innovation such as applied projects, undergraduate thesis based on start-ups, and business plans.

Post-graduation – it acts in the production of innovative knowledge in the various areas of knowledge. The main results are the production of academic papers and patent applications.

Extension – it contributes to the socialization of knowledge produced in environments outside the classroom, directly impacting on the society as a whole.

International Agency – it develops and accompanies international partnerships to ensure compliance with the objectives of UFPR.

Pro-Rectorate of Planning – it follows and formalizes the processes of projects of UFPR with the different members of the society.

Junior Enterprises – they act in the professional development of undergraduate students and contribute to knowledge transfer actions, mainly through consultancies.

Foundations of Support – they contribute to agreements between UFPR and public and private institutions.

Communication Superintendence – it works by presenting the actions of the university and in the institution's relationship with the media.

Innovation Agency – it articulates UFPR's innovation policy, working to strengthen entrepreneurial culture and innovation, technology transfer, and the registration and management of university patents.

One of the major roles of universities in the national innovation ecosystem has been the development of talent, as well as basic and applied research at the frontier of knowledge. The domain of tools and the use of laboratories for testing and prototyping has allowed integration between science and innovation.

Despite all the advances, Brazilian public universities have few connections with companies and the government, which has hindered the innovation process. One of the most striking examples is the low level of technology transfer compared to patent applications. The main strengths and weaknesses of UFPR innovation ecosystem are presented below.

Main strengths and weaknesses of the Innovation Ecosystem of UFPR

<i>Strengths</i>	<i>Weaknesses</i>
Consolidated teaching and research	Low internal ecosystem integration
Large number of patent applications	Low external ecosystem integration
Structure for patent registration	Little funding for innovation
Laboratories and research facilities	Lots of bureaucracy to formalize contracts
Well-established organizational roles and leaderships	Underdeveloped innovation culture
Strong research culture	

The new innovation law, which requires the definition of innovation policies by each university, tends to encourage and facilitate the maturation of the internal ecosystem at UFPR, as well as its expansion through new partnerships with other institutions, new forms of financing, and proximity to major industries and start-ups. This process is still recent, but it has already become a real solution to ensure greater integration between the actors.

Although the innovation process results in the implementation of products, services, or processes, this happens through a long path that begins with the generation of basic research, its transformation into applied research and experimental studies, the development of customized solutions, and finally, innovation per se.

Once an ecosystem is formed by actors, with their distinctive characteristics, and the connection between them, it seems that UFPR has already the foundation for the construction of the relevant ecosystem.

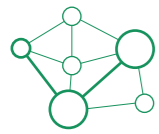
However, there is little integration between the parties, since departments tend to develop their activities in isolation. Another feature of an ecosystem is the provision of resources and incentives. If, on the one hand, universities have the resources and the physical structure for research, they cannot say the same about the incentive policy. The main evaluation metrics prioritize the production of knowledge and the generation of patents, but not the implementation of the solutions and the innovations created.

This is reinforced by the Brazilian context that has low capacity to absorb new technologies, making it difficult to assimilate and apply inventions and projects, which came from the society for trading purposes.

The innovation ecosystem of UFPR has privileged the offer of technological solutions (Technology push) to the detriment of the understanding of the needs of the society of science and innovation (Technology pull).

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Example

3.2.3 Entrepreneurial Universities Index

Daniel Pimentel Neves

Former Director of Brazilian Confederation of Junior Enterprises & Coordinator of the 1st Entrepreneurial Universities Index

The story behind the Entrepreneurial Universities Index

More than a desire to measure and rank, the purpose of the Entrepreneurial Universities Index is to change the public image and academic culture of the university in order to prepare it for its role in our knowledge society of today. What surprised the public was not only the proposed avant-garde construction of the Index, but also the fact that more than 10,000 student volunteers from across the country were involved in it. In an increasingly connected society, where access to information is easy and disruptive technologies can be created anywhere, what is the role of the university today? How sustainable is a model composed of nineteenth-century schools, twentieth-century teachers, and twenty-first-century students? This is a global debate. Brazilian students have taken an initial, pioneering step in the world to contribute to this debate in a pragmatic and idealistic way.

All the positive reviews and entrepreneurship outlooks at universities impressed us students. Our project was six months from conception to launch. The involvement of renowned researchers, consultants from large consultancies, several other collaborators and, above all, the five student organizations that mobilized the entire academic community in this purpose were essential: Enactus Brasil, Aiesec Brasil, Brasa, Rede CsF (Science Without Borders) and Brasil Júnior. What I always like to highlight is the story of the rack that inspired the conception of the Entrepreneurial Universities Index. Our inspiration came from the approval of Law nº 13.267/16, the Junior Enterprise Law that regulates junior enterprises. After having passed all Houses of Congress unanimously for five years, a last-minute setback threatened the entire law. We received news that the Civil House would veto the ninth article of our Law, one of the most important for the junior enterprises inside universities.

We found out that a presidential veto could only occur for two reasons: unconstitutionality and public interest. Regarding unconstitutionality, we could disprove it by means of opinion. But regarding public interest, how can this be demonstrated? We drafted a letter of support of rectors and sent it to the entire network of the Brazilian Junior Enterprise Movement at midnight, explaining the importance of this and having a meeting already scheduled at 2:00 pm the next day in the Civil House to discuss the veto. In this short time, we received more than 30 letters of rectors from all regions of Brazil in favor of the legislation. In the end, the law passed without objections.

Basking in this victory, we began to think of what else we could do. What would be the next step to leverage an entrepreneurial education into higher education institutions? The result of it was the Entrepreneurial Universities Index. Like the Law, the index was based on meeting people and



Entrepreneurial Universities Index Team. Kamil El Kadri, Guilherme de Rosso Maçães and Daniel Pimentel in 2016 © Brasil Júnior

organizations with a very clear purpose. When this happens, the chances of achieving huge results is much higher. Thereupon, we integrated several organizations, researchers, and consultants to the team.

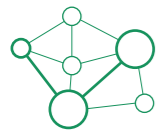
After mapping the variables that influence a university entrepreneurial ecosystem, research was carried out to discover the students' perspective and to understand the factors according to which they regard a university as entrepreneurial. These variables make our Index so innovative. Beyond that, student ambassadors were in charge of collecting other institutional data. The research team obtained over 10,000 responses, and the conceptualization was formed: "An Entrepreneurial University is an academic community, inserted into a favorable ecosystem that develops society through innovative practices".

The final document constitutes a manual that anyone can use to see how Brazilian universities can become more entrepreneurial, generating healthy interfaces between the Triple Helix (universities, industry and government) and other sectors to shape society. The organizations leading this process are proud that they were able to contribute to this growth and to spark debate in the country, and we aim to scale this project to a global level.

Adding the word "entrepreneurship" to the university already corresponds to a great change of perspective of the traditional university, especially for those who feel that it compromises its academic purity, often neglecting their immediate surroundings. By putting the entrepreneurial lens on our higher education institutions, they can take a leading role in a more fluid society, and see that knowledge is increasingly valid when applied to improving the lives of its citizens, developing their region and building leadership.

Constructing a law in a collaborative and honest way in politically difficult times for the country, proposing solid and consistent public policies such as the Index, growing exponentially like the Junior Enterprise Movement, working collaboratively between national and state organizations and other organizations are all actions that the Brazilian youth has given as an example to our country; actions that could be applied to our nation, in the National Congress, in the economy and even in the Federative Pact and international relations.

In my opinion, it is time for our universities to be entrepreneurs, both to progress and grow, and out of necessity. Finally, in times of crises and budget cuts, we did not come to complain or criticize, but to propose solutions. These will not come without investment and strategic vision in science, technology, innovation, youth and in our universities.



Example

3.2.4 Junior Enterprise Movement

Prof. Dr. Karin Graf

Professor for Mechanical Engineering, UFPR

Ilana Thaíse First

Electrical Engineering Student, UFPR

Rodrigo Heller Marba

Mechanical Engineering Student, UFPR

Bruna Rohloff

Mechanical Engineering Student, UFPR

Introduction

Junior Enterprises are non-profit civil associations, composed and managed by university students, whose main purposes are:

- To promote practical learning for the student in his/her occupational area
- To bring the job market closer to the universities
- To encourage the entrepreneurial spirit and autonomous management through the development of consulting projects

Students that work at Junior Enterprises are volunteers and a tutor or a specialized professional accompanies and supervises all projects. Thus, Junior Enterprises are considered as extension projects, requiring physical space and direct and continuous involvement of tutors aiming at the professional development of their members.

The Junior Enterprise Movement is the largest student movement in the world, gathering Junior Enterprises from more than 40 different countries, being the main confederations from Brazil (Brasil Júnior) and Europe (JADE – European Confederation of Junior Enterprises). Its concept was created in the late 1960's, when the first Junior Enterprise was established in France: Junior ESSEC. At that time, students intended to create a professional student-led organization by giving fellow students the opportunity of having some practical experience in industry. It was in the 80's that the first Junior Enterprise outside France was founded at the École Polytechnique Fédérale de Lausanne (Lausanne Federal Polytechnic School) in Switzerland. Five years later, in 1988, the concept of learning by doing and fostering entrepreneurial skills started spreading all around the world, growing in countries such as Brazil, Italy, Austria and Denmark. This expressive expansion resulted in the creation of a bigger confederation, JADE, whose main responsibility was to organize and bring together all the junior enterprises across Europe to support, integrate and represent at the continental and global level the European Junior Enterprise Movement.

JADE is a non-governmental student organization based in Brussels, from where JADE's team, jointly with their global partners, such as the European Parliament and the European Commission, coordinate the activities of 14 different European countries. Nowadays, there are more than 40 thousand junior entrepreneurs in more than 35 different countries around the world, supplying the gap between the academia and the real market.

With the main goal of expanding the movement around the world and bringing together junior entrepreneurs towards common values, an international association, the Global Council, was created in 2016. This organization offers several events, such as JEWD and JEWG, in which junior entrepreneurs from all over the world can participate:

Junior-Enterprise World Day (JEWD): JEWD is an annual event that brings together junior entrepreneurs around the world in November, during the Global Entrepreneurship Week. The purpose of this event is to celebrate the involvement of students, exchanging their best practices, success cases and present their plans for the future. JEWD also celebrates the concept of Junior Enterprises, the Junior Enterprise network, the connections and experiences generated by the movement and all the junior entrepreneurs around the globe.

Junior-Enterprise World Conference (JEWG): The Junior Enterprise World Conference is a biennial meeting that aims to integrate and to foster the Junior Enterprise Movement around the world. This event is organized by JADE and Brasil Júnior, alternating the event between Europe and Brazil and its main idea is to allow junior entrepreneurs from around the world to attend conferences to discuss the movement and their concept. Another global event is the Exchange Program, in which junior entrepreneurs exchange experiences by visiting each other's countries and enterprises. The aim is to discuss different points of view, to discover the functioning of a foreign Junior Enterprise and to get to know a new country and its culture.

Brazilian Junior Enterprises

In Brazil, the concept of a Junior Enterprise started in 1987, through the Director of the Franco-Brazilian Commerce Chamber, João Carlos Chaves. The first Brazilian Junior Enterprise was founded in 1988 at the School of Business Administration from Getúlio Vargas Foundation (FGV). João Carlos Chaves met the Junior Enterprise model in France and believed that Brazil would be a good place to apply this new concept. With Rogério Cher's help, an FGV student, the concept of implementing a student-managed business with the objective of providing practical experience allied to the theoretical academic education became possible.

Cher was responsible for leading the group of students who founded EJFGV (Empresa Júnior da Fundação Getúlio Vargas). Despite of the disbelief and mistrust of the teachers, the school provided space for the students so that they could start working. Over time, the Junior Enterprise gained support from the state government, leading to its growth within FGV. After having started the model at FGV, João Carlos Chaves promoted a meeting at the Commerce Federation for other students that wanted to know how a Junior Enterprise works.

Between 1988 and 1995, more than 100 Junior Enterprises were created in Brazil. In 1998, the National Commission of Junior Enterprises (CONEJ) was created in order to organize meetings for Brazilian Junior Enterprises, but the attempt to establish a confederation started only in 2001. At the time, there was only a Brasil Júnior network, a group of state federations that had started to structure themselves to create the confederation. These federations established a set of goals, which were necessary so that Brasil Júnior could officially be founded in August 2003. The confederation's mission

is to represent the Junior Enterprise Movement and potentialize it as the forming agent of committed entrepreneurs capable of transforming Brazil.

The growth process until the creation of the confederation was gradual, but as Brasil Júnior was finally established, it became very strong. Currently, according to Brasil Júnior, there are more than 2,000 Junior Enterprises, composed by more than 22 thousand students all over the country, being Brazil recognized as the country with the largest Junior Enterprise movement in the world. In 2016, the operation of Junior Enterprises in Brazil became regulated by law. The approved model recognizes Junior Enterprises as a consulting service for customers outside the university. This resulted in bringing students closer to the market, allowing the theoretical knowledge learned in the classroom to be put into practice.

Currently the Junior Enterprise Movement in Brazil under the roof of Brasil Júnior is managed as a network and it has its own strategic planning with annual growth goals and specific guidelines for the next three years. The Junior Enterprises are divided into clusters and they have their own goals according to their size and maturity level. If a Junior Enterprise beats its annual goal by 20% or more, it is considered a High Growth Junior Enterprise, a concept created by Endeavor (which is the largest organization supporting entrepreneurship and high impact entrepreneurs) to rank all types of growing businesses. Junior Enterprises that belong to the highest cluster (i. e. the ones with the highest number of projects and highest revenues) are considered the ones that have the highest impact on the society with their projects and services, being known as High Impact Junior Enterprises.

At the moment, Brasil Júnior's board of directors lives in São Paulo and it counts six junior entrepreneurs located in six distinct directories: Presidency, Vice-presidency of people and management, Entrepreneurial formation, Vice-presidency of communication, Network Development and Presidency of the council. Each directory has a team of coordinators and advisors to support different areas of the activities related to the confederation.

Brasil Júnior is also responsible for promoting national events concerning the Junior Enterprise Movement, being the most important: ENEJ, EDL and EAI.

ENEJ: The greatest event of the Brazilian Junior Enterprise Movement is the National Meeting of Junior Enterprises (Encontro Nacional das Empresas Juniores). It takes place annually in different cities in Brazil. During four days, there are meetings that approach different themes, and students have the opportunity to attend to speeches, workshops and listen to success cases, besides getting involved in discussions and courses. The 2017 edition happened in Porto Seguro, Bahia State, and brought together more than 3,000 junior entrepreneurs during the four days.

EDL: The Leader's Meeting is the most important moment for leadership formation of the Junior Enterprise Movement in Brazil. It is an eight-day event focused on gathering presidents and directors of federations, nuclei and Junior Enterprises. It takes place annually in São Paulo.

EAI: The High Impact Meeting (Encontro de Alto Impacto) is focused on High Impact Junior Enterprises and it takes place twice a year in São Paulo, encouraging Junior Entrepreneurs to become even more committed and able to offer more accessible and quality solutions to the market. The event includes poster sessions, speeches and business cases.

Junior Enterprises in Paraná

In 1996, as the Junior Enterprises in Paraná became more numerous and mature, several Junior Enterprises of UFPR founded the Junior Enterprise Federation of the State of Paraná (FEJEPAR), among them: EMJEL (Electrical Engineering), COEM (Mechanical Engineering), JR (Applied Social Sciences) and EJEQ (Chemical Engineering). Currently, FEJEPAR's board of directors has six members occupying the positions of: Expansion, Development, Operations, Communication, Executive President and Counsel President. In 2018, FEJEPAR estimates that there are more than 160 Junior Enterprises in Paraná State.

FEJEPAR also organizes several events all over the state in order to get together the Junior Enterprises in Paraná. Among them, the largest one is Paraná Júnior, that takes place once a year in a different city and embraces more than 600 participants.

The main objective of the nucleus of Junior Enterprises from Federal University of Paraná, NEJ – UFPR, is to represent the Junior Enterprises in the organizational and student spheres solely of UFPR. As its mission is to get together and potentialize results, the nucleus team works together, pushing each other and thinking about solutions to turn every project into a satisfying and valuable outcome.

Thus, the nucleus seeks to foster, help and empower start-ups enabling everyone to grow, as the exchange with other like-minded students from all different consultancies across the university can help each one to overcome the borders, by sharing different ideas and views on topics and problems. In addition, it also seeks to promote the foundation, giving support and advice to future companies that may arise within the university.

NEJ is also responsible for organizing events focused on the development of junior members associated with the nucleus. For this purpose, events such as "Sinergia" (Sinergy) and "Energia" (Energy) are promoted every year.

"Sinergia": This event aims to promote the integration of the new junior entrepreneurs, as well as to bring new perspectives to the former, through the transmission of new knowledge and concepts to everybody.

"Energia": It is a training event promoted annually in which the main objective is to train and enhance the knowledge of junior entrepreneurs through courses, lectures and workshops, generally focused on the development of the individual and the professional aspect of the student.

Junior Enterprises at UFPR

EMJEL

A group of electrical engineering students at UFPR founded EMJEL – Electro-electronics Junior Enterprise – in 1993. At first, the purpose of the Junior Enterprise was to accomplish some projects that the electrical engineering department itself received, and the first project indications came from professors. Since the Junior Enterprise Movement was not very known at the time, the biggest problems were the lack of credibility in the market as well as the lack of business intelligence of the members themselves. Nevertheless, in the first two years of operating the Junior Enterprise got the required documentation and structure to work, and elected its first board of directors including the president. Trying to handle the challenge of getting credibility and know-how, the members came up with many initiatives such as capacitation courses and presentation meetings to get closer to the professors of the university and marketing strategies in order to get projects and clients.

During the years, EMJEL changed its structure and went through two management breakdowns, in the years of 2006-2007 and 2011. Despite that, there were always members that resumed activities, focused on giving the Junior Enterprise visibility, and obtain projects. In 2016, after a great restructure and documentary regularization, EMJEL became a federated Junior Enterprise, getting the official title of a Junior Enterprise in Brazil. Therefore, in 2017, EMJEL was consolidated and became the first Junior Enterprise of UFPR to be considered a High Growth Junior Enterprise, beating its target in more than 500%.

Currently EMJEL has over 20 members and a board of directors. Besides that, each project has its own manager and team, who are responsible for the execution and keeping in touch with the client. In its 25 years of existence, EMJEL has accomplished more than 30 projects, ranging from projects for large industries (such as a timer for home appliances to start-up development), to smaller projects like portable gardens and robots.



EMJEL team in 2017 © EMJEL

CoemJr

In the mid-1990s, in the mechanical engineering course offered by UFPR, there were several projects focused on different areas of mechanical engineering. Projects like BAJA (whose name is originated in cars which were used on running competitions in Baja Desert), whose objective was the development of a mechanical design and construction of an off-road car, and two other projects, aimed to build an aircraft model, represented the extension projects offered by the university. Furthermore, some other research projects led by professors were the only opportunities that students had to experience contact with mechanical engineering outside the classroom. However, none of them enhanced students' skills to face the real market.

To meet this requirement, a group of six students founded CoemJr in 1996. At first, the main intention was to spread the Junior Enterprise Movement among students and show them the positive impact that it could cause in their personal and professional life. With the strong support of the professors, in less than a year, CoemJr acquired its own space and received a structure to start their projects.

For years, CoemJr struggled with projects. In addition to the lack of knowledge about the market in which the company was inserted, Junior Enterprise was not recognized by the mechanical engineering market, which did not trust the work performed by students. As a result, many projects with social purposes were carried out by the company in exchange for courses offered by their clients, which helped the students to learn and be able to work with projects that are more complex.

Nowadays, CoemJr has a corporative structure of directors and project management teams that are responsible for performing the project itself, being in direct contact with the client and the project that is being developed. However, as well as the electrical engineering Junior Enterprise, CoemJr went through some management breakdowns and discouragement of the company members, but after years of learning, the company was able to reverse the negative situation. Since then, CoemJr has experienced a significant increase in financial revenues, number of members and projects, having accumulated more than ten national awards.

As a result, Junior Enterprise had cases (term "business case", i.e. that deserves to be studied) approved in more than four Brazilian states, and was awarded with the case called "The industrial revolution and how to engage your company with Gamification" on an event that took place in October 2017, in Volta Redonda, Rio de Janeiro. Currently, CoemJr has over 20 members and a board of directors. In its 22 years of existence, CoemJr has accomplished over 50 projects, from large industries demands, such as a wind power generator, to small projects like as a modular hydroponic garden.

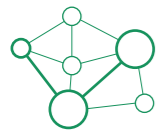
Success case

As one of the main objectives of the Junior Enterprise Movement is to encourage the entrepreneurial spirit and autonomous management through the development of consulting projects, the Junior Enterprises are highly recommended to act as a network and get together to be capable to meet interdisciplinary requests. An example is a project entitled "Magical Garden" ("HortaMágica") which was developed by CoemJr, EMJEL and EJEQ (Chemical Engineering Enterprise at UFPR). The main idea was to create a modular hydroponic garden, i.e. which does not need earth to germinate, being fed by water vapor. Regarding the electrical and electronic part, EMJEL was responsible for developing a device with sensors and actuators with an interface for controlling the portable garden. At the mechanical engineering stage, CoemJr was responsible for developing the structure, shape optimization and dimensions.

"HortaMágica" became a recognized start-up in Brazil: It went through an investment round of over BRL 1 million and it has sales contacts to more than ten countries. This is one of the many examples of success cases that became possible because of Junior Enterprises, bringing positive results not only for junior entrepreneurs, but also for clients and for the society.



CoemJr team in 2017 © CoemJr



Example

3.2.5 Entrepreneurship and Start-Up Acceleration: Inovativa Brasil and Sinapse da Inovação

Janice Rodrigues Maciel
Project Coordinator at Inovativa Brasil

Fernanda Konradt de Campos
Project Coordinator at Sinapse da Inovação

Leandro Carioni
Director at Fundação CERTI

In order to encourage entrepreneurship and the generation of an entrepreneurial culture in a given region, it is fundamental to create and develop an innovation ecosystem that integrates different actors in the process of supporting entrepreneurs. Santa Catarina's innovation ecosystem is an example of how investment in technology and innovation, when done in an integrated way and with complex networks, can work. Part of these results can be attributed to the creation of the CERTI Foundation in 1984 and the establishment of the CELTA business incubator in 1986. Since then, several companies have emerged and other programs have been created to support innovative entrepreneurship. The most outstanding of them, the Sinapse da Inovação (Synapsis of Innovation), has already helped in the creation and development of hundreds of companies, in a solid and integrated way to the ecosystem.

The Sinapse da Inovação is an innovative entrepreneurship incentive program that offers financial resources, training and support to turn innovative ideas into successful ventures. Conceived by the CERTI Foundation in 2008, the program has already carried out six editions in Santa Catarina, promoted by the State Government through the Foundation for Research and Innovation Support of Santa Catarina State – FAPESC in partnership with Sebrae (Brazilian Service for Support to Micro and Small Companies). The program has already involved more than 30,000 citizens of Santa Catarina, among proponents of ideas, evaluators and visitors of the Sinapse da Inovação Portal, reaching 262 municipalities in the state. In these eight years, more than 6,600 innovative ideas were submitted and a network with more than 60 partner institutions was created.

In its history, the Sinapse da Inovação supported the creation of 385 companies in Santa Catarina, of which 83% are active in the market with an estimated revenue of over US\$ 52 million in 2014, generating more than US\$ 12 million in taxes, which proves the effectiveness of the program and the high return on public investment. Those companies have already deposited at least 151 patents and

generated 385 partnerships with universities, large companies and among themselves. Moreover, the program generated at least 1,500 highly qualified jobs and disseminated the entrepreneurial culture in the academic environment of Santa Catarina. In addition to the Sinapse da Inovação, since 2015, the CERTI Foundation is acting at national level, promoting innovative entrepreneurship through the implementation of Inovativa Brasil, in partnership with the Ministry of Industry, Foreign Trade and Service and Sebrae.

Created in 2013, Inovativa Brasil is the largest and most comprehensive start-up acceleration program in the country. The program's focus is to help innovative entrepreneurs with good technology but little knowledge and business experience, guiding their first steps in fundraising and customer acquisition. The program, which emerged to fill a gap in the Brazilian market, is now recognized internationally. With the increasing of public investments in science and technology in the early 2000s, a series of promising new technologies began to emerge in the country. This attracted the attention of national and international investors, but Brazilian entrepreneurs still lacked the notion of how to shape the business and insert it into the market. Inspired by the best global practices in accelerating start-ups, the Inovativa Brasil comes as a public program offering free and high-level support for early start-ups from anywhere in the country.

In 2016, InovAtiva received the highest award in the country's innovative entrepreneurship sector, when it was voted as the Best Accelerator at the Startup Awards. In 2017, InovAtiva Brasil was chosen by the Organization for Economic Cooperation and Development (OECD) as a worldwide example of innovation in the public sector and joined the Observatory of Innovation in the public sector. Before that, in 2015, the recognition was in the Brazilian public administration – the program was among the five winners in the competition in the public sector, promoted by the National School of Public Administration (Enap). In addition to a high-level training program, one of the program's greatest successes was the building of Brazil's largest mentor base. There are more than 750 national and international corporate executives, investors and successful entrepreneurs that work helping entrepreneurs in the creation and evolution of nascent business and voluntarily contribute to the strengthening of the entrepreneurial ecosystem in the country.

Over five years, the program has received more than 8,400 projects, offered training and mentoring for 1,400 selected start-ups and accelerated 750 innovative new companies. Although information and communication technology start-ups are always the majority, the program has already accelerated companies from more than 20 segments of the economy, from sectors such as industry, nanotechnology, health, agribusiness, energy, finance and sustainability. According to a survey carried out in 2017, after passing through Inovativa, accelerated start-ups managed to capture 6.1 times

the amount invested by the government in the execution of the program, consolidating it as a public project with high return on investment and a promoter of the country's economic growth. Parallel to programs such as the Sinapse da Inovação and InovAtiva Brasil, CERTI also executes other acceleration programs, such as the Darwin Starter, and the Sapiens Parque technological park. This structure helps companies to overcome the "death valley" with the so-called innovation bridge, a methodology that aims to facilitate the transformation of knowledge and technologies generated in the academy into innovative products in the market, through the creation of mechanisms to support the new enterprises.



CERTI Foundation – 34 years supporting entrepreneurship © CERTI



BEST PRACTICE AWARE

Transferring Applied Teaching to Brazil: Project AIM

Cooperation THI, UFPR, UFSC & industry partners

The basic mission of the transfer project AIM – Automotive. Innovation. Momentum. launched by THI and the partner universities UFPR and UFSC in Ingolstadt in 2018 consists in transferring application-oriented teaching modules and hands-on advice for the development of automotive study programs to Brazil that are already established but within a new application-oriented context jointly with Brazilian industry.

Prof. Dr. Harald Göllinger
Scientific Director of AWARE, THI

Anne-Sophie Lohmeier
Operative Director of AWARE, THI

Funded by
Federal Ministry for Economic Cooperation and Development (BMZ) / German Academic Exchange Service (DAAD)

Partners
THI, UFSC, UFPR, Audi, BMW, Renault, Volvo and Senai (Paraná)

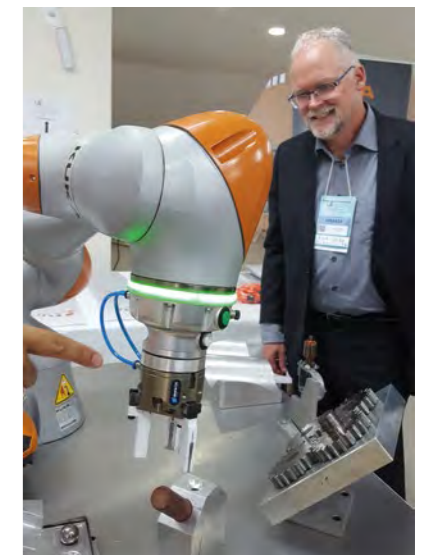
Project period
2018-2021

Contact
Prof. Dr Harald Göllinger (THI)
Prof. Dr. Ewaldo Luiz de Mattos Mehl (UFPR)
Prof. Dr. Lucas Travassos (UFSC)

This new 4-years funding project aims to transfer knowledge and structures of THI to UFSC and UFPR in order to increase marketability for Brazilian engineering student in their future workplaces at car manufacturers and suppliers located in Santa Catarina and Paraná and thus support for their integration into the Brazilian labor market. The main strategy of AIM focuses on three core areas: vehicle technologies, automotive production and development of automotive systems. Apart from developing hand tailored study modules for the needs of industry, all AIM-partners work on the transfer and exchange of study program structures in general, extending the cooperation with local industry through teaching activities and international short-term activities such as Automotive Summer Schools or further industry-academia-workshops like the workshop at UFSC “U4i – A University for the Industry of the Future” in 2018. Furthermore, internationalization and digitalization of teaching are central issues to prepare the academic partners involved to become open-minded universities prepared to receive students from all over the world and to attend to their different demands. Due to the lack of industry-related study programs in public universities in Brazil, AIM counts with important financial support from the automotive industry and further institutions located in Paraná and Santa Catarina, such as Audi, BMW, Renault, Volvo and Senai Institute in Paraná, a nationwide training and capacity-building organization.



AIM-Kick-Off in May 2018 at THI © THI



Scientific Director Professor Göllinger at AIM-U4i Workshop in Joinville (UFSC) with a KUKA demonstration robot © THI



BEST PRACTICE AWARE

Brazilian Mentoring Program with Airbus Defence and Space

Cooperation AWARE & AIRBUS

Airbus Defence and Space have supported Brazilian students from UFPR and UFSC since 2015. They are offered an internship, bachelor or master thesis position. These opportunities allow them to gather professional expertise and receive insight into innovative and cutting-edge technology projects.

Dr. Andreas Schweiger & Marina Reich
Airbus Defence and Space

Funded by
Airbus Defence and Space, DAAD/BMBF (AWARE)

Since
2015

Partners
THI, UFSC, UFPR and Airbus Defence and Space (Manching)

Contact
Dr. Andreas Schweiger,
Airbus Defence and Space GmbH



Research drone as test carrier for innovative software technology projects © Airbus Defence and Space GmbH

Airbus Defence and Space are inviting students from Brazil to choose from a set of highly innovative projects. These offer a wide range of real world and cutting-edge technology topics from state of the art software development and artificial intelligence applications for avionics systems.

As an example, the technology demonstrator drone depicted above covers several core areas where students can apply their knowledge: From systems engineering, to flight control systems, mission and operator software, and new applications such as autonomous navigation. With its realistic setup, this project goes beyond the reinforcement and application of knowledge and strives for research in new technologies such as formal verification and artificial intelligence as well as upcoming challenges such as software security.

Students work in teams, but self-reliantly on the assigned topics. They present their intermediate results to colleagues for collecting feedback and optimizing the proposed solutions. Students are permanently supervised by experienced engineers.

Airbus Defence and Space so far have coached highly motivated students with brilliant ideas. Therefore, we are looking into a bright future regarding the cooperation with UFPR and UFSC.



BEST PRACTICE AWARE

Internships in Research and Development in Santa Catarina

Cooperation AWARE, CERTI & NEO Empresarial Group

AWARE and CERTI Research Institutes offer a structured internship program for students in Brazil and Germany where trainees have to challenge and solve various types of technical problems. The program offers the opportunity to gather first international practical experience in research and development and to solve technical tasks in an international environment both in Brazil and in Germany.

Anne-Sophie Lohmeier
Operative Director of AWARE, THI

Dipl.-Ing. Manuel Steidle
Head of Mechatronics Department, CERTI

Funded by
BMBF/DAAD (AWARE),
FAPESC

Since
September 2013

Partners
THI, UFSC, CERTI Research
Institutes

Contact
Anne-Sophie Lohmeier
(THI)
Prof. Dr. Rodrigo de Souza
Vieira (UFSC)
Dipl.-Ing. Manuel Steidle
(CERTI)

To enable first international practical experience in research and development, THI and CERTI established a structured internship program for students in Brazil and Germany.

Internship in Brazil: Thematically, the internships focus upon the areas of mechatronics and software development. Recently completed internships had their main emphasis on driver training simulators and their corresponding technical equipment. The interns are formally enrolled at UFSC, develop problem solutions in about 720 hours of work and attend lectures to gain coherent, compatible and complementary theoretical knowledge. Involving the trainees in joint project teams besides learning Portuguese also gives the opportunity to acquire deeper knowledge concerning Brazil's social environment and various cultural aspects as well.

Internships in Germany: In order to foster practical exchange and working experience in Germany, AWARE recently started closer cooperation with Cerci's talent group NEO, a group of self-managed highly talented engineering students from UFSC seeking to work abroad for some time during their studies. AWARE provides internship possibilities within R&D or other departments of its network partners in order to gather practical experience in a high-professional environment. The long-term experiences at THI in research projects together with partners from industry and combined with further training programs form a unique opportunity for budding engineers, IT specialists and business economists in the technical environment of the German industry.



CERTI intern Tim Klingenberg during his work at CERTI © Tim Klingenberg



BEST PRACTICE AWARE

Senac Entrepreneurship Course at THI

Cooperation THI Center of Entrepreneurship & Senac Santa Catarina

Thiago Rafael Ferreira Marques, professor at the Department of Innovation and Technology of Senac in Santa Catarina (see page 52/53), followed the invitation of Prof. Dr. Martin Bader to come to THI Business School and hold a course on entrepreneurship and start-up business for students from THI and other Bavarian Universities of Applied Sciences.

Thiago Rafael Ferreira Marques
Professor of Entrepreneurship,
Senac (Santa Catarina)

Funded by
Senac Santa Catarina, THI

Project period
2 weeks in 2018

Partners
THI, Senac Santa Catarina

Contact
Prof. Dr. Martin
Bader (Center of
Entrepreneurship, THI)
Thiago Rafael Ferreira
Marques (Senac, Santa
Catarina)



Entrepreneurship course at THI © Prof. Dr. Martin Bader

In order to strengthen the partnership between THI and Senac in Santa Catarina, an exchange program was developed, focusing on the promotion of entrepreneurial and innovation education. Professor Bader of THI was invited to come to Brazil to share his experience, while Marques was invited to offer an innovation bootcamp at THI.

During the bootcamp, students had the opportunity to get in touch with the start-up culture through an educational methodology based on the professor's experience at Silicon Valley. The purpose of the seminar was to demonstrate to the students the tools used to create an innovative business. Through a highly active education method, in just one week, the students created, tested and presented six start-ups. The seminar was extremely productive and the ultimate goal was achieved successfully.

The partnership between THI and Senac continues to be strengthened. Prof. Dr. Martin Bader and Prof. Dr. Marc Knoppe were invited to join a Senac delegation in a one-week immersion in Silicon Valley, visiting companies as Airbnb, Netflix, Facebook, among others. Senac expects that the partnership with THI will continue to be fruitful, and is already planning new actions for 2019.



BEST PRACTICE AWARE

German-Brazilian Double Degree in “International Automotive Engineering”

Cooperation THI, UFPR & UFSC

Engineers with interdisciplinary knowledge in mechanics, electronics and computer science offering international experience are particularly sought after in the current job market. In close cooperation with the automotive industry and our strategic partners UFPR and UFSC, THI developed an excellent format for future automotive engineers.

Prof. Dr. Andreas Hagerer
Program Coordinator, THI

Prof. Dr. Evelio Martín García Fernández
Program Coordinator, UFPR

Prof. Dr. Mauricio Porath
Program Coordinator, UFSC

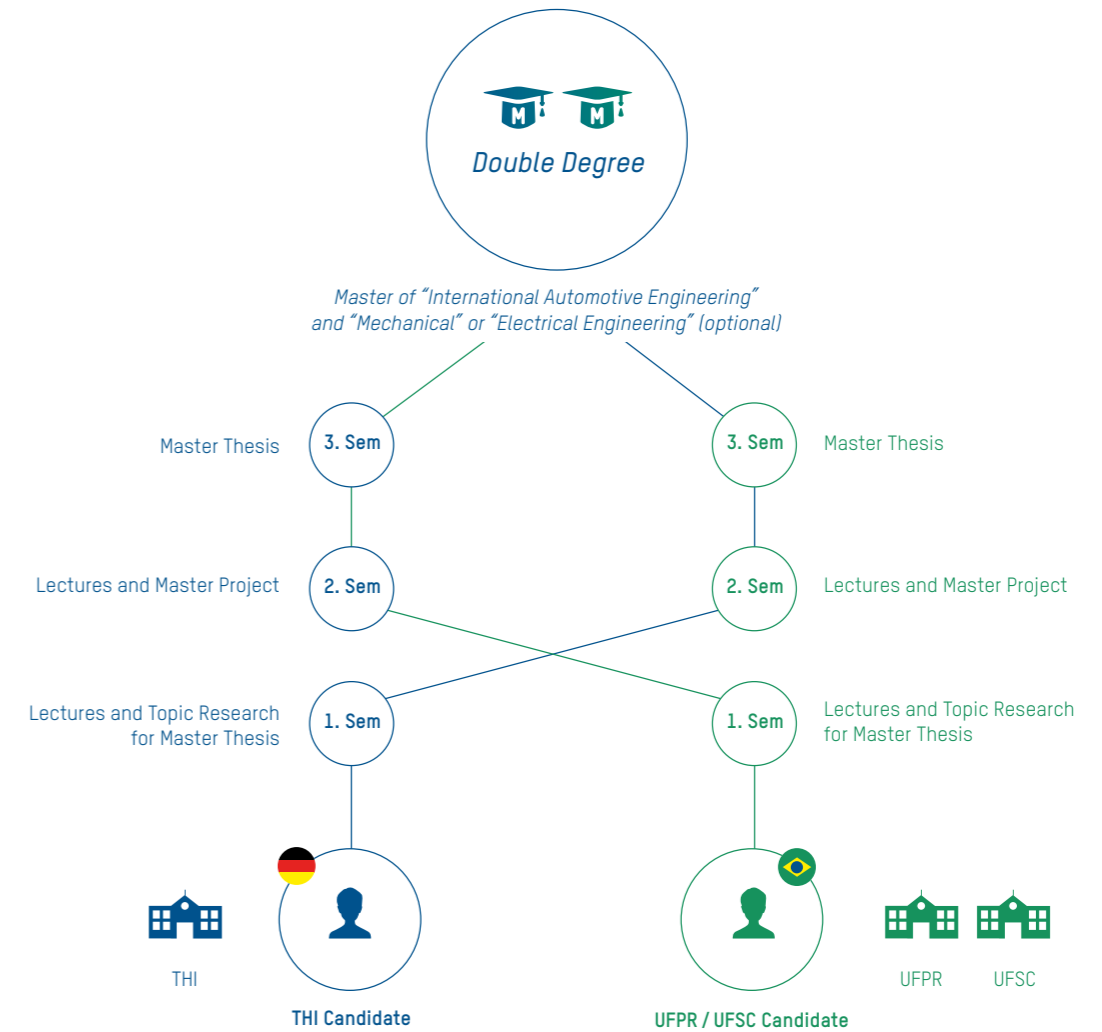
Funded by
BMBF / DAAD (AWARE), FA,
FAPESC

Duration:
3-4 semesters (semester
1 at home university,
semester 2 and 3 abroad,
semester 4 optionally)

Language: English

Partners
THI, UFSC, UFPR

Contact
Prof. Dr. Andreas Hagerer
(THI)
Prof. Dr. Evelio Martín
García Fernández (UFPR)
Prof. Dr. Mauricio Porath
(UFSC)



Curriculum of the double degree based on a modular design: International Automotive Engineering (THI) + Electrical Engineering (UFPR or UFSC) or Mechanical Engineering (UFPR or UFSC) ©THI

In the field of automotive development, strong efforts should be made on a national and international level to adequately prepare students for coping with the technical exigencies of future automobiles. Developed together with several R&D-teams of the automotive industry partners, THI's Master Program of “International Automotive Engineering” was opened up to a double degree program with UFPR and UFSC in order to prepare their students to carry out interdisciplinary research in international teams and develop innovative solutions for current global challenges in topics such as sustainable use of resources or vehicle safety.

Studying in Ingolstadt, one of the most important automotive locations in Germany, and at UFPR and UFSC in Southern Brazil, Brazil's corresponding dynamic center of automotive industry, our double degree program prepares students to face the current and future challenges of the automotive industry by combining disciplines of electrical and mechanical engineering with the student's personal focus on a specific field of automotive research.

But not only for the students this program means special benefit, also for the partner universities THI, UFPR and UFSC, the double degree has consolidated joint research groups and has even been further developed to a cooperative doctorate program between THI and UFPR (see page 132/133).



BEST PRACTICE AWARE

Brazilian Spin-Off Mobilis: Start-Up for Electric Vehicles produced in Santa Catarina

Cooperation THI & Mobilis

Mobilis is a Brazilian electric vehicle manufacturer which aims to offer innovative mobility solutions and to fill the lack of suitable products in the field of electric mobility for the Brazilian market. Mobilis was founded in 2014 by UFSC students, as they received valuable first-hand suggestions and ideas from experts during the first AWARE eMobility Forum in Joinville. Mobilis started to produce its first prototypes in 2016 and now sells and produces the very first units of the so-called Li.

Thiago Hoeltgebaum
Co-Founder of Mobilis

Funded by
THI, Mobilis

Since
2014

Partners
THI, Mobilis

Contact
Mahatma Marostica &
Thiago Hoeltgebaum
(Mobilis)



First Mobilis' prototype Li © Mobilis

One of the first results of the first eMobility Forum Mobilis in 2013 in Joinville was the foundation of the Brazilian start-up Mobilis by UFSC students in 2014. Since its beginnings, Mobilis has worked closely together with researchers from UFSC and THI, working on joint research proposals, exchanging staff and knowhow and organizing joint industry-academia-events, such as the annual eMobility Forum.

Today, Mobilis can look back proudly on first success stories. In 2017, the first product, the vehicle Li, was finalized and successfully launched in 2018. Today, the company is developing and selling scooters and further electric powertrain products to the Brazilian market.

Nowadays, Mobilis has two main products on sale: the electric vehicle Li, which is designed to run on closed spaces such as industrial spaces, golf courts and airports. The other product is an educational version which is offered to the universities as a platform in order to study and experience electric vehicles.

For THI, the close connection to Mobilis is of great value as it offers its students special insights into the challenging reality of a start-up in the Brazilian market. For Mobilis in turn, THI offers access to unique technical knowhow regarding battery safety systems or electric powertrains.

4.
*Internationalization
& Organizational
Innovation in
Universities*



Overview

4.1.1 Internationalization & Organizational Innovation in Universities in Germany

Prof. Dr. Georg Krücken

Director of the International Centre for
Higher Education Research Kassel, INCHER

Sören Magerkort

Researcher at INCHER

Universities have been engaged in international exchange since their early beginnings in the Middle Ages. For a long time, this exchange was mostly driven by individual motivation of scientists. Even in the 20th Century, international exchange was based on the personal interests of the researchers and the structure and organization of universities enhanced this kind of individual collaborations. Especially in Germany, where freedom of research and teaching is a constitutive element of university culture and even a constitutional right, professors decide, independently from administration or overall strategies, with whom to collaborate. Consequently, universities were constantly running the risk to lose valuable collaborations, once established personally by some professor. By then, it was difficult for the institution to make sustainable use of internationalization beyond individual contacts.

This has changed in the last 20 years. Through different policy reforms, the university leadership gained more power²⁴. In consequence, universities found out of their passive role and can now be described as strategic actors. This is because the focus shifted from a national level to an international one. In this setting, global university rankings played an influential role transferring the competition for reputation from a national to an international level.

In consequence, universities today are engaged in a worldwide competition, mainly for reputation, but also for best researchers. Hence, universities themselves started to work on strategies to position themselves in an international market. Most of them cannot compete with the bigger players if they stay isolated. The only chance they have is collaboration with other partners, strategically combining resources and knowledge.

²⁴ Hüther, O. & Krücken, G. (2018). Higher Education in Germany – Recent Developments in an International Perspective. Cham: Springer International Publishing AG.

Institutionalization of internationalization

In line with the above-mentioned reasons, German policy actively supports the internationalization process of universities. For example, the German Rectors' Conference (HRK) started a project called "Audit: Internationalisation of Higher Education". Since 2009, they have evaluated, supported and advised universities in finding profile matching internationalization strategies and institutionalizing them on a sustainable basis²⁵. Due to this fact, German universities generally include internationalization in their overall strategy. About 80% of all higher education institutes in Germany have a special organization unit dedicated to internationalization, the so-called International Offices.

The main goal of those strategies is to support universities in their institutionalization process of all international actions and contacts that happen within the institution. Until very recently, international activities in German universities were associated with student and staff mobility, along with joint research projects and international publications. According to this understanding, internationalization was mostly carried out through individual collaboration.

Contacts and knowledge were hardly bound to the university itself and risked to get lost once a researcher left the institution or retired. Being aware of this loss, universities all over the world started to set themselves the goal to institutionalize collaborations lifting them on a sustainable basis. This was how the idea of building strategic partnerships – meaning collaborations on multi-dimensional levels – between universities was born.

Within this setting, German funding agencies and policies currently try to support this process with the help of multiple funding programs. Besides the HRK, especially the German Federal Ministry of Education and Research and the German Academic Exchange Service (DAAD) intend to fund strategic alliances and thus help universities to sharpen their internationalization strategies. In recent years, the share of international students at German universities increased more than 30% from 250,000 in 2006 to 340,000 in 2016²⁶. That means that 12.3% of all students in German universities are foreign nationals. Despite of every effort, it seems to be challenging to establish long-lasting strategic partnerships beyond pure student mobility programs.

Strategic Partnerships and Thematic Networks

This is why funding organizations in Germany currently seek to offer support for universities to consolidate already existing collaborations and lift them on a sustainable basis. In the German context, the most important current initiative with this mission is the program "Strategic Partnerships and Thematic Networks" by DAAD. The DAAD claims to be "the world's largest funding organization for supporting

²⁵ <https://www.hrk.de/themen/internationales/strategische-internationalisierung/audit-internationalisierung-der-hochschulen/>, accessed on 01/10/2018.

²⁶ <http://www.wissenschaft-welttoffen.de/publikation>, accessed on 01/10/2018.

²⁷ <https://www.daad.de/der-daad/zahlen-und-fakten/en/30736-budget-and-funding-bodies/>, accessed on 01/10/2018.

the international exchange of students and researchers"²⁷. Whereas they fostered internationalization mostly throughout mobility programs, this relatively new program seeks to support universities to assure the sustainability of their international relations and integrate them into an overall international strategy. The program offers to support two different type of partnerships: one focusing on specific topics, the "Thematic Networks" and the other one on "Strategic Partnerships", an overall partnership on multi-dimensional levels and disciplines.

Thematic Networks are multilateral networks that establish collaboration on a faculty level. This means that a team of different scientists from different universities from the same field work together. This kind of cooperation is quite similar to usual research projects with different universities with the only difference that this funding focusses on sustainable, long-lasting partnerships from the very beginning and thus do not risk to disappear easily after the funding period ends.

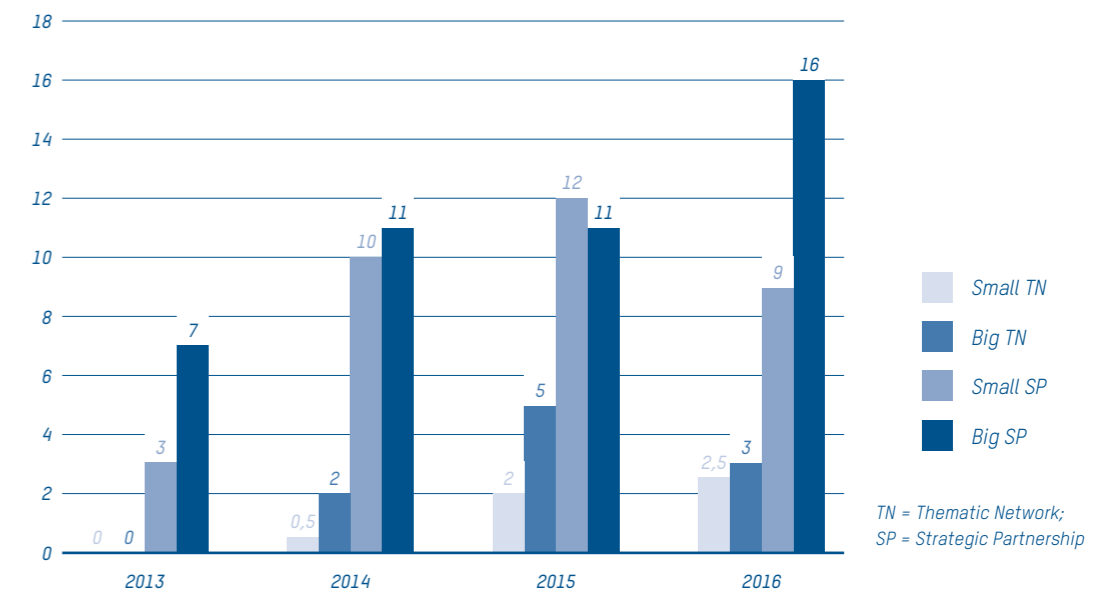
Strategic Partnerships in turn are part of an overall strategy of the institution and thus integrate cooperation in different scientific fields and on different levels, such as mobility programs for both scientific and administrative staff, joint organization of events, workshops and conferences as well as double degree programs.

The biggest difference between short-term funded projects and this big DAAD-program, published in 2013 for the very first time, is the focus on an overall strategy instead of specific research topics. It can be considered as "start-up financing"-program for a bigger overall goal.

In what else does this DAAD program differ from previous funding programs? One of the characteristics is the funding of visits. The German professors and the administrative staff were encouraged to visit their different partners for a few days in order to get to know each other and meet on a regular basis. These regular visits helped to build up trust between the different partners and thus increased the motivation to continue and intensify the cooperation. The program in itself is considered an innovation because the DAAD funded in the very first phase 21 projects for 4–6 years with about EUR 1 million without sticking with rigid target-settings or evaluations. A funded partnership is considered a success if the established collaboration continues on a stable basis after the expiration of DAAD funding.

²⁸ International Centre for
Higher Education Research.

The INCHER²⁸-Kassel evaluated the program's success during project realization of the very first four years and thus conducted different interviews and surveys as well as indicator-based research on the first 21 funded projects to detect the most important success factors of this new approach of collaborations:



Example for gradual change over time: Student mobility increases from 2013 to 2016. In 2013, there is almost no mobility. It increases in every kind of partnership. © INCHER

Implementing strategic partnerships needs time

Working with many different partners proved to be very difficult for most German universities. The biggest obstacle was to create structures and routines that scientists could use to work together. For the most part, scientists—even after establishing a partnership—still only worked together with the people they knew previously from personal experience. Hence, at first it seemed that the collaborations only existed on paper, but not in reality. Looking closer at the particular activities one could observe that universities invested a lot of time in establishing a common ground for communication. University leaders, professors and administrators met each other at conferences or workshops and established regular personal meetings and joint schedules. Through these meetings, the involved people got to know each other and gradually started to work together on their own. Returning to their home university, further colleagues found out about the existence of interesting partners and the information spread inside the university.

Only after realizing those first meetings, it was possible to identify the first outcomes. Most projects needed at least one to two years to get going. In the very first year, most projects found innovative ways to cope with the problems that arose from working together with partners all over the world. It turned out very quickly that each university had its ways and ideas to realize cooperation and that there was no "Best-Practice" solution for handling certain problems. Each university had to find its own solutions that fitted best with their partners. For example, in order to improve communication, the solutions ranged from introducing routinized meetings to establishing regular Skype-Calls or using Instant-Messaging for daily communication.

Importance of coordination

Furthermore, a discovery in this research was the importance of project coordination. Each project had special resources to fund a full-time project coordinator in charge of managing the overall collaboration. Even the project partners were expected to determine a coordinator. This proved to be one of the biggest strengths of this program. Firstly, the coordinators established trustful relationships with the coordinators from the partner universities. The mutual trust established meeting by meeting led to faster communication between the partners and sometimes to preventing possible problems. Further, scientists, who at the beginning had their problems to really appreciate the work of those administrators due to a traditional gap between administration and science, after some time experienced the benefits of having a project coordinator who centralizes information and has an overview of all joint actions. In this way, the coordinators can help with the administrative tasks and keep aspects in mind that scientist would not really care about, concentrating on their research. Interviews with project members showed that the projects, that temporarily did not have coordinators, produced less scientific outcomes and even said that they lost some of the progress they had made in the past years.

Constant communication

International collaborations have great potential for innovation. Science has to deal with very complex problems nowadays. Due to the increased complexity of global challenges, it is not feasible for one scientist or even a few scientists from one university to deal with these kinds of complex problems. A vast array of knowledge and expertise on the most diverse topics is required to challenge these problems and often one has to look abroad in order to find all needed experts. Through collaboration with partners from different countries, it is possible to find new solutions for these kinds of problems. Not only in terms of knowhow, but by combining different approaches, different ways of thinking and different cultures, new solutions can be found.

But working together in a team that is distributed all over the world is challenging. For a good working atmosphere, it is key to communicate regularly. Only through regular and direct communication trust is built. And trust is essential for any innovating process. For successful innovation, a planned project has to be perceived as feasible by the scientific group²⁹. If one side does not trust in the motivation of their partners to work together, they perceive their goal as not reachable themselves and do not invest enough energy and time in solving the project. Furthermore, sometimes cultural differences can lead to misunderstandings and thus hinder the success of the project. Through international collaborations, the German universities achieved new insights into different cultures and approaches of other countries and thus, how to work to together (see key success factors identified by the AWARE partners on page 121). Having gained certain experience in how to work and research together, challenges are

²⁹ West, M.A., Hirst, G. Richter, A. und Shipton, H. (2004). Twelve Steps to Heaven: Successfully Managing Change Through Developing Innovative Teams. European Journal of Work and Organisational Psychology, 13(2), 269-99.

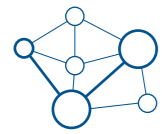
met jointly and new solutions can be developed. Additionally, this knowledge helped the German universities to cope with their own problems as well learning from their partners who sometimes simply had better strategies.

Implications

Our research implies diverse results. At first, it seems that establishing strategic international collaboration on a large scale is a relatively new task for German universities. So far, the prevailing university structures permitted a lot of power to individual professors to conduct international research and not to an overall leadership. However, strategic partnerships between universities are gaining more and more importance. The DAAD-program "Strategic Partnerships and Thematic Networks" showed that it is possible to create these strategic alliances – in accordance and cooperation with individual professors – when they meet certain criteria.

Collaborations take a long time to establish. In the first couple of years, it is unlikely that significant scientific outcomes will result out of these collaborations. It is necessary to fund the starting stage of these partnerships. Our research showed that personal visits and further meetings are the foundation for long-lasting and trustful relations. Nevertheless, universities rarely dispose of resources to fund these visits themselves. In addition, central coordination is important. Partnerships can only maintain its activities if there are administrators or network managers who centralize information and manage these big projects.

Finally, our research suggests that these international collaborations can lead to new discoveries and new ways of solving complex problems.



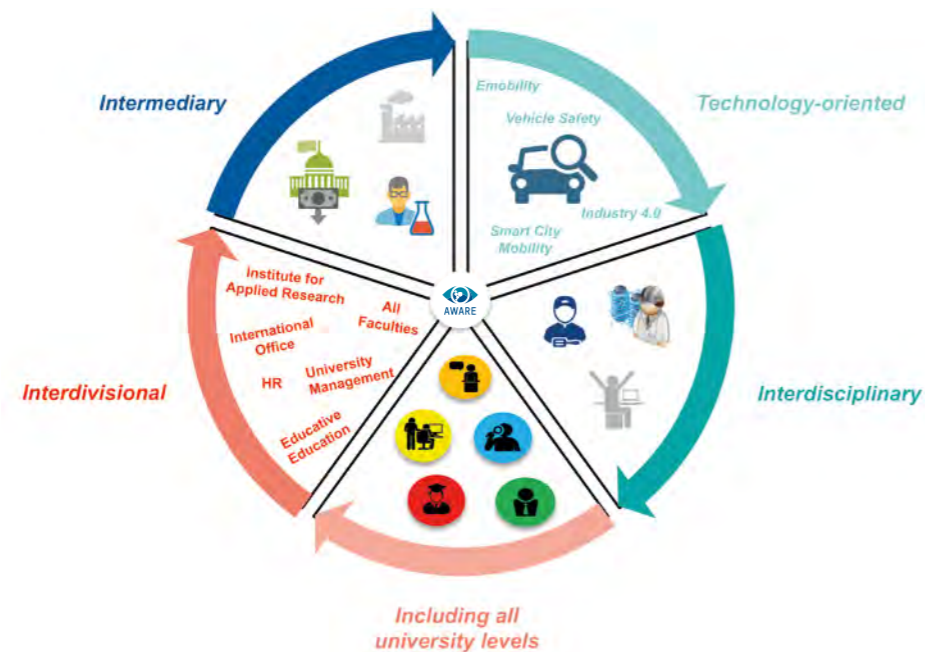
Example

4.1.2 AWARE from an Organizational Innovation Perspective

Anne-Sophie Lohmeier

Operative Director of AWARE, THI

As presented in chapter 1.2, the strategic partnership AWARE between THI, UFPR, UFSC and multiple associated partners from further science institutions, politics and industry is one of the very first funded projects within the scope of the Federal German call “Strategic Partnerships and Thematic Networks” by DAAD and the Federal Ministry of Education and Research. For THI and its partners, it was also the first time to establish a comprehensive multi-dimensional partnership, driven by a strong university leadership, as such coordinated by a funded full-time network management position and supported by a wide array of financial resources for almost any kind of partnership activities. Creating an interdisciplinary technology-oriented network, involving all university levels inside and intermediary partners outside the respective university, has had great impact on the development of the organization and administration within each partner university itself: long-term established organizational routines needed to be reconsidered and new ways of thinking and driving internationalization were experimented.



Dimensions of the strategic partnership of AWARE © THI

To name but a few examples:

Establishing a double degree between the THI Master of International Automotive Engineering, a program that integrates both mechanical and electrical engineering, with the Master Programs of Mechanical and Electrical Engineering at UFSC and UFPR resulted in a closer cooperation and coordination between the two hitherto separated departments of Mechanical and Electrical Engineering at both Brazilian universities. Whereas there weren't any connections or interfaces in the past at all, the two different departments now see the importance to work closely together, due to the fact that in application-oriented courses, students need an interdisciplinary approach and the competency to combine different streams of engineering. This relatively new approach today results in a joint initiative of both Brazilian partner universities to develop a completely new master in Automotive Engineering combining both engineering fields.

One of the very first students from UFPR who came to THI with an AWARE scholarship pushed his professors at THI and UFPR to find a way to realize his PhD, formally enrolled at UFPR, at the same time working as a full-time employee in an industry project at THI, co-supervised by a THI professor. His effort resulted in a new agreement formalizing a new cooperative PhD-program between THI and UFPR. This was only possible due to the fact that the majority of the professors at the UFPR department voted for this novel mode of cooperation between Brazilian and German university, being aware of the benefit for them to supervise a project in a high-technology-field, a project that would not have been feasible at the UFPR laboratories at that moment. This is but one example of the new ways of thinking and acting within the respective institution due to internationalization.

Furthermore, introducing new types of events not only dealing with one but several university missions – like the eMobility Forum combining teaching, research, technology transfer, and outreach – introduced new cooperation structures for extramural partners at the respective partner universities. By hosting an International Automotive Summer School, an eMobility Forum or industry-academia workshops, UFPR and UFSC today are increasingly perceived as platforms where academia and industry can meet in an informal setting, to discuss research topics, find partners and recruit talented students for internships, thesis projects or further employment. These regular meetings are currently reducing, step by step, the gap between industry and academia at both universities.



New AWARE-logo reflecting Latin America from 2019 on © THI

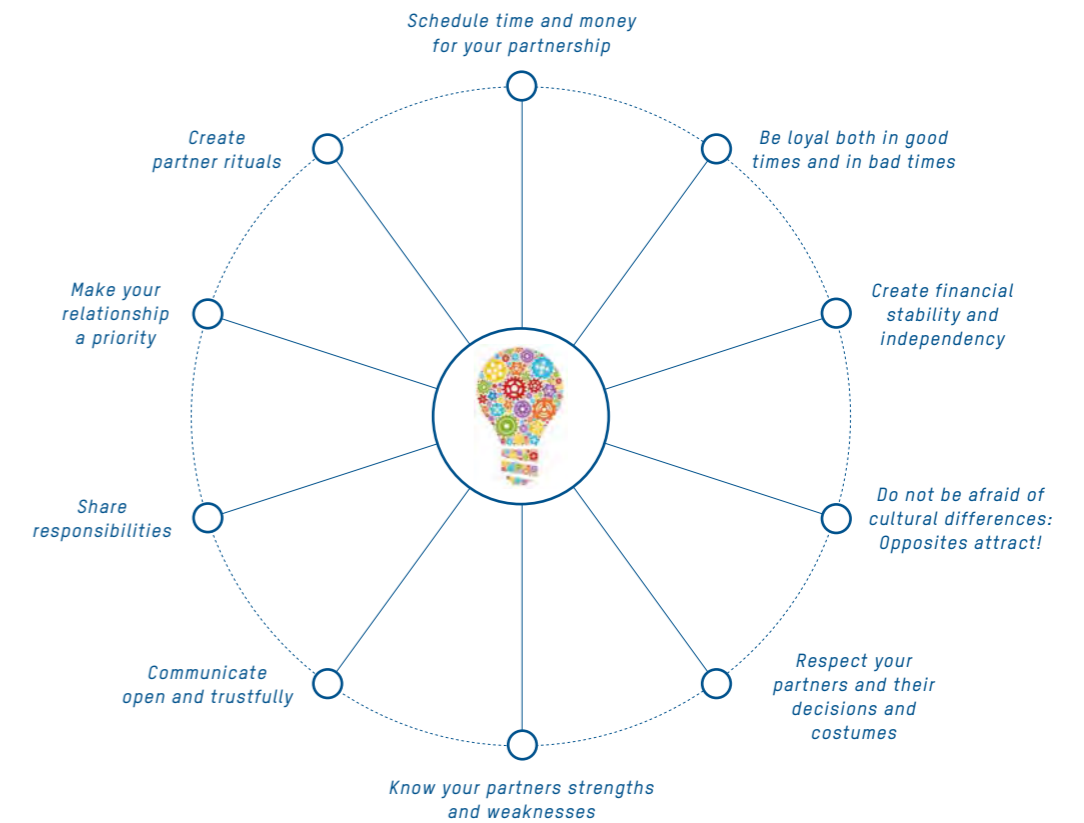
On the German side as well, THI has learned and innovated as an organization through AWARE. Just the fact that THI today counts on a group of Brazilian researchers engaged in permanent employment at THI helped not only to internationalize research at THI, but also to build up further international competencies in central university departments such as Human Resources, Center for Applied Research, the research and test center CARISSMA (see page 16) and even our International Office. Together with dealing with new challenges, also new procedures, structures and responsibilities were to be established and novel job positions, such as a network or partnership manager, had to be implemented. Besides, while the Brazilians reduce their gap between academia and industry through German expertise, the Brazilian universities look back on a long tradition in serving to and making projects with civil society. In this field known in Germany as Third Mission, THI is currently developing and implementing transfer structures and strategies and can thus strongly profit from Brazilian experiences in this field.

Furthermore, all involved partners, both administrators and academics, had to develop network skills and learn how to manage successfully a strategic partnership. Invited as a best practice university partnership at the ACA European Policy Seminar "Quality in international university partnerships" 2017 in Brussels, both German and Brazilian AWARE coordinators and members resumed the key ingredients as follows

- Schedule time and money for your partnership
- Be loyal both in good times and bad times
- Create financial stability and independency
- Do not be afraid of cultural differences: Opposites attract!
- Respect your partners and their decisions and costumes
- Know your partners strengths and weaknesses
- Communicate open and trustfully
- Share responsibilities
- Make your partnership a priority
- Create partner rituals

Actually, the ACA Seminar makers and the audience agreed finally that the ingredients are not that far away from a long-lasting marriage³⁰.

³⁰ See also the whole title of the ACA European Policy Seminar 2018: "Quality in international university partnerships – newlyweds, happily married, in marital counselling or on the verge of divorce".



Key success factors and lessons-learned for a long-lasting university partnership © Anne-Sophie Lohmeier

Last but not least, implementing a strategic partnership which involves basically all departments and target groups of a university means inventing and innovating continuously in terms of organization and administration; it also means working in interdisciplinary teams with both administrative and academic staff, with different departments and in wide-ranging missions. In order to succeed, traditional routines and former practice were scrutinized, new ways of solving problems were tried, mixed teams were established and risks had to be taken jointly. After many years of implementing and establishing a strategic partnership with a foreign country (and many years to come), we can observe multiple examples of organizational innovation. It was not always easy to convince our staff to break up with the long-established practice, but luckily the positive results of our established partnership AWARE have finally shown that it is worth risking new ways of thinking and that internationalization today means more than student or staff mobility. AWARE belongs to everyone, to all of us.

Overview

4.2.1 Internationalization & Organizational Innovation in Universities in Brazil

Guilherme de Rosso Manços

CEO at Emerge, Brazil

Researcher at Center for Technology

Policy and Management (PGT),

São Paulo University

Globalization and internationalization are related to each other, however, according to Altbach and Knight (2007) they are not the same thing. For the authors, globalization is the context of economic and academic tendencies that are part of the reality of the 21st century. And internationalization includes policies and practices carried out by academic systems and institutions—and even individuals—to cope with the global academic environment. Internationalization can also be understood as the process of integrating an international and cultural dimension into the teaching, research and extension of higher education (Knight, 1994). In this way, corroborated by different authors, internationalization is not an objective in itself, but rather a process (Jibeen & Khan, 2015; Wit, 1998). Considering the importance of internationalization, it is possible to articulate the different actors to carry out joint actions in favor of common benefits. And part of these actions are international academic mobility programs.

The international academic mobility of students, teachers and researchers is a way of conducting studies, training and research in institutions in other countries. Several nations develop international cooperation programs aimed at academic mobility, and this is one of the activities that stand out most in the process of internationalization. Examples include: (i) 100K US-China Strong (United States); (ii) Erasmus Mundus (European Union); (iii) University Mobility in Asia and the Pacific (UMAP); (iv) Science without Borders (Brazil); among others. The joint initiative of educational exchanges in science has become a tool of modern strategic diplomacy. Diplomatic reports indicate that in the face of US President Barack Obama's efforts to send 100,000 American students to China between 2010 and 2014 and 100,000 to Latin America—100K Strong for America—by 2020, the then Brazilian President Dilma Rousseff was “impressed by the scope and ambition of the American Initiative” (SIC) and, in this sense, committed itself to equating actions in 2011 (Shannon, 2012), this being one of the possible inspirations (and motivations) to create an expressive program of international academic mobility such as Brazil Science without Borders (SwB) program.

The Science without Borders program in Brazil

The SwB program was instituted by Decree No. 7.642 (2011) by the Federal Government with the objective of “providing training and qualification of highly qualified people (...) and attracting highly qualified talents and foreign researchers to Brazil”. The global scholarship goal was set at 101,000, with the initial expectation of funding of 75,000 scholarships with resources from the Federal Government and 26,000 scholarships with resources from the private sector. According to the “Bolsistas pelo Mundo”³¹ tool, the program sent scholarship recipients to educational and research institutions in forty-seven different countries of the globe until 2016. The United States received 27,821 scholars, the United Kingdom 10,740, Canada 2,321, France 7,279, and Australia 7,074, these being the five countries that most received Brazilian scholars. Countries such as Switzerland, Austria, Chile, Mexico, South Africa and others received less than 200 students and researchers.

Being the largest internationalization program in Brazil's history, the program has reached in 2016 the goal of granting scholarships to more than 101,000 Brazilian students and researchers to conduct academic exchange in several higher education institutions around the world. Undergraduate and graduate students participating in the program have established contact with competitive education systems in relation to technology and innovation through research experiences and internship overseas. In addition, the SwB also sought to attract researchers from abroad to settle in Brazil or to establish partnerships with Brazilian researchers. The Ministry of Education and the Ministry of Science, Technology and Innovation, which defined 18 priority areas, managed the program. ‘Engineering and other technological areas’ was the one with more granted scholarships, 41,594 in total, followed by ‘biology, biomedical and health sciences’ with 16,076 and ‘creative industry’ with 8,061. Until January 2016, the priority area of ‘mineral technology’ was the least contemplated area, with 136 scholarships distributed in total³². On April 2, 2017, a few months after President Dilma Rousseff was impeached, the Ministry of Education issued an announcement that government was terminating the program.

Some discussion without convergence of opinions concern the criteria of program selection and the prioritization of certain courses to the detriment of others; to the real private investment against the contribution that was expected when the program was planned; language proficiency issues and the impact on academic experience; “brain drain” and “brain gain” of talents; resources and budgetary sources for the maintenance of the program; the program's own management and evaluation; and also the impact on innovation and socioeconomic development after the scholars return to Brazil. All these aspects of the SwB program are eager for evaluations and can be judged under different approaches, logical mechanisms, standards and indicators to discuss the qualities and shortcomings of Science, Technology and Innovation (ST&I) public policies.

³¹ “Bolsistas pelo Mundo” is a geolocation tool that presents all the Brazil Science without Borders scholars according to their host university abroad: www.cienciasemfronteiras.gov.br/web/csf/bolsistas-pelo-mundo, accessed on 01/01/2016.

³² Data collected from “Painel de Controle do Programa Ciência sem Fronteiras”: www.cienciasemfronteiras.gov.br/web/csf/painel-de-controle, accessed on 01/01/2016.

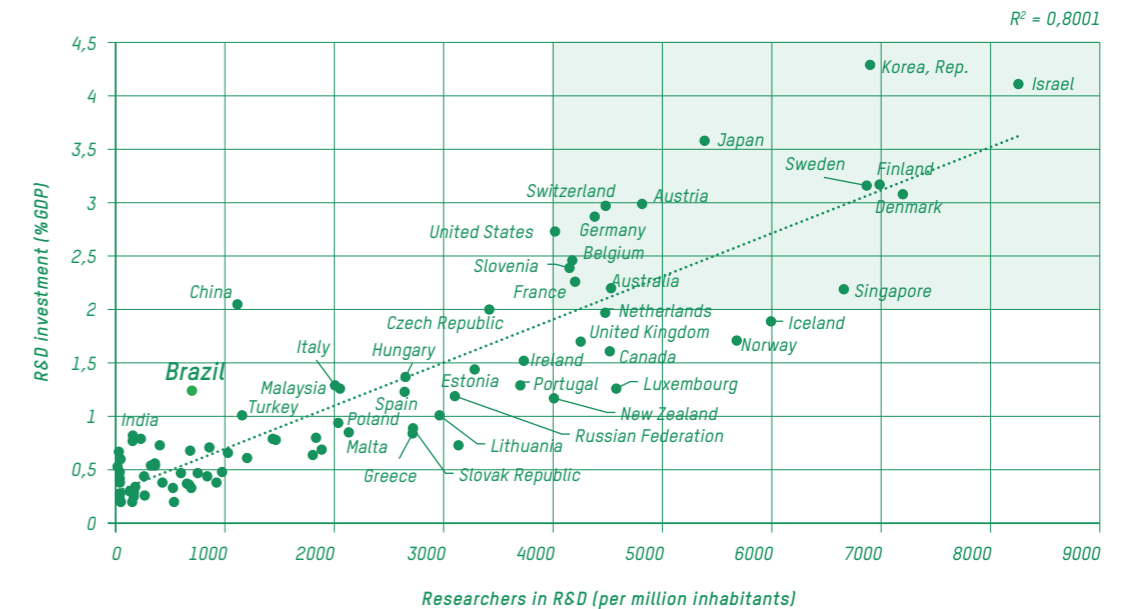


SwB Scholars and Prof. Dr. Sun Hee at Clark University 2012 © Guilherme de Rosso Manços

Science, technology and innovation policy

National Science, Technology and Innovation policies are part of growth and competitiveness strategies around the world. In Brazil, the National Science, Technology and Innovation Strategy (ENCTI) 2012-2015 has identified five challenges for the country and defined four strategic cornerstones. Two of these challenges directly explain the interest in reducing the scientific and technological gap between Brazil and other countries as well as the interest in international insertion. Moreover, two cornerstones indicate aspirations for strengthening national research and for training and qualification of human resources for ST&I.

The training of qualified human resources in basic sciences, engineering and other technological areas is essential for the functioning of science, technology and innovation systems and, consequently, for the long-term development of countries. At the beginning of the decade, in 2010, Brazil trained 40,921 engineers, equivalent to only 4.93% of all 829,286 higher education degrees awarded in that year. For the area of 'sciences, mathematics and computing', which comprises 35 higher education courses grouped in 11 subareas, the number of graduates in 2010 was equivalent to 6.29% of the total number of degrees in all areas combined (Ministry of Education, 2010). When we analyze the availability of human resources in the country that work with research and development (R&D), data shows that Brazil has about 700 professionals in R&D for each one million inhabitants. This is a low amount compared to developed countries such as Germany, the United States, Canada and the United Kingdom, which have about 4,000 researchers per million inhabitants, or Denmark and Israel, who have, respectively, more than 7,000 and 8,000 researchers per million inhabitants. Brazil also invests proportionately less R&D resources than developed countries, about 1.2% of the Gross Domestic Product (GDP), when the OECD average is 2.4% and Israel exceeds 4.0% (World Bank, 2016).



Scatter plot of 85 countries R&D investment and researchers per million inhabitants. Master Thesis, School of Arts, Sciences and Humanities, Universidade de São Paulo, São Paulo © Manços, G. R. (2017)

Note 1: Plot considers the 85 countries that invest at least 0.2% of GDP in R&D, with data provided by the World Bank.

Note 2: The yellow region highlights countries that invest in the order of 1.5% of GDP in R&D or more and have 4,000 or more researchers per million inhabitants.

With regard to the production of knowledge and technological development, Brazil's economic position is not reflected in the results of the production of scientific knowledge or technological development. In a decade comparison, Brazil jumped from 17th place in terms of the number of publications indexed by Scopus in 2001, when it was responsible for 1.16% of world scientific production, to 13th place in the ranking in 2010, when it registered 49,778 scientific publications and came to represent 1.85%. However, it is only the 23rd in the H index (Scopus, 2016) – an index that quantifies the productivity and the impact of the publications based on the number of citations. Considering publications in the period 1996-2016, the Brazilian H Index is 461, that is, there are 461 scientific publications with at least 461 citations. Among the BRICS countries, they are all ahead of Brazil but South Africa: China H Index is 655, India is 478 and Russia is 467. When analyzing data on the production of technological knowledge, Brazil shows growth in the number of international patent applications registered in the Patent Cooperation Treaty (PCT), from 173 applications in 2001 to a peak of 619 applications in 2012. However, when compared to other countries, Brazil is only 25th in the list, indicating little expression in the international scenario with only 0.25% of all the 218,000 international patent applications in the world in 2015. This evolution of Brazil in the period is insignificant compared to the five countries that most request international patents. In 2001, the United States registered 43,060 patent applications, a number that Japan – ranked second on the list – only achieved in 2012. China grew proportionally the most, increasing patent applications by 1,625% between 2001 and 2015, compared to 217% of Brazilian growth (WIPO, 2017).

Conclusion

Two main problems can be identified regarding the Brazilian scenario in science, technology and innovation in early 2010:

1. Deficit of qualified human resources, especially in the areas of basic sciences, engineering and other technological areas
2. Low scientific and technological insertion in the international scenario

Terziev and Georgiev (2017) argue that the key factor for socioeconomic development are people and, similarly, Bernal (1939) analyzes the connection between the work done by scientists and socioeconomic development in the world around them when talking about the social function of science. There is a correlation between the level of socioeconomic development of a country with investment in research and development and the availability of qualified researchers and human resources. In terms of internationalization, the international scientific collaboration network has been dominated by some European nations and by the United States, while such a network is rapidly expanding to a global level. This shift in the relationship between the geographic and intellectual dimensions of science also influences implications for countries' ST&I policies (Leydesdorff et al., 2013).

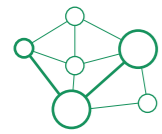
The understanding of such studies thus reinforces the relevance of the problems indicated above for the socioeconomic development of Brazil. In this sense, one can reason that given the characterization of Brazil in the international scenario, both in the scenario of human resources training and in the production of scientific and technological knowledge, there were plausible justifications in 2011 for the creation of an international academic mobility program. This argument is reinforced strategically with the definition of the lines of action of ENCTI 2012-2015 that also aim to "broaden and strengthen the formation of strategic human resources, with a focus on basic sciences and engineering (...) and the consequent increase of the insertion of Brazilian science into international R&D networks" (Brazil, 2012).



SwB Scholars and Dilma Rousseff at Harvard University 2012 © Roberto Stuckert Filho

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Example

4.2.2 Internationalization Strategy at UFPR

Prof. Dr. André Duarte
Head of International Affairs, UFPR



UFPR is cooperating with THI for over a decade now © UFPR



International Agency (AUI) at UFPR © UFPR

UFPR has regularly featured among the top ten universities in the country over the last decade, and has long appeared in world rankings among the top 1,000 universities. The quality of our Graduate degrees is reflected in the high number of programs that were given grades 5 to 7 (maximum grade) in the latest assessment of CAPES, the funding agency for research and education in Brazil: 37 total programs in various key knowledge areas. In order to receive this score, the programs have already proven to carry out work with international dimension and impact.

In November 2016, the UFPR International Agency (AUI) was created, whose purpose is to give strategy and organization to all internationalization actions at UFPR. In addition to the Agency Director, AUI is structured into three coordination units: Academic Cooperation, Mobility and Language Policies. With regard to Academic Cooperation, the actions of prospection and institutionalization of agreements and Memoranda of Understanding (MoU) were accelerated, thus greatly reducing the time of its institutionalization. With respect to mobility, the Agency now has a coordinator and staff working on the development of open calls, public disclosure of results, contacts with foreign institutions and institutional support for outbound UFPR faculty and students and for inbound students and international faculty. The UFPR International Agency supports the reception of international scholars (students and teachers) through an information protocol written in several languages. With the creation of the Coordination of Language Policies, it was possible to start deploying several actions aimed towards the linguistic training of the university community, such as: a) support for research writing in English to help increase international publications; b) faculty training in English as a Medium of Instruction (EMI) and, last but not least, to increase the number of subjects taught in English. These initiatives are developed in partnership with the UFPR Writing Center.

Finally, a word on our internationalization project. Consistent internationalization strategies are relatively new in Brazilian universities, and so CAPES, the Brazilian funding agency for research and education, decided to stimulate a more organized process by launching a national call for international strategies in 2017, the so-called PrInt (Programa Institucional de Internacionalização). We defined our internationalization strategies thoroughly discussing the matter with distinguished researchers and with other branches of UFPR administration, mostly the Provost for Graduate Affairs, who led the process. Out of 108 institutions who submitted projects, only 25 were approved by CAPES to receive funds for the next four years. Our project was very well received and earned a grant of nearly EUR 10 million. Taking UFPR Graduate Programs of Excellence (rated 5 to 7) as its basis, the PrInt UFPR Steering Committee defined five broad strategic areas of greatest importance at UFPR, comprising 16 top research transdisciplinary projects:

1. **Biodiversity and Environment:** Brazil is one of the megadiverse countries of our planet, with two of its biomes included among the ten hotspots of major relevance for world conservation: the Atlantic Forest and the Cerrado. These forests play an important role in mitigating climate problems such as greenhouse gas emissions and global warming. In addition, the large number of plant species and microorganisms of Brazilian biodiversity constitutes a potential reserve for the discovery of new molecules with pharmacological and biotechnological properties.
2. **Advanced Materials:** The research projects comprised in this strategic area focus on materials such as nanostructures of carbon – nanotubes, graphene, graphene oxide, nano graphite, fullerenes, nanoparticles and metallic films, oxides and nitrides of transition metals, semiconductors, conventional and conductive polymers, lamellar materials (nano ceramic composites, molecular magnets, metal alloys), all of them with great potential for technological application.
3. **Renewable Energy and New Forms of Energy:** The research projects are committed to developing new ways of generating clean energy, increasing its generation capacity and promoting its consumption in a sustainable and environmentally correct way. Biofuels from renewable sources are an excellent alternative to petroleum products due to the need to mitigate atmospheric pollution from burning fossil fuels. At UFPR, several research groups work in fronts such as photovoltaics, the production of liquid fuels (biodiesel, ethanol, H₂O and hydrocarbons) and gaseous (biogas and hydrogen) fuels, and the integration and strengthening of processes.
4. **Biosciences and Health:** Investing in health research is relevant not only because this is a universal and indispensable service, but also to ensure progress in improving the quality of life of the population. In countries with larger populations, continental dimensions and important health expenditures, it is crucial to improve the treatment and control of chronic noncommunicable diseases. New forms of prevention, diagnosis and treatment are necessary in the face of the complexity and diversity of phenomena involving advances derived from basic and applied sciences.
5. **Democracy, Culture and Development:** Research projects discussing power relations and social asymmetries under the light of the human rights agenda; the cycle of public social policies, considering aspects related to the proposal, implementation and evaluation of government initiatives; issues related to economic and social development, analyzing social phenomena linked to urban and rural spaces and its development; the historical production and circulation of different forms of knowledge, aiming to understand different cultural traditions and the transformations of aesthetic, political, formative and epistemological models; the processes of formation of the digital public sphere in Brazil, in view of more effective forms of communication and sharing, organization and analysis of historical, cultural and artistic documents, data, information and research results.

Our PrInt project was considered by CAPES to be an example of a well-succeeded plan towards the internationalization of Brazilian universities.



BEST PRACTICE AWARE

Brazilian Researcher on Sensor Technologies at Research and Test Center CARISSMA

Cooperation THI & UFPR

Thanks to AWARE, the research and test center CARISSMA came in touch with the Brazilian professor Dr. Alessandro Zimmer from UFPR, who supports them for two years on sensor technologies as cameras and radars for secure autonomous driving.

Prof. Dr. Alessandro Zimmer
Professor of the Department
of Electrical Engineering, UFPR
Invited Professor and
CARISSMA Researcher, THI

Prof. Dr. Thomas Brandmeier
Head of CARISSMA, THI

Funded by
THI

Project period
November 2017-
November 2019

Partners
THI, UFPR

Contact
Prof. Dr. Alessandro Zimmer
(UFPR/THI)
Prof. Dr. Thomas Brandmeier
(THI)

Prof. Dr. Alessandro Zimmer was the one who built up the AWARE network between THI and his home university and later partner university UFPR from 2010 on and worked on a future cooperation in the sphere of car security and mechatronics as well as computer vision and other sensor technologies. He also established the contacts to the city of Curitiba as well as to the respective ministries of the Federal State of Paraná, which subsequently became part of the THI network. In the last few years, Zimmer worked as director of the innovation department of Lactec, which has an application-oriented profile, belongs to one of the biggest non-academic research centers of Southern Brazil and became a constitutive partner of the AWARE network (see page 48 ff.). During his stay at THI, Zimmer had the mandate to support CARISSMA in the topics of image processing, radar and artificial intelligence and to build up a research team. After less than a year in Ingolstadt, a group of five Brazilians and one Portuguese, some of them already in Germany, were gathered and are currently working together towards this goal. Despite the short time period, the team has already successfully signed contracts with big automotive industries in Germany and are working on several new proposals as well. Meanwhile, Zimmer also supports THI by giving lectures on artificial intelligence and guiding student projects of the International Automotive Engineering Master Program. He continues, of course, to mentor the activities of the AWARE program.



Professor Zimmer's research team working on sensor technologies © THI



BEST PRACTICE AWARE

Cooperative PhD in Applied Automotive Projects

Cooperation THI & UFPR

A German university of applied sciences (UAS) has its strength in bringing research outcomes to the industry. However, it is not allowed to grant a doctoral degree. Still, junior scientists researching at a UAS earn their doctoral degree in cooperation with a traditional research university. Within this scope, THI and UFPR have elaborated a way for Brazilian students to be enrolled at UFPR as a PhD student and to conduct their research in applied projects at THI at the same time.

Prof. Dr. Werner Huber
Professor for Vehicle Safety Systems
and Test Methods of the Department
of Electrical Engineering, THI

Prof. Dr. Eduardo Parente
Professor of the Department
of Electrical Engineering, UFPR

Fabio Reway
Research Assistant and
PhD Student, THI

Funded by
BMBF/DAAD (AWARE) and
industry partner

Since
2017

Partners
THI, UFPR

Contact
Prof. Dr. Werner Huber (THI)
Prof. Dr. Eduardo Parente
(UFPR)



Simulation-based testing of an ADAS algorithm for
detection of traffic participants © Fabio Reway

The cooperative PhD is a well-established practice all over Germany. It allows researchers to pursue their doctorate while at the same time being employed at a UAS or extramural research institute in cooperation with a traditional research university, since this institutional type of university has the sole right to grant doctor degrees in Bavaria.

The respective doctoral positions are mainly financed within joint research projects among the research institutions, industry, universities or funded by the German Federal and States Governments. The researcher – and PhD candidate – must meet the requirements set by the supervisor in the UAS, the respective managers from partnering companies and institutions and, above all, comply with the demands of the doctoral supervisor in the university.

Doing research within a cooperative PhD was a novel concept for all AWARE partners. As a first step, a cooperative PhD agreement between THI and UFPR was signed in 2017, giving permission for the Brazilian doctoral degree to be conferred to the researchers working for the German UAS.

AWARE supported this very new agreement awarding the PhD candidates and their supervisors with a mobility scholarship, as the agreement defined an obligatory yearly stay at UFPR for personal exchange and transfer of the automotive expertise between THI and UFPR as a requirement.



BEST PRACTICE AWARE

Transfer via Minds: Scientific Staff Members from Brazil at THI

Cooperation THI, UFPR & UFSC

AWARE has laid the foundations for students and scientists from its Brazilian partner universities to conduct research and to teach within the frame of a regular employment at THI. The strong network between THI and local industry and, therefore, the development of state-of-the-art technology are the main reasons that attract Brazilians to settle and pursue their academic careers in Ingolstadt

Fabio Reway
Amauri da Silva Junior
Matheus Zimmermann
Research Assistants and
PhD Students, THI

Funded by
THI and industry partners

Since
2015

Partners
THI, UFPR, UFSC

Contact
Prof. Dr. Alessandro Zimmer
(UFPR/THI)
Prof. Dr. Thomas Brandmeier
(THI)



From the left to the right hand-side: Matheus Zimmerman, Fabio Reway and Amauri da Silva Jr. © Fabio Reway

The AWARE Partnership has specially broadened the horizons of three young Brazilian Engineers. Fabio Reway (UFPR), Amauri da Silva Jr. (UFSC), and Matheus Zimmermann (UFPR) first came to THI via AWARE as exchange students to write their final thesis. After that, they decided to settle in Ingolstadt and are now working as research assistants.

Fabio and Matheus were born in Curitiba and both work for the research and test center CARISSMA, the recently built institute of vehicle safety annexed to the THI campus. They have been working on a project financed by the German Federal Ministry of Education (BMBF) and industry partners. Fabio is a PhD candidate in the field of testing environmental sensors for autonomous driving. Meanwhile, Matheus works on the development of a dummy that replicates realistic pedestrian movements.

Amauri comes from Camboriú and works in the laboratory of Engine and Vehicle Technology at THI. In a partnership with a German automotive supplier, his research group under the supervision of Prof. Dr. Karl Huber develops a novel concept of a layer heating technology and its application in vehicles.

These experiences contribute to the interculturalism between higher educational institutions from Germany and Brazil, tightening up the relationship between both countries.



BEST PRACTICE AWARE

International Automotive Engineering Spring School at UFPR

Cooperation AWARE & UFPR

Following the example of the Summer Schools that are regularly offered in July at THI, the managers of AWARE designed a similar initiative to be held at UFPR: The International Automotive Engineering Spring School. Two weeks of excellent automotive lectures, industry presentations and networking activities in Curitiba, one of Brazil's main automotive industry locations, were organized in 2016 and 2018 – to be continued.

Prof. Dr. Ewaldo Luiz de Mattos Mehl
Professor of the Department
of Electrical Engineering and
AWARE Coordinator, UFPR

Funded by
BMBF/DAAD (AWARE) in
2016; DAAD-Program
"Summer Schools abroad"
in 2018

Since
2016

Partners
THI, UFPR

Contact
Prof. Dr. Ewaldo Luiz de
Mattos Mehl (UFPR)
Prof. Dr. Karin Graf (UFPR)
Anne-Sophie Lohmeier (THI)

The International Automotive Engineering Spring School 2016 had the main objective to give an insight in the fields of automotive engineering and management with special focus on mobility. The courses were taught in English and the target public were graduated and undergraduate students of engineering with special interest in the automotive field, along with professionals from the automotive industry. In total, 37 inscriptions from Brazil, Germany, India, China and Indonesia were accepted.

The program included lectures from professors from THI and UFPR, trips to the local plants of Renault, Volvo and Volkswagen-Audi, a number of visits to UFPR laboratories, and social and cultural activities as a train excursion to the historical city of Morretes. The participants' feedback was very positive and the experience of the Spring School certainly a success. In fact, it was very important to experience different ways of teaching engineering education in Germany and Brazil and everyone was capable to understand the advanced topics shown in the lectures and could make instant connection of the theoretical issues presented in the classroom with the practical aspects from the automotive industry.

After having experienced the impressive intercultural and technical outcome of an international course like this, the AWARE managers successfully applied for further DAAD-funding in order to organize a second version of the International Automotive Engineering Spring School in November 2018.



Participants of the International Automotive Engineering Spring School in 2016 in front of the Volkswagen-Audi plant (left) and the Renault plant (right), both located near Curitiba, Brazil © UFPR



BEST PRACTICE AWARE

Binational Research on Renewable Energies: Accelerated Aging Test of Li-ion Batteries

Cooperation THI, UFPR & Lactec

UFPR is one of the largest and oldest universities in Brazil, which accompanies a total of 40,000 students and 5,000 professors in the campus of Curitiba. On the other hand, Lactec is a private and self-sustaining non-profit organization, working in various field of research and technology. The partnership of THI, UFPR and Lactec is having a long span in the field of automotive research, however, only in 2018, the three institutions started researching jointly in the field of renewable energy systems.

Prof. Dr. Daniel Navarro

Program Coordinator of Renewable Energy Systems, THI

Anuj Sinha

Christian David Kortright Barbosa
Divyam Bhavsar
Master Students in of Renewable Energy Systems, THI

Thaís Marzalek Blasi

Master Student in Electrical Engineering, UFPR

Funded by

BMBF/DAAD (AWARE)

Since

Winter term 2018/2019

Partners

THI, UFPR, Lactec

Contact

Prof. Dr.-Ing. Daniel Navarro (THI), Prof. Dr. Alexandre Rasi Aoki (UFPR), Prof. Dr. Patricio Impinnisi (Lactec)



THI research team working in the battery laboratory of Lactec © THI



Li-Ion Cells 10 Ah © THI

In April 2018, the first research exchange activities in renewable energies were started between THI and its Institute of new Energy Systems (InES), the Department of Electrical Engineering at UFPR and the applied research institute Lactec, when three THI master students realized several technical experiments on Li-ion cell in the battery laboratory of Lactec. The jointly supervised experiment was performed to know how a cell of Li-ion batteries degrades itself under harsh conditions. The main challenge for the students was to define a technical procedure to test the degradation of cells, present a technical report and write a technical paper for a conference. Within this scope, the students developed three methodologies to test the degradation of cells: the DTV Test, the Coulombic Efficiency Test and Electrochemical Impedance Spectroscopy (EIS). By the end of their stay in Brazil, the test had already run for 50 cycles out of 800 cycles. The THI student team presented their analysis to their supervising professors at UFPR, Lactec and THI. Besides the technical experiments, the THI students got the opportunity to visit the impressive Itaipu Hydropower plant, the strongest of the region Paraná, as well as the Itaipu Technological Park.

After the successful experiments, the UFPR supervisor Prof. Dr. Alexandre Rasi Aoki, together with one of his master students, visited some THI laboratories and entered in closer exchange with THI coordinator and researcher in Renewable Energy Systems, Prof. Dr. Daniel Navarro, in order to intensify this recently initiated cooperation on a higher scientific level.

*5.
Innovation &
Transfer to
Economy*



Overview

5.1.1 Innovation & Transfer to Economy in Germany

Georg Overbeck

Administrative Director Research Center (ZAF), THI

Prof. Dr. Christian Facchi

Scientific Director Research Center (ZAF), THI

Knowledge Transfer to Economy – the Perspective of a University of Applied Sciences

Development trajectory and key elements

With the first institutions established around 1970, Universities of Applied Sciences (UAS) – formerly polytechnic or technical colleges – are a comparatively young type of university and thus reflect the continuous development of the German tertiary education sector. At that time, the former higher technical and engineering schools were aggregated into a new type of institution in order to meet the increasing demand of companies from the respective region for young scientific and at the same time application-oriented staff. Corresponding to this practical orientation, study and professional profiles range from engineering and economics over social pedagogy and social work to design and agriculture. In recent times, additionally, more and more study courses in health professions have been introduced due to medical advancements, increasing life expectancy and the challenging demographic trend.

Scientific perspectives on-site in combination with local problem-solving competence and research infrastructure make UAS an interesting partner in particular for small and medium-sized enterprises (SMEs) who cannot afford their own research infrastructure. Thus, UAS pay particular attention to long-term, often strategic relationships with companies, especially within their closer region. As a result, regional profiling and specialization arise and also transregional cooperation in specific scientific fields. Through this cooperation, teaching is enriched with problem definitions from real life. Accordingly, also assistant lecturers come from companies that already partner with a UAS. Departing from the commitment and cooperation in teaching, it is no longer a major step towards collaborative research. Therefore, the profile-forming feature of an UAS usually emerges along the interlinked double axis “Practical Teaching and Applied Research” in close cooperation with the region³³.

³³ <https://www.bmbf.de/de/forschung-an-fachhochschulen-543.html>, accessed on 02/08/2018.

³⁴ <https://www.thi.de/forschung/safir/>, accessed on 02/08/2018.

Last but not least, this close regional relation reflects itself in the institutional linkage on the governance level: Thus, the University Council, as the supervisory and advisory body of the university, is equally composed by internal and external members. Naturally, this link finds its counterpart in advisory boards of various network and research projects. For THI, the network project SAFIR³⁴ (see page 146/147) and the research and test center CARISSMA (see page 16) shall be mentioned as examples.

Teaching

In accordance with the above-mentioned application orientation, teaching at UAS is usually organized in small groups which besides theory deal also with practical case studies or even real problems from the business world. This sets the foundation for a long-term cooperation between the university and future corporate partners already on a low level: While the students are being prepared for the requirements in the respective professional fields, especially of the region, the companies are gradually introduced to subject matters, quality demands, and professional recognition of qualifications. Thus, it is not surprising that the vast majority of degree theses is dedicated to industrial questions formulated by a company. The graduate student is integrated into the company and its workforce and, in solving the question, is supervised by a contact person within the company as well as by a professor who makes sure that the scientific requirements are met. In order to guarantee an application-oriented teaching at the same time, the UAS professors are usually required to have five years of professional experience, of these at least three years within industry.

A further measure to link UAS with the non-academic world is the practical semester which is compulsory. The so-called dual study programs, which combine synergetic vocational training with a bachelor's degree, go even further or even to complete interlinkage. A combination of traditional regular studies and dual study programs as a third option also comprises long practical periods within a company, but without formal vocational qualification.

On professorship level, endowed chairs are another essential form of cooperation between academia and industry, with two possibilities currently feasible: a pure (teaching) endowed professorship that has a full teaching assignment from the respective company (or from several companies if funding an endowed professorship together). Or a (research) endowed professorship which includes on the one hand a reduced teaching assignment and on the other hand resources for infrastructure, in particular in form of research assistants. The respective company solely determines the title of the endowed professorship, and there shall in no case be any kind of advantage or exchange of services involved.

Technology transfer

As the term “applied research” suggests, it is the proximity to application and industry that characterizes research at UAS in terms of structure as well as in terms of contents. Even on the periphery of universities, for example via affiliated institutes, Fraunhofer regional centers or further business incubation and technology centers, a low-threshold and affordable access to cooperations is possible which however cannot compete with the broad, differentiated range of UAS services, such as:

- Study & student projects
- Research projects and
- Research projects conducted by PhD students

Within the frame of student projects, students – under the supervision of assistant lecturers or doctoral candidates – work on individual, clearly defined topics which they afterward present to the respective project partners who often specify the subject beforehand. In the best case, students

already commenced working on a research project in an early semester and continue to work on it during the following semesters. In the Bavarian context, the study program “Research Master” is to be emphasized, in which the cooperation partner is one of the research groups established within the university: This research-oriented project study course runs over three semesters and deals with a consecutively structured research question. In particular, a base for further research assignments like a PhD is laid through this. Most research master students receive a very individual and intensive supervision, comparable to that of doctoral students. The supervising professors are willing to invest such a high level of support, as most of the research master students regard their studies as a basis for a subsequent PhD. Even if the research master primarily aims at a doctoral qualification, jobs in industrial research or pre-development departments as well as in innovative smaller size companies are possible. This is also due to the hybrid profile of this program which combines research qualification with professional qualification.

³⁵ <http://www.forschung-fachhochschulen.de/massnahmen/eu-antrag-fh>, accessed on 02/08/2018.

Concerning research projects, around half of the research activities at UAS are usually carried out as so-called contract research, which means through direct commissioning by industry. The companies appreciate the practical orientation mentioned above and, as a result, their high transfer character. The other half are often oriented along the value-added chain as publicly financed projects, whereas UAS often act as a hub between basic research and industrial pre-development. In order to further sharpen this profile, the German Federal Ministry of Education and Research (BMBF) has launched a research funding program specifically for UAS. By focusing more strongly on applied research, structural deficits in existing funding programs that primarily aim at basic research at universities shall be balanced. By now, numerous subprograms exist within the German Federal program “Forschung an Fachhochschulen” (Research at Universities of Applied Sciences), ranging from start-up financing for large-volume EU proposals³⁵ over doctoral programs³⁶ to big research equipment³⁷. At state level this program finds its counterpart in the “Bayerisches Landesforschungsprogramm” (Bavarian State Research Program) that is also specifically designed for UAS and thus a perfect complement to the German Federal program just mentioned.

³⁶ <http://www.forschung-fachhochschulen.de/massnahmen/ingenieurnachwuchs>, accessed on 02/08/2018.

³⁷ <http://www.forschung-fachhochschulen.de/massnahmen/fhinvest>, accessed on 02/08/2018.

Due to the dominant, still widespread primacy of teaching at UAS, there is, as just described, no or just small-scale basic funding for research available. Thus, funding comes mainly through projects of industrial contractors – that are direct beneficiaries – or through competitive public research grants. Furthermore, free research services via publicly financed universities or projects for companies are prohibited through the respective regulations provided by the European framework for State aid for research and development and innovation for research, development and innovation³⁸ (prohibition of cross-subsidization of competitive activities by public authorities).

³⁸ ec.europa.eu/competition/state_aid/modernisation/rdi_framework_en.pdf, accessed on 02/08/2018.

University cooperation and competition

In the meantime, more and more doctoral candidates pursue their doctoral degree in cooperation with UAS which as a rule do not have the right to award doctorates, at present still the domain of the traditional universities. So, what makes such a doctorate in combination with a UAS attractive? First of all, the idea of cooperation is inherent in all research. Secondly, this possibility is structurally anchored through a supervising tandem of a traditional university and a UAS professor. So, the doctoral candidate lives in both worlds, the practice-oriented UAS and the traditional research-oriented university, which is characterized by a theoretically profound treatment of practical questions. In Bavaria, this model of cooperative doctorate is institutionally based on a new platform with the exclusive mission to enhance collaboration of traditional universities and UAS in Bavaria: the Bayerisches Wissenschaftsforum BayWISS. These cooperative or collaborative doctorates enhance long-term cooperation between the two types of universities, starting with the supervising tandems as initial nucleus.

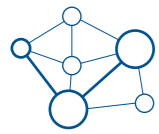
At the outset, we stated that German tertiary education institutions are constantly developing. Due to growing independence and responsibility of the individual institutions, research orientation in terms of contents, scope and objectives increasingly differs between UAS themselves. In 2012, the Bavarian Government actively encouraged this development by inviting its UAS to participate in a competition for the title “Technische Hochschule” (Technical University). Besides future research, also the strategy pursued by the universities submitting the application was an essential evaluation criterion. The approved universities themselves were rewarded with additional financial resources for strengthening their scientific profiles. This could e.g. include more mid-level academic positions, or the strengthening of the research administration capacity. For the first time, UAS face the opportunity to profit from (albeit low-scale) basic funding for their research activities.

In contrast to the competition “Technical University” the German Federal and States government funding measure “Innovative Hochschule” in 2017 also dealt with transfer capacities and the development of specific institutional transfer profiles. However, it focused upon the needs of the whole society in a much wider setting (see page 174 ff.).

Development perspectives in a global world

What does the future of UAS look like? Due to their application-oriented, respectively problem-solving profile, UAS are particularly capable of absorbing and feeding in impulses from their regional environment, no matter if from economy or society. Because of the initially mentioned demographic trend, lifelong learning that has already been taken up through numerous training institutes – in Ingolstadt for example by THI’s Institute for Executive Education (IAW) – will gain importance. Furthermore, UAS with their hands-on approach offer perspectives also for those sections of the population with an educationally disadvantaged background. This also implies a transfer task: to target as many groups, but especially the disadvantaged, to make progress through education. Also concerning research activities, UAS try to do address all companies, regardless of their form, size and branch. This implies low-threshold and affordable entry for SMEs and start-ups which otherwise would not approach traditional universities.

In the meantime, UAS have grown out of their formerly purely regional orientation, although the region remains a core element: By taking the market requirements of the globalization into account – this naturally applies to local but globally operating corporate partners as well – internationalization activities have gained momentum at UAS. This development is enhanced by research activities which normally expand to international level. At THI, this combination of the integration into international academic networks on the one hand and high-quality research on the other hand resulted in the funding of a 28 Mio. Euro research building funded by the Federal German government. This was the first time that the German Science Council recommended a research building to be constructed at a UAS: Since 2016, our research and test center CARISSMA has operated on the THI campus – a privilege formerly solely conceded to traditional universities. Key achievements like these spur on further cross-border networks such as AWARE. These networks especially comprise application-orientated partners with a focus on the market – predetermined by our UAS’ basic construction principle: the proximity to the market. What our local and supranational cooperations will have in common in the near future is a stronger involvement of stakeholders outside mere science and business.



Example

5.1.2 The Research Partnership SAFIR

Prof. Dr.-Ing. Thomas Suchandt
Vice President, THI

Sabine Kapfhamer
SAFIR Project Coordinator, THI



Network partners who participated in the opening event of the SAFIR partnership in July 2017 in Ingolstadt © THI

As described in the previous article “Knowledge Transfer to the Economy – the Perspective of a University of Applied Sciences”, THI is characterized by its closeness to industry; its practice-oriented teaching and applied research make it an attractive cooperation partner for companies, in particular for regional actors. Knowledge and technology transfer are regarded as “Third Mission”, a further social task of universities alongside research and teaching which is politically desired and subsidized at the different levels.

Consequently, various German federal and state government funding programs provide specific grants for universities to concretely pursue and promote the cooperation between academia and economy. An example for this is the research partnership SAFIR (Safety for all – Innovative Research Partnership on Global Vehicle and Road Safety System)³⁹. SAFIR is financed by the German Federal Ministry of Education and Research (BMBF) through its subprogram “Starke Fachhochschulen – Impuls für die Region (FH-Impuls)⁴⁰. Under the umbrella of SAFIR, THI is establishing a strategic partnership with more than 20 highly specialized small and medium-sized companies (SMEs) as well as automobile manufacturers and large automotive suppliers based mainly in the Ingolstadt region. The partners involved are conducting joint research on innovative technologies in the field of vehicle and road safety. It is worth mentioning that FH-Impuls aims specifically at universities with strong research activities that want to expand an already existing research focus with high potential of transfer and implementation. Universities of Applied Sciences (UAS) thus have the opportunity to further sharpen their research profile and to unlock more effectively potential for more innovation, additional revenue and synergies. In this regard, the strategic cooperation with different industry branches and other stakeholder representatives plays a central role.

³⁹ <https://www.thi.de/forschung/safir/>, accessed on 23/08/2018.

⁴⁰ <http://www.forschung-fachhochschulen.de/massnahmen/foerder-massnahme-fh-impuls>, accessed on 23/08/2018.

⁴¹ European Commission, White Paper on transport. Roadmap to a single European transport area – towards a competitive and resource-efficient transport system, 2011.

SAFIR: THI is driver for innovation in “traffic safety 4.0”

On its way to the long-term goal – a contribution to the global Vision Zero⁴¹ – SAFIR pursues the following objectives:

- Bundling the regional automotive competences of SMEs, large companies and scientific institutions to form and further develop a center for road safety
- Increasing the international competitiveness of partner companies
- Strengthening the Bavarian and German automotive and automotive supplier industries through transfer effects
- Expansion of the Ingolstadt region and the European Metropolitan Region Munich (EMM) via the motorway A9 as a test field for networked mobility and autonomous driving
- Creation of innovations by partnering companies and start-ups
- Establishment of CARISSMA (see page 16) as Germany’s leading scientific center for vehicle safety

That is why the core approach of SAFIR is the combination of integrated, passive and active vehicle safety leading towards the development of a global model of “traffic safety 4.0”. Partly and fully autonomous as well as conventional and electrified vehicles should become safer. Future-oriented mobility trends such as autonomous and energy-efficient driving, digitization, networking and lightweight construction are also addressed.

THI vice president Prof. Dr.-Ing. Thomas Suchandt is the partnership spokesperson who steers the overall network. SAFIR is divided into four research clusters:

- Mixed-Reality Test Bed to Safeguard Driving Functions (head of cluster: Prof. Dr. techn. Priv.-Doz. Andreas Riener)
- Test Methods for the Global Safety (head of cluster: Prof. Dr.-Ing. Michael Botsch)
- Global Safety Systems (head of cluster: Prof. Dr. rer. nat. Christian Facchi)
- Safe Electromobility (head of cluster: Prof. Dr. Hans-Georg Schweiger)

THI’s traditionally good contacts to the innovative medium-sized sector support the institution to act as an innovation driver and to set important impulses in and for the region through SAFIR. In order to ensure the transfer of the achieved applications into products, the most important large companies of the region were integrated into the SAFIR network. Besides, public institutions like IFG Ingolstadt, the business development agency of the city of Ingolstadt, and scientific partners like universities and research institutions are also committed to the network. The cross-sectoral and thus interdisciplinary nature of the partners makes it possible to integrate the specific know-how into the different product phases so that the entire product life cycle is covered. Thereby, the basis of the partnership is the THI-owned research and test center CARISSMA. SAFIR is supposed to promote the expansion of CARISSMA to become the nationwide center for road safety.



Impulses for the region generated by the strategic partnership SAFIR © THI

Outlook: Impulses for the region and beyond

Ingolstadt is a member of the EMM, on which the SAFIR partnership lays its focus. EMM is one of the world’s leading automotive areas with a network of original equipment manufacturers (OEM), automotive suppliers, engineering service providers and research and development facilities with an automotive focus. As a UAS with practical training and application-oriented research in the field of vehicle safety, THI is an important partner for companies of the regional automotive sector. In particular, the construction of CARISSMA laid the central foundation for the concentration of vehicle safety research in the region of Ingolstadt. Accordingly, the creation of the SAFIR network can be regarded as another milestone to promote the regional development of the automotive sector. It is the aspiration of the SAFIR partnership to create innovations and generate knowledge that is directly applicable in the region, with a direct benefit for society. Two young researchers from Brazil also work full time within SAFIR, thus promoting the exchange with Brazil and their home University UFPR (see page 134/135).

Overview

5.2.1 Innovation & Transfer to Economy in Brazil

Prof. Dr. Ewaldo Luiz de Mattos Mehl

Professor of the Department of Electrical Engineering, UFPR

Prof. Dr. Alessandro Zimmer

Professor of the Department of Electrical Engineering, UFPR

Invited Professor and CARISSMA Researcher, THI

Cláudia Raisa Tavares Romano

Innovation Agency, UFPR

Technology transfer is the process in which innovative knowledge developed in a university or a research center is made available to society, resulting in benefits and socio-economic development in a sustainable way.

Until recently, the technology transfer in Brazilian universities happened only on a case-to-case basis. That means that some individual researchers managed to register their inventions in the legal national authority and, in some particular occasions, were able to transfer the intellectual property to the industries. However, the lack of an official regulation was considered a main obstacle to increase and disseminate the technology transfer among university researchers.

The Brazilian innovation ecosystem as structured today is separated into four pillars:

- The government, through its regulation agencies, state policies in seven different areas (energy, agriculture, education, industry, public health, defense and environment) and local funding agencies on state and municipal levels
- The academic sector, through its universities
- The workforce, through the unions
- The enterprise sector, with its regulation agencies

The origin of the Brazilian stimuli to innovation can be traced back to the year 1994 with the creation of the first Informatics Law, the Federal Law 7.232, and later, in 1987, the so-called Software Law, through the Federal Law 7.646. The first one created a market reserve that would only allow Brazilian computer products, both hardware and software, to be sold inside the country in order to stimulate and consolidate the computer industry in Brazil. The second law developed the concept of intellectual property over computer programs and rules to guarantee the licensing, commerce and technology transfer of software products. The market reserve ended in 1991 with the Federal Law 8.248, called

the New Informatics Law. Taxes exemptions of up to 4% were proposed by the Federal Law 8.661 in 1993, aimed at the stimulation of endogenous innovation inside companies, but the formal definition of R&D activities came with the Federal Law 10.637 that also, for the first time, included explicit stimuli for the production of international patents.

Another important milestone in this scenario was the introduction of the Federal Law 10.973, in December 2004, that is known as “Law of Innovation”. In its text, the general guidelines for supporting innovation with the creation of fiscal incentives were set out. Also called the “Legal Framework for Science, Technology and Innovation”, this law was created with the main purpose of stimulating partnerships between academic institutions and the Brazilian productive sector. By establishing a specific regulatory framework for the area of science, technology and innovation and removing the general rules previously applicable, a more flexible regime was created for real estate assignments, technology licensing, subsidies, research, development and innovation agreements, public procurement, budget modifications, among other topics.

With the aim of stimulating partnerships between public research institutes and private companies, the law defines rules to stimulate:

- The creation of specialized and cooperative innovation environments
- The participation of Scientific and Technological Institutions (ICT, in Portuguese) in the innovation process
- Innovation in companies
- The independent inventor
- The creation of investment funds for innovation

It was the first Brazilian law dealing with the relationship between universities (and research institutions) and private companies. Its purpose is to stimulate the partnership between the public power, the academy and the private sector, with a view to generating knowledge that turns into technological products fed into the market.

At the beginning of 2016, the Technological Innovation Law was profoundly modified by Law 13.243, dated January 11, 2016. The changes brought by this new regulation sought to overcome obstacles encountered at the time of the implementation of the original legislation of 2004. The new law improves the rules for transferring resources, the contracting of goods and services makes budgetary rules more flexible, among other measures.

In 2018, Federal Decree 9.283 made the flexibility of the new regime for these partnerships even clearer. This decree expressly rules out the application of regulations that hindered the execution of activities in the area of research, development and innovation, simplifying the system of accountability, budgetary movement, receiving resources from companies to execute projects in universities to create so-called innovation environments. With the support of those legal regulations, universities, research centers and companies in Brazil have the flexibility of work regimes of researcher teachers so that they can act in ICTs, the waiver of R&D product bidding, simplified import procedures to stimulate the sharing of laboratories and other research structures among ICTs, companies and universities.

Another very important advance in the Brazilian educational system is the recent focus on applied sciences master courses that start to gather more importance by the regulation agencies and government policies and the new applied sciences PhD courses that did not exist a decade ago. Those courses focus almost entirely on application-oriented and industry-oriented research, narrowing the gap of technology transfer and innovation between the academia and the industry.

In accordance with the legal regulations, there are two types of hiring for a technological improvement developed inside a university:

- Hiring with exclusivity clause of use: to be preceded by the publication of an extract of the technological offer in an official ICT website, as established in its innovation policy
- Contracting without granting exclusivity to the technology recipient or to the licensee: to be signed directly with the company, observing the compliance with the internal rules of the institution

Inside the Federal University of Paraná (UFPR), the coordination of technology transfer aims to ensure that the scientific and technological knowledge produced in the University is within the reach of the productive sector, in order to develop practical applications based on the results of the scientific research conducted at the institution.

Upon the creation of a new technology, from the knowledge production process to the development of a commercial product, the coordination of technology transfer acts in the dissemination and negotiation of UFPR's intellectual property and in the monitoring of contracts.

The UFPR Innovation Agency conducts the process of formalization, through licensing agreements, to authorize the exploitation by third parties of the object protected by the specific branches of intellectual property.

The main points of negotiation of a licensing agreement are:

- Deadlines: the duration of the licensing agreement and the period of insertion or development of the product or process prior to commercialization or use
- Royalties: percentage of revenue obtained through the commercialization or use of licensed technology
- Up Front: initial value referring to the business opportunity and reimbursement of part of the amounts invested in the research

The UFPR Innovation Agency works collaboratively with the technical staff of the university. The researchers are encouraged not to conduct any type of negotiation without the involvement of the UFPR Innovation Agency. If there are contacts of interested parties in partnerships for RD&I (Research, Development and Innovation) or licensing of patent applications, the UFPR Innovation Agency should be informed.

All institutional relations should be regulated by specific instruments. Both the UFPR Innovation Agency and the Institutional Relations Coordination (CRI/PROPLAN) are administrative units with specific competencies for guidance, observing compliance with the internal rules of the institution and the higher laws that govern the matter, providing technical and administrative subsidies for quality, transparency and efficiency.

According to the National Institute of Industrial Property (INPI), patent applications in Brazil have been declining in the past five years. The requests dropped from 33,912 in 2013 to 28,667 in 2017. Among those numbers, 47% were done by natural persons, 24% by education, research institutions and the government, 18% by medium and large enterprises and 9% by small business.

From the ten main patent requestors, representing 9.4% of the total demand in 2017, nine were federal and state universities, and the other one an agribusiness company. The Federal University of Paraná is among one of them.

The state of São Paulo had the greater demand, with 1,640 requests in 2017, followed by Rio de Janeiro, Minas Gerais and Paraná with 672, 638 and 444 requests for patents, respectively. The foreign countries that made more requests for patents in Brazil in 2017 were the United States with 7,949 requests and Germany with 1,910 requests, followed by Japan, France, Switzerland, and others, totaling 20,178 requests.

According to INPI data from 2015, the main technological fields with the greatest patent requisitions in Brazil were organic chemistry, health technology, pharmaceutical products, transport and chemistry of basic materials.

An important point to stress is the required time for a patent to be awarded in Brazil. It varies according to the field of application, from 7.38 years in cosmetics and dentifrices up to 13.69 years in telecommunications.

Despite advances in legislation and administrative organization, there are still major challenges for the consolidation of technology transfer in Brazilian universities, especially in the initial phase of the research. In most universities in Brazil there are no clearly defined institutional guidelines for research. Each researcher applies the human and financial resources under his or her management, according to their professional interests. This guarantees autonomy and freedom to seek new solutions, but on the other hand it pulverizes research efforts, making them fragile and with a low level of development.

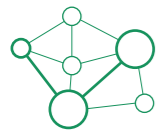
In addition, due to the fact that the research objects are chosen based largely on the interests of the researcher, there is often no dialogue and validation of this object with the companies, resulting in promising solutions but with little or no application in the market.

In general, it is observed that the initial phases of the research are successfully completed and the registration of intellectual property is carried out, which can be seen from the growing patent banks of the universities. However, it is not possible to advance to the final stages of application and validation of the technologies within the companies, precisely because of the lack of dialogue between the researcher and the market during the initial stage of definition of the research object.

This can be easily evidenced in the FORMICT Report of the 2016 base year, prepared by the Brazilian Ministry of Science, Technology, Innovation and Communications (MCTIC) to evaluate the implementation of the intellectual property policy in the scientific, technological and innovation institutions of Brazil. According to this report, from 278 ICTs interviewed, largely composed of universities, 63.7% carried out intellectual property registrations, but only 20.8% formalized some type of technology transfer contract.

Thus, it is perceived that the next major challenge for universities will be to establish research guidelines in line with the demands of the market in order to strengthen research efforts and actually apply the knowledge generated in benefits to society.

In conclusion, both the industry and academia innovation drive in Brazil present several challenges. From the need of adjusting the response time of the academia, taking into account its internal regulations and strict control system, to the quick pace of the industry, from promoting a straight communication channel despite the different language adopted by the academia and the industry, up to the lack of a mature innovation culture inside the companies, step by step, with its new regulations and policies, the country is progressing towards a more dynamic innovation ecosystem that will foster and enhance technology transfer from the university to the economy and the society as a whole.



Example

5.2.2 Innovation and Transfer at UFPR

Prof. Dr. Cleverson Renan da Cunha

Professor of the Department of General and Applied Administration & Coordinator of Entrepreneurship and Incubation, UFPR Innovation Agency

Alexandre Donizete Lopes de Moraes

Coordinator of Intellectual Property and Technology Transfer, UFPR Innovation Agency

Waleska de Liz Giese Marçal

Administrator in Coordination of Intellectual Property and Technology Transfer, UFPR Innovation Agency

Eduardo de Oliveira Silveira

Administrative Assistant in Coordination of Intellectual Property and Technology Transfer, UFPR Innovation Agency

The Federal University of Paraná (UFPR) is part of the federal system of education offering undergraduate and postgraduate courses since 1912. Traditionally Brazilian universities seek to integrate teaching, research and extension. Recently, the innovation theme has become the fourth pillar of the central objectives of all federal universities, due to a constitutional amendment.

The UFPR Innovation Agency aims to support the internal community in the demands of knowledge protection, guides the procedures, along with other administrative units, on technology transfer and defines building plans and events for entrepreneurship and innovative business generation projects.

Among the competencies of the Innovation Agency are:

- To ensure that the UFPR's technological innovation policy is in line with the current legislation
- To value the applied research which results in technological innovation capable of adding economic value and improving the quality of life in society
- To articulate strategic partnerships between UFPR and the business, governmental, and non-governmental sectors to work on cooperative projects of scientific and technological development
- To stimulate the process of pre-incubation and incubation of innovative technology-based companies within the scope of the university
- To disseminate the culture of knowledge protection and intellectual property at the university to stimulate the registration, licensing, and commercialization of intangible assets
- To disseminate the entrepreneurial culture for the entire university community

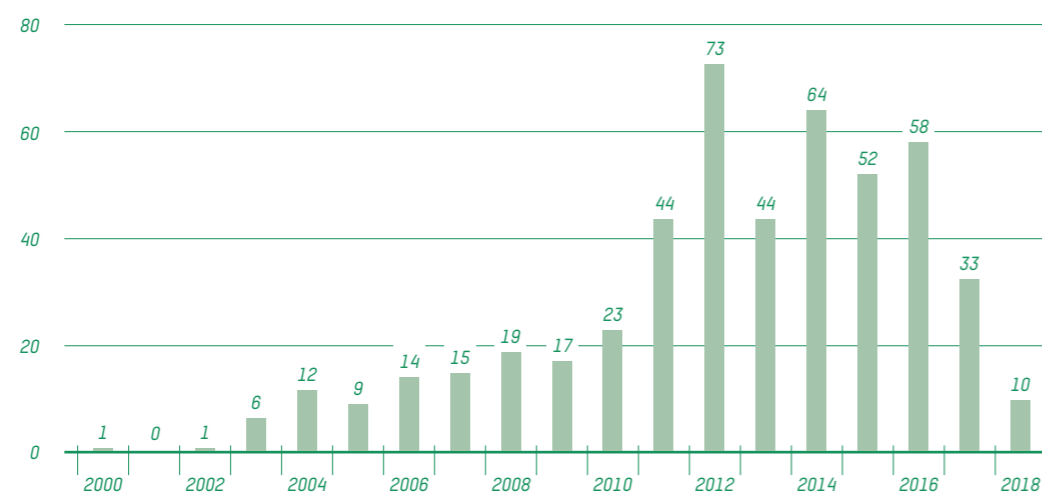
The Innovation Agency is coordinated by an executive that organizes and directs the activities carried out by three coordination units: entrepreneurship and incubation of companies, intellectual property, and transfer of technology, in order to potentiate the generation of innovation.

- The coordination of entrepreneurship and business incubation seeks to improve the entrepreneurial skills of students, faculty, and administrative staff at the UFPR. When it disseminates the entrepreneurial culture to the entire university community, it also stimulates the incubation process of innovative technology-based companies within the university.
- The main purpose of the intellectual property coordination is to guide, support, monitor, and manage the processes of protection of intellectual property generated at the UFPR. The intellectual property coordination, within the strategy of dissemination of the innovation culture, participates, creates, and executes several events during the year.
- The technology transfer coordination comes from the extinct UFPR relationship portal. Its main attribution is to allow the knowledge generated at the UFPR to be transferred to society, in order to achieve innovation and the social and economic benefits that it can offer.



The graph below shows the increase in the number of patent applications filed at the INPI by UFPR, with a significant increase after the establishment of the UFPR Innovation Agency.

The total number of patent applications



Technology transfer contracts signed up to 2017: 16

More than 50 other signed instruments

Incubated (or graduated) companies: 2 (14)

Pre-incubated projects: 16

Courses and events in 2017: 1800 assisted people

Management of intellectual property: Since 2008, the Agency has applied for patent registration. Starting in 2017, a process of migration for the management of intellectual property as a whole began, involving the mapping of market and society demands; monitoring and support for the creation of patents; new criteria for the selection of patent applications, thus avoiding to reduce requests from research without obvious commercial interest; monitoring of the applications and elaboration of the technology showcase to better expose the patents generated at UFPR.

Incubation and pre-incubation: It is a program to support innovation through the creation of projects and companies with a technological base and social impact. It includes consultancy, advice and support in technical and business areas. The pre-incubation helps the identification and validation of business ideas up to the modeling of the proposed solution.

Support and follow-up of technological development projects: prospecting needs of public and private organizations; mapping of internal competencies of UFPR; support in the formalization of partnerships, agreements, and contracts; raising awareness of basic and applied research in experimentation and technological development.

Courses and events: Lectures, workshops, seminars, and courses focused on strengthening the entrepreneurial culture and innovation, aimed both at the academic community and the general public.



UFPR research group in traffic psychology visiting THI © THI

Despite the great progress achieved over the past ten years, there are some challenges and new prospects for the work of the Agency. Perhaps the most relevant one is the implementation of the university's new innovation policy, which will allow us to take advantage of the advances achieved with the new Legal Framework for Science, Technology, and Innovation regulated at the beginning of 2018. This new policy defines new forms of relations between UFPR and the society, reinforces the competencies of the Innovation Agency, in addition to highlighting the strategic role of innovation in the university context.

Another relevant fact is the intensification of the innovation and entrepreneurship culture in the university context focused on teaching and research. Traditionally, the evaluation and incentive policy contemplates few aspects focused on innovation and relationship with the society.

The creation of the Innovation Center and the innovation units, entrepreneurship and creativity in the various sectors and university campuses, in progress, tend to promote new innovation projects by allowing greater integration between the departments and greater approximation with the society as a whole.



BEST PRACTICE AWARE

Binational Research on Material Sciences: Laser Cladding for Disk Brakes

Cooperation THI & UFPR

Maximilian Kiehl, master student at THI, started writing his master thesis in material technology in mechanical engineering under the supervision of Prof. Dr. Tetzlaff in 2018. In cooperation with Prof. Dr. Graf and Prof. Dr. Scheid of UFPR, part of his project was to produce disk brakes with a wear resistant surface coating. Therefore, he worked for one month at UFPR in Curitiba in October 2018. THI, UFPR and UFSC are realizing joint research in material technologies since the early beginnings of AWARE in 2013.

Prof. Dr.-Ing. Ulrich Tetzlaff
Professor of the Department of Mechanical Engineering, THI

Prof. Dr. Adriano Scheid
Professor of the Department of Mechanical Engineering, UFPR

Prof. Dr. Karin Graf
Professor of the Department of Mechanical Engineering, UFPR

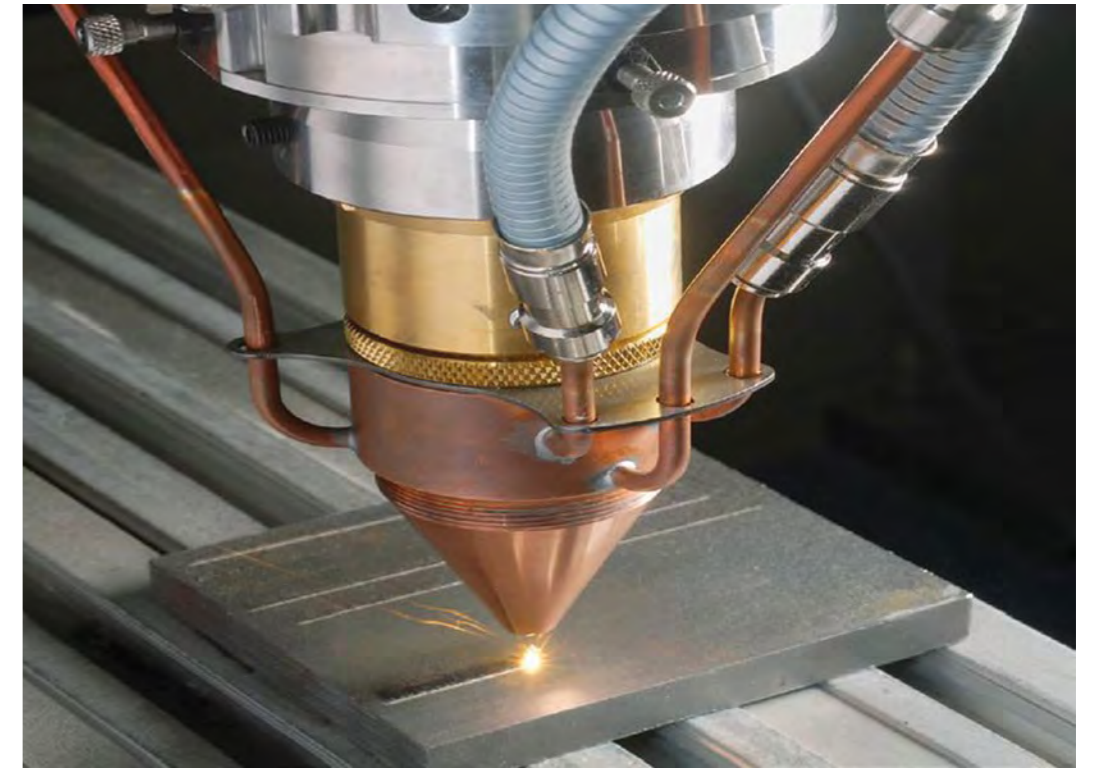
Maximilian Kiehl
Master Student of Technical Development, THI

Funded by
BMBF/DAAD (AWARE)

Project partner
THI, UFPR, Fraunhofer Institute for Laser Technology (ILT)

Since
October 2018

Contact
Prof. Dr.-Ing. Ulrich Tetzlaff (THI)
Prof. Dr. Adriano Scheid (UFPR)
Prof. Dr. Karin Graf (UFPR)
Maximilian Kiehl (THI)



Laser surface cladding on a flat sample (Dr. Andres Gasser) © Fraunhofer Institute for Laser Technology (ILT), Aachen

The aim of Kiehl's master thesis is to develop a wear resistant surface coating for grey cast-iron disk brakes by dint of laser cladding. This method is intended to enable the production of long-term disk brakes for automobiles in the future. A higher durability and the reduction of the brake abrasion, which decreases the particulate pollution, makes the disk brakes more environmentally friendly. Moreover, the coating provides corrosion resistance, thus preventing film rust formation on the surface coating of the disk brakes and enhancing the appearance from a customer perspective.

The coating consists of a cobalt-based alloy and is applied in form of gas atomized particles using a laser with a coaxial powder feed system as illustrated, provided by the Fraunhofer Institute for Laser Technology ILT. This generates a metallurgy bonded coating with a thickness less than one millimetre.

The coated specimen were tested for their resistance to corrosion and wear. During these tests, the analysis of the behavior of the macro- and microstructure is of particular interest.

The cooperation reveals the great potential of combining to complementary strengths of two universities to work successfully on one task: UFPR has more capacities in their laboratory for the required sample specimen coating and microstructure analysis, whereas THI disposes of comprehensive instrumentation for the surface evaluation⁴².

⁴² Read more about the joint research projects between Professor Tetzlaff and UFSC (Prof. Dr. Márcio Fredel) in AWARE publication 2013-2016, p. 172-173.



BEST PRACTICE AWARE

Field Study in Brazil: Comparing Marketing, Sales and Media in Germany and Brazil

Cooperation THI, UFSC & Senac

THI Business School sends more and more master students for research stays to Brazil. One project dealt with a market analysis of electric cars in Brazil in cooperation with AUDI AG; a further project examined the transferability of a German discounter to Brazil; and a third one was dedicated to the internationalization of the football club FC Ingolstadt 04 at the production facility of Audi in Curitiba.

**Isabell Schuster, Nicola Knöbl,
Florian Ritzl, Vera Schollmeier**
Former Students of the Master Program
"Master Marketing, Sales and Media", THI

Funded by
BMBF/DAAD (AWARE)

Since
2014

Project partner
THI, UFSC, Senac

Contact
Prof. Dr. Marc Knoppe
(THI)

Vera Schollmeier's market analysis with AUDI AG was mainly a survey about the attitude of potential Audi customers and car dealers towards electric cars and an evaluation of trends and challenges for sale and distribution of electric cars in Brazil. She found out, that customers are generally interested in electric cars, especially due to its economic benefit, but still skeptical due to corruption in the country, inflation, a lacking infrastructure and high costs of purchase.

Nicola Knöbl and Isabell Schuster aimed at finding out if a German discounter concept would be successful in Brazil and recognizing the main differences between the countries. Their research is connected to the research of Brazilian consumer behavior in a comparative perspective (see page 162/163).

The topic of Florian Ritzl's master project was the internationalization of the soccer club FC Ingolstadt 04 at the production facility of Audi in Curitiba. In two weeks, he met responsible persons of professional soccer in Curitiba (e.g. the sports director of Atletico Paranaense), and spoke with a couple of workers at the Audi plant. He concluded that an event for employees' motivation at the plant could be realized with the soccer school of FC Ingolstadt (Audi Schanzer Fußballschule) and that there might be options for a cooperation with Atletico Paranaense.



Vera Schollmeier conducting her research in Brazil
© Vera Schollmeier



Florian Ritzl (left) in front of the production facility of VOLVO,
Brazil © Florian Ritzl



BEST PRACTICE AWARE

Brazilian Consumer Behavior in a Comparative Perspective

Cooperation THI & UFSC

Consumer behavior in Germany and Brazil became a focused research topic within AWARE. During her stay in Ingolstadt, Ludmila Barros (UFSC, Senac) analyzed the impact of the store environment on impulse buying behavior, and their differences between cultures, while Nicola Knöbl and Isabell Schuster (THI) were in Florianópolis following the question: “Would a German discounter concept be successful in Brazil and what are the main differences?”

Ludmila Barros

Professor of Interior Design, Senac
Master Student of Business Administration,
UFSC

Isabell Schuster & Nicola Knöbl

Master Student of Marketing,
Sales and Media, THI

Funded by

BMBF/DAAD (AWARE)

Project period

October 2017 to February
2018

Project partner

THI, UFSC

Contact

Prof. Dr. Marc Knoppe (THI)



Ludmila Barros (UFSC, in the center) during her research stay in Ingolstadt with Amela Dizdarevic (on the left) and Prof. Dr. Knoppe (on the right) © Ludmila Barros

The study of Ludmila Barros was designed to understand the relationship between cultural differences and consumer behavior, investigating the influence that store atmosphere factors exert on positive emotions and consequent consumer impulse buying behavior in conjunction with the individual culture characteristic and situational variables as moderators of this influence. To achieve the study purpose, a descriptive study was carried out making a survey with about 200 consumers at WestPark Shopping Center in Ingolstadt, with the support of THI students. A previous survey was also carried out in Florianópolis at Iguatemi Shopping Center. The results indicate that the influence of the emotions on impulse buying behavior is greater among the collectivist consumers, characteristic for Brazil, than among the individualistic consumers, characteristic for Germany.

In order to find an answer to their research question whether a German discounter concept could be successful in Brazil, Nicola Knöbl and Isabell Schuster used qualitative impressions and additionally conducted a survey in the leading supermarkets in Florianópolis (Bistek, Hippo, HiperBom and Imperatriz) using a standardized questionnaire. In total, the data of 350 questionnaires was evaluated and has shown that a German discounter concept – with certain adjustments to Brazilian culture – can be successful, and that for Brazilian customers price and promotion, two main aspects of the discounter concept, play the most important role in buying groceries.



BEST PRACTICE AWARE

Expanding the AWARE Network to Colombia

Cooperation AWARE & EAFIT

The initiation of cooperation with the Colombian partner university EAFIT is a strategic step to extend AWARE to further countries in Latin America. In 2018, Dr. Dagmar Tomanek participated as keynote speaker in a workshop on Industry 4.0 organized by EAFIT, and, in return, THI hosted a group of EAFIT professors and students to attend the first International Autumn School on Industry 4.0.

Lisa Hermsen

Research Manager International Projects,
THI

Dr. Dagmar Piotr Tomanek

Research Assistant focused
on Industry 4.0 and Digitalization,
THI

Funded by

THI, EAFIT, DAAD,
private funding

Project partner

THI, EAFIT

Since

2014

Contact

Dr. Dagmar Piotr Tomanek
(THI)

Since 2014, THI has been fostering a closer cooperation with EAFIT in Colombia, a university with approx. 13,400 students and 1,000 professors located in Medellín. The exchange became especially vivid through the developing contact between Dr. Dagmar Tomanek, research assistant focused on Industry 4.0 and digitalization at THI, and the Department of Production Engineering at EAFIT. Tomanek was invited twice to EAFIT: In 2017 to teach a four-day seminar on smart factories and digitalization and in 2018 as the keynote speaker for a workshop on Industry 4.0 with more than 120 participants from industry and science.

Aiming to intensify this promising strategic cooperation, THI and EAFIT developed an International Autumn School on Industry 4.0 at THI, hosting 28 students and professors from EAFIT, UFSC, UFPR at THI. Besides theoretical input through lectures by experienced THI professors, the program also included discussions with experts and company and plant visits combined with cultural excursions to Munich, Erlangen, Freising and Augsburg. The interdisciplinary approach of the program allowed the participants to put theory into practice and get to know the regional specifics and technical standards in Industry 4.0 in Southern Germany.



EAFIT students at Fraunhofer Learning Factory Augsburg
© THI



Dr. Tomanek at EAFIT in Medellín, Colombia, in summer 2018
© Dagmar Tomanek and EAFIT



BEST PRACTICE AWARE

Expanding the AWARE Network to Argentina

Cooperation AWARE & UTN

Within the scope of identifying further strategic locations in Latin America, Argentina and its largest engineering university UTN – Universidad Tecnológica Nacional – turned out to be a further strategic partner country for the AWARE network. After first academic exchange and sharing best practices in network management of strategic partnerships, AWARE organized an innovation forum in automotive engineering at UTN's automotive faculty in Buenos Aires in 2018.

Anne-Sophie Lohmeier
Operative Director of AWARE, THI

Carla Allende
International Relations, UTN

Funded by

THI, UTN, DAAD Program
"Summer Schools in
Germany", Bayerische
Forschungsallianz
(BayFor)

Since

2017

Project partner

THI, UTN

Contact

Anne-Sophie Lohmeier
(THI)
Carla Allende
(UTN)



Carla Allende (UTN) and Anne-Sophie Lohmeier (THI) presenting AWARE in a videoconference on innovative higher education strategies and governance of strategic networks © UTN

Besides Brazil, neighboring country Argentina is one of the strongest automotive clusters in Latin America. In 2014, THI's Dean for Internationalization paid a first visit to UTN, the biggest national university in engineering sciences of the country, with 32 locations and 90,000 students. Especially its automotive faculty FRGP (Facultad Regional de General Pacheco) turned out to be a perfect match with the mobility-oriented THI. Since signing the first agreement in 2014, academic cooperation has been prospering: Since THI has been offering DAAD-scholarships to UTN students to participate in the International Automotive Summer School at THI, this yearly event counts on a group of participants from UTN.

Besides academic exchange, UTN's rectory invited the AWARE coordinator Anne-Sophie Lohmeier in 2017 to give a presentation on innovative higher education strategies and governance of strategic networks at a conference on internationalizing higher education in Buenos Aires. Based on this exchange on university governance, a new tri-national project called "USE – Universities. Society. Entrepreneurship" was developed between THI, UTN and UFPR and recently submitted to DAAD within its funding program "DIES – Dialogue on Innovative Higher Education Strategies" funded by the Federal Ministry for Economic Cooperation and Development (BMZ).

Last but not least, AWARE organized together with UTN a first joint innovation forum in automotive engineering in Buenos Aires, initializing successfully first joint research projects between the research and test center CARISSMA and UTN in the area of electrical vehicle drives, autonomous driving, electric mobility and automotive composites. The Forum was funded by the Bayerische Forschungsallianz.

*6.
Innovation &
Transfer to
Society*



Overview

6.1.1 Innovation & Transfer to Society in Germany

Georg Overbeck

Administrative Director Research Center (ZAF), THI

Third Mission

On the anatomy of a many-faceted term

Within German higher education, opinions regarding the meaning of “Third Mission” vary greatly. This does not come as a surprise given that perspectives can be markedly different according to the type of higher education institution as well as with regard to each individual university’s perspective. Nevertheless, or maybe for this very reason, this many-faceted term has been increasingly disseminated and critically reflected within the university sector in recent years. The newest and most outstanding example of this is the German Federal and States government funding measure “Innovative Hochschule” (“Innovative University”) of the German Federal Ministry of Education and Research. This was put out to tender last year, with the first projects prepared and implemented in the context of collaboration between different partners in the first half of 2018. “Innovative University” is devised for smaller traditional universities and Universities of Applied Sciences (UAS), which are to be supported in the sustainable development of meaningful concepts to share ideas and novel ways of dissemination of knowledge with relevance to society.

Regarding the meaning of Third Mission the following main points emerge from the tendering text “Innovative University” and its underlying administration agreement:

- As already suggested by the name, Third Mission, deliberately includes activities outside of pure teaching and research that
- thus go beyond the internal structure of the individual university and
- pursue a long-term, reciprocal exchange via the external structure (keywords: interaction loops, makerspace, co-creation)
- address practical challenges formulated and acted on in the region itself as the individual university’s sphere of influence

What makes the difference?

Now every modern and vibrant university can refer to diverse activities in its social surroundings, whether in the form of student initiatives, student science projects with local industry, open days or contract research. So, what makes the Third Mission concept so different? At first glance, this question seems easy to answer: The difference is that all these activities summed up under the catchword Third Mission are clustered into one long-term strategic approach, or in other words: have become a new institutional task. This is apparent

- within the strategic area: as the development of an adequate transfer strategy (compulsory criterion for approval within the funding measure “Innovative University”)
- within the structural area: as pooling and expanding future Third Mission activities
- within its contextual content: as it pursues genuine extramural interaction activities to solve practical problems

Albeit a rather general suggestion, this last aspect is essential and presents various challenges in the light of the actual implementation measures, depending in characteristics and scope very much upon the type of the higher education institution and its partners. From the UAS perspective, the crucial success factor has hitherto been a powerful all-around problem-solving culture in the form of bringing together competences from science and local industry (see page 142 ff.). Since UAS as a rule are financed through short-term projects and not through public funds in the long run, they essentially have to rely upon commissioned, demand-driven research for further developing existing or as yet unresearched and untested scientific technologies. This traditional, principally technological perspective is now to be fundamentally challenged, as the term “Innovation” within the context of Third Mission

- goes beyond the mere technical and market-oriented focus referred to, thus
- ensues sociotechnical innovation processes which are also to be carried into mainstream society, in order to
- cope with real-world problems that affect everyone.

As far as the aforementioned sociotechnical innovation processes are concerned, the term innovation should not be positioned in technical innovation or marketability but on its use from a mainstream society perspective; thus, an innovation may also involve a new app, a new kind of crowdsourcing method or novel citizen participation or urban planning projects. This comprehensive readjustment can also be seen in the light of the increasingly important role of the so-called “Grand societal challenges” within German funding policy and programs⁴³. Furthermore, this term suggests that these activities are no longer solely aligned to scientific disciplines or to the solving of specific individual problems but understood within the much broader scope of certain comprehensive key topics such as digitalization, demographic change or the mobility of tomorrow. Consequently, this broad perspective from a UAS point of view demands the strategic inclusion not just of local industry, but of all possible future stakeholders, these now ranging from business and politics and also to civil society and its natural environment. Then vice-versa traditional universities characterized by the humanities will likewise increasingly have to seek access to more cooperation with local industry. Different institutional profiles, such as UAS and traditional universities may also be complementary and thus brought under one umbrella concept such as the joint Third Mission project “Mensch in Bewegung” of THI and Katholische Universität Eichstätt-Ingolstadt (see page 174 ff.). This wide opening to society may also have the positive side effect to re-legitimize science in those cases where its objectivity has been increasingly questioned recently.

⁴³ Wissenschaftsrat | German Council of Science and Humanities; Grand Societal Challenges as a Topic for Science Policy; Position Paper; Stuttgart; 2015.

Background

Knowledge created locally is characteristically tied to its specific location as suggested in the so-called “Diamond Model” by American economist Michael E. Porter. Producing knowledge is therefore gaining more importance in comparison to the other classic production factors (land ownership, capital, labor) in our globalized, networked and highly specialist world. In doing so, the role of universities in value or knowledge creation is also increasing. It goes without saying that the interrelationship between research results, implementation projects and future partnering institutions as well as the integration of mainstream society establish a certain “resilience”, thus creating market-entry barriers. Therefore, the transfer of knowledge and technology has become an important strategic instrument for regional economic policy of national governments as well as of supra-national and international institutions. Thus, universities, rooted firmly in society, are among the most important knowledge bearers. Regarding the latter, the so-called “Quintuple Helix” provides the necessary theoretical background as it extends the well-known Triple Helix Model theorized by Henry Etzkowitz and Loet Leydesdorff⁴⁴: The new “Quintuple Helix” adds the two further dimensions civil society and environment⁴⁵ to the previous triad of research, industry and politics that constituted – together with academia – the “Triple Helix”. This in turn once more illustrates that the concept of innovation must go beyond the mere technological dimension and be seen within the broader context of other important social and ecological subsystems.

New transfer formats

How can a broad interaction with society which rightly earns its name as such be brought to life against this background? At least from the perspective of UAS, whose education and research activities are relevant to local industry, a first step might be to leave the beaten one-way tracks “Technology Push” and “Market Pull”, and to convert them into multiple interaction loops between the five dimensions within the Quintuple Helix. This in turn requires new and innovative forms of communication and cooperation processes. This requirement is reflected in the invitation to tender for the funding measure “Innovative University” which visually depicts universities as “Innovation Poles” rather than “Innovation Motors” or – in more simple terms – “Transmission Belts”, as it was the case in previous policy statements and funding programs. Nowadays, dialogue processes with as much participation as possible from all stakeholders are to set in motion future solutions for local societal challenges. These individual transfer measures have largely first to be developed or tested as a whole. From this point of view, the funding measure “Innovative University” serves as a type of “experimental laboratory”, a field test for the total of 48 universities, altogether endowed with 550 million Euros until 2027⁴⁶, to create appropriate new transfer competences and formats. The example “Mensch in Bewegung” shows how this transformation into a broader socioeconomic dimension also corresponds to novel transfer formats (see page 174 ff.).

Main opportunities and risks

There is a great opportunity to make use of the already existing resources at each university in the form of the many faceted unselfish engagement of university members as well as centrally bundling all these hitherto dispersed activities. A comparison with research activities at UAS, officially entrusted to them only some ten years ago, outlines that intrinsic motivation might be the driving force. However, one should bear in mind the comparatively high teaching load especially at UAS. Another, more recent parallel can be drawn to the funding program Strategic Partnerships and Thematic Networks (see page 113 ff.), which was similar insofar that it also devised a strategic bundling of activities with partners outside of the applying universities, albeit particularly in the field of internationalization: Either way, success depends often upon improving the human resources side, increasing satisfaction or job motivation, and thus cooperativeness and identification with the respective “own” university. In the end, each university has to find its individual balance between intrinsic and extrinsic motivation such as

⁴⁴ Henry Etzkowitz and Loet Leydesdorff (eds.), *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*; London: Pinter; 1997; pp. 155-162.

⁴⁵ Elias Carayannis, David Campbell; *Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other?; A Proposed Framework for a Trans-disciplinary Analysis of Sustainable Development and Social Ecology*; *Journal of Social Ecology and Sustainable Development*; 2010; pp. 41-69.

⁴⁶ <https://www.innovative-hochschule.de/de/startseite>, accessed on 08/08/2018.

providing room for job enrichment whenever possible to achieve a sense of “what we do together is important” or to reduce the high teaching load at UAS mentioned above.

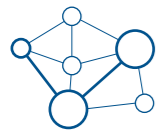
“Community Engagement” or “Outreach” pushed and realized by university members are tender shoots that must be carefully nurtured. Otherwise they remain just a flash in the pan without any long-lasting impact. Thus, so-called “slack time”, unstructured time without specific outputs or procedures attached to it, allows room for creativity and invention. It is, from a long-term perspective, also clear that Third Mission activities are mainly depending on synergies with teaching and research. Or, to put it bluntly, Third Mission can also be regarded as a kind of “boarder” dependent upon the goodwill of the universities’ “heartland”: teaching and research. Thus, it is crucial to reduce any existing “trade-offs” and creating “win-wins” between teaching, research and Third Mission. Consequently, this resource related consideration is also of strategic importance for the profile of each university: How does it position itself? Demand-driven? Research-related? As University of Technology? Open only to certain stakeholders or to the world? Furthermore, if the Third Mission is taken seriously, it does become a task that must continuously be financed and supported by each institution and its community inside and outside. This gives way to the question how the community outside the academic walls shall be integrated. Thus, the keywords mentioned at the beginning of this essay (interaction loops, makerspace, co-creation) have to be continuously imbued with life, more specifically with activities of citizens who are to be regarded as active subjects – quite similar to a company or policy makers – and therefore embedded within the Third Mission. The question arises how far this concept of participation goes, as the Third Mission main target group is outside of the closer academic community:

- How high may/ought the degree of external influence be? To what extent can freedom of research and teaching be reconcilable with external agenda setting?
- What is meant by participation? For instance, how far does citizen science go in the future?
- Who defines what is the common good? Is it compatible with aggregated individual interests?

Here, above all, it is a matter of finding the broadest possible interfaces between Third Mission on the one hand and the core fields of teaching and research as well as strategic entrepreneurship and internationalization on the other hand. Both of these two comparatively new fields which have been implemented for a few years now might also offer routines and practices concerning interaction between academia and society that might in part be replicated for Third Mission activities. Still, Third Mission embraces much larger parts of society in comparison to these two fields and therefore presents a more complex challenge.

Conclusion

As the Quintuple Helix concept already suggests, Third Mission activities are not confined to universities but also viable options for other institutions such as museums, libraries, collections and foundations which are often, next to their core activities, increasingly becoming aware of new transfer possibilities and challenges beyond their walls and own core mission. However, the understanding of the Third Mission and its corresponding activities varies greatly, just as formulated at the opening of this essay. According to the respective institutional profile, its mission, trajectory, funding schemes and local partners, different interests, needs and scopes of action emerge, as a rule resulting in stronger institutional profiles. In the end, all Third Mission endeavors make, in one way or the other, cultural connections between different worlds and eventually find their way back to teaching and research at universities or the relevant core activities within extramural institutions. A broader perspective embracing universities in different countries, cultures and languages leads to the overall conclusion that Third Mission on the one hand departs from sciences and technology, and on the other hand is all about an insight into their role as social forces that shape the future.



Example

6.1.2 Third Mission Project: “Mensch in Bewegung” at THI

Thomas Bartholomé
Project Coordinator
“Mensch in Bewegung”, THI

Melanie Stowasser
PR Coordinator
“Mensch in Bewegung”, THI

At German universities, the idea Third Mission is gaining more and more in importance. Third Mission extends the original tasks of universities, teaching and research, by adding another aspect: transferring knowledge and innovation into society. The initiative “Innovative Hochschule” (innovative university) of the German Federal Ministry of Education and Research, aims to support a mutual exchange between universities and representatives of politics, economics, culture and society. A research-based transfer of ideas, knowledge and technology is seen as the precondition for solving economic wealth and quality of life in the corresponding region. Technological and social innovation shall create constructive solutions for today’s most pressing challenges.

Within the scope of “Innovative Hochschule” THI and Catholic University of Eichstätt-Ingolstadt (KU) obtain financial support by the government. For five years, both universities receive EUR 15 million. The joint project “Mensch in Bewegung (MiB)” aims at contributing to a sustainable development of the region⁴⁷. THI is focusing on technical and economic aspects and has stable connections to the industry as well as to economic players in the region. KU contributes social aspects with a strong focus on ecology and sustainability. MiB gives both universities the opportunity to bundle their individual strengths. The combination of the different perspectives is to generate creative innovations.

⁴⁷ <https://www.mensch-in-bewegung.bayern/>, accessed on 27/10/2018.



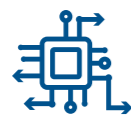
Seniors Action Day at THI © THI

In the past, both universities focused mainly on cooperating with local enterprises. MiB has the objective to extend this collaboration to the broad public. Together with representatives of the local economy, politics, culture and the society in general, THI and KU intend to develop a network for the transfer of knowledge and technology. The topics, summarized in so-called transfer clusters, are Innovative Mobility, Digital Transformation, Sustainable Development, and Civil Engagement.



In detail, the cluster Innovative Mobility, intends to create innovative mobility concepts and instruments for the region. In addition, it plans to create awareness for and to strengthen the acceptance of these concepts within society.

One of the project teams, for example, researches the impact and acceptance of connected automated driving. The event “Seniors Action Day” allowed examining the specific knowledge of elderly persons, considering the latest developments in automated driving. Furthermore, researchers analyzed the requirements that seniors have, towards vehicles that would transport them autonomously from A to B. In a driving simulator, the 70 participants had the opportunity to practice automated driving. Additionally, the seniors could test modern windshield displays as well as virtual reality glasses. In a discussion with students, they talked about the advantages and ethical aspects of automated driving.



The transfer Cluster Digital Transformation deals with the question how the local region, especially the people living in that area could take advantage of the technological progress in digitization.

Considering the challenges of digitalization, an objective of the cluster Digital Transformation is to collect information on the question what kind of support and counselling the universities could offer to business people as well as to the civil society. At an evening event with members of the local Chamber of Industry and Commerce (IHK), project members spoke about Risks and Chances of Digital Transformation, IT-Security as well as about Sustainable Digitalization. Afterwards, the audience had the opportunity to discuss these topics in workshops. Basing on the workshop results, the cluster-team will now create professional trainings. Furthermore, an online platform will be set up, offering people to exchange their experience and read about best-practice cases in terms of digitalization.

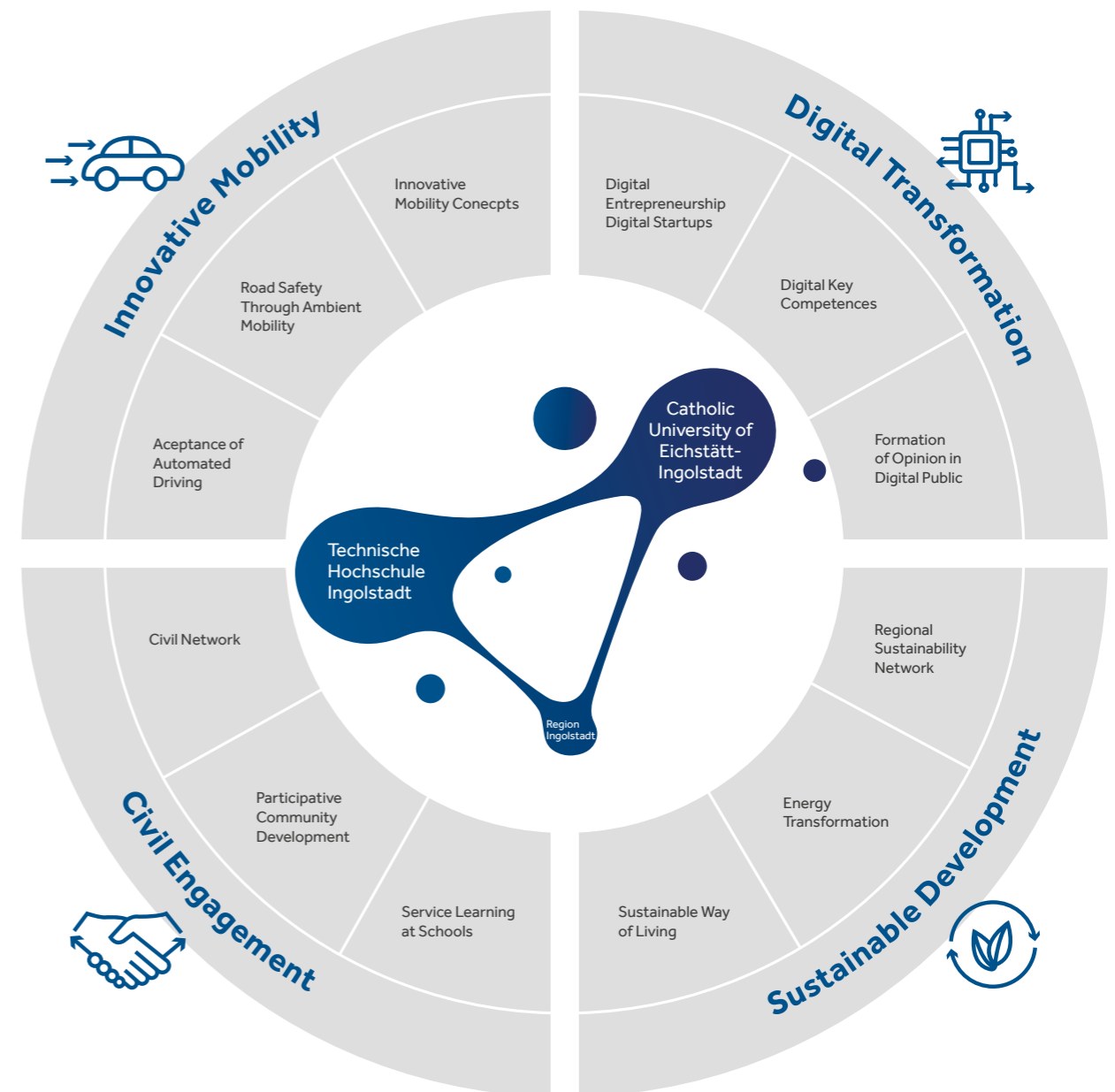


The cluster Sustainable Development aspires to stimulate sustainable thinking and acting, which should support the general development of the region in a positive manner.

The first step is to monitor the regions present status in terms of sustainability. The monitoring results are then used to create an online-based balancing system. Households and individuals can use this system to check how sustainable their personal thinking and acting is at the moment and what they can do to improve their ecological footprint. Additionally, an energy transformation tool will be set up. This tool is supposed to encourage enterprises, households and individuals to control their energy consumption and their energy mix. Accordingly, this aims to increase the use of regional and renewable energy sources and accelerate the energy transformation. Another project of this cluster is to establish a sustainability concept for Landesgartenschau (Federal State Horticultural Show), taking place 2020 in Ingolstadt. The Show will have the motto "Sustainability". Following a circular walk, visitors will find many information about sustainable thinking and acting.



The cluster Civil Engagement aims at encouraging citizens' voluntary engagement in the region. The plan is to provide an online-based transfer platform. Here, people intending to volunteer will find information about organizations as well as about available honorary positions. Moreover, the platform will provide information about transfer activities with regional partners. Non-profit organizations will therefore receive the opportunity to promote their work and interact with potential volunteers.



Overview

6.2.1 Innovation & Transfer to Society in Brazil

Prof. Dr. Leandro Gorsdorf
Vice-Director of Extension, UFPR

Third Mission in Brazil: From Córdoba to the process of democratization

The advent of the discussion on extension – the Brazilian designation for Third Mission – in Brazil was influenced by the discussions in the events that took place in Córdoba on June 21st 1918 and which are considered to be the beginnings of university extension in Latin America. That was when students at the University of Córdoba made public their manifesto demanding the academic world to open its doors and give attention to social issues. They wanted the University of Córdoba to enhance extension efforts and to look beyond its walls; to include free higher education; to create mechanisms to ensure university autonomy; public admission to teaching careers and direct elections for the chancellor's office. These were crucial demands that pointed to certain issues in order to achieve changes in universities and university teaching that would lead us to democratic and socially committed universities.

In Brazil, the starting point was in 1931 when the Brazilian Universities Statute was drafted. When defining the concept of extension, the document appeared to be unaware of the contribution of the Córdoba manifesto. Rather, it turned to the North American concept of extension and this became one of our greatest influences. Extension was closely linked to economic growth and its purpose was to disseminate technical and scientific knowledge. This was what was offered through courses and technical assistance to meet the needs of rural areas, identified as places behind the times but fundamental for the country's development. The institutions that emerged in the wake of the Statute did not ensure a more relevant role for university extension.

At the end of the 1950s and the beginning of the 1960s, Brazilian university students, within the National Students' Union (UNE), organized cultural and political movements recognized as fundamental for preparing the leaders that the country lacked, in addition to demonstrating strong social commitment and seeking an interprofessional way of working via methodologies that made reflection on their practice possible. Notwithstanding the dynamism it stamped on Brazilian civil society, the student movement of that time did little to contribute to the institutionalization of university extension. When the military dictatorship came to power, the long-demanded basic reforms took place, albeit with modifications. In the field of education, there were three important initiatives. The first two of these relate to the creation in 1966 of the Rural Community Training and Action Centre (CRUTAC) and to the Rondon Project.

The Rondon Project was created in 1967 and is still in existence today. It was particularly active in the 1970s and 1980s and became well known throughout Brazil. With its motto "Integrate to prevent giving in" ("integrar para não entregar"), proper to the civic-military government period, the Rondon

Project was an important action in relation to the polarized debate on the "extension or intervention" dilemma. At the end of the 1980s, the Rondon Project ceased to be a Federal Government priority and ended in 1989. In 2005, in another guise, the Rondon Project reappeared on the governmental program agenda and its coordination fell to the Ministry of Defense. Today the Rondon Project is in the process of being consolidated and is increasingly sought by universities and university students. It is characterized as a moment when students are present in communities completely different to their origins. Nevertheless, it is appropriate to question the nature of this action, given that students remain for a short period in these communities and with no perspective of returning there afterwards. As such, some of the guiding principles of university extension have been displaced.

The Mixed CRUTAC/MEC Commission – Outlying Campus/MINTER, created by the Ministry of Education and Culture (MEC) and the Ministry of the Interior (MINTER), had the role of proposing measures aimed at institutionalizing and strengthening university extension. Standing out among the Commission's proposals is the creation of the Extension Activities Coordination Body (CODAE), which came into existence in 1974. One of its first productions was the University Extension Work Plan. Under the influence of the ideas of Paulo Freire (1992), it defined extension as an institutional action aimed at meeting the needs of organizations and populations, with a sense of feedback and exchange of academic and popular knowledge. From this perspective, working-class people ceased being the object of extension actions and instead became the subject thereof, thus denoting significant progress in relation to the notion of university extension built in the preceding decade. The progress introduced by the University Extension Work Plan practically coincided with the beginning of the process of the "slow and gradual opening" of the Military Regime. Indicating the revitalization of Brazilian civil and political society, at the end of the 1970s and the beginning of the 1980s, countless peoples' movements and civil associations emerged, including trade unions; legislation on political parties underwent reforms, which enabled the creation of new political parties; and, finally, political amnesty was approved. In the midst of the struggle for the redemocratization and reconstruction of political and social institutions, the concept of the public university was reformulated, teaching, research and extension practices were redefined and the existentialist vision of extension actions was questioned. From then on, university extension came to be seen as a process articulating teaching and research and interacting with the new social movements. Although still restricted to the procedural dimension, the quest to institutionalize extension became the main challenge. The understanding was that such institutionalization should involve the entire public university.

Forum of public university pro-vice-chancellors for extension: Concept and principles of university extension

The gestation of the building of the concept of extension began in 1999 with the National Extension Plan and was reinforced over years of discussion between the public universities. In 2010, the National Extension Policy provided the following concept:

University extension, based on the constitutional principle of the inseparability of teaching, research and extension, is an interdisciplinary, educational, cultural, scientific and political process that promotes transformational interaction between the university and other sectors of society.

Thus defined, university extension denotes a posture of the university within the society of which it is part. Its scope is that of an interdisciplinary, educational, cultural, scientific and political process, through which interaction is promoted that transforms not only the university, but also the social sectors with which it interacts. As stipulated by article 207 of the 1988 Constitution, university extension also denotes an academic practice to be developed inseparably from teaching and research, with a view to promoting and guaranteeing democratic values, equity and the development of society in its human, ethical, economic, cultural and social dimensions.

In order to characterize the differences of extension and the institution with regard to research and teaching, despite the inseparability between the other activities of this university tripod, five principles were established which established the parameters for framing an extension action. Therefore, in order for an extension action to be identified, it is imperative for the five principles to be present.

The five university extension principles defined by the Forum (FORPROEX) support any proposal for extension actions that may be defined, revealing the educational and, above all, the political character of extension actions that articulate the relationship between university and society. The principles are as follows: a) Dialogical interaction; b) Interdisciplinarity and interprofessionalism; c) Inseparability of Teaching, Research and Extension; d) Impact on student development; and e) Social impact and transformation.

A) Dialogical interaction

The principle of Dialogical Interaction gives priority to integrated actions, based on the understanding that the transformative relationship that is intended to be achieved through extension activities should take into consideration the demands of partners, the internal and external communities, the different areas of knowledge and the context in which the actions are developed.

The objective of dialogue here "is the problematization of one's own knowledge and its unquestionable reaction with the concrete reality in which it is generated and on which it bears influence, in order to understand, explain and transform in the best manner" (FREIRE, 1983, p.52).

This principle reaffirms that it is not the university that transfers knowledge, but rather that knowledge is shared and both contribute to strengthening and consolidating science and technology, making them accessible for the participants of projects and programs.

B) Interdisciplinarity, interprofessionalism and intersectorality

When thinking about the preparation of students in a complex society, postgraduate specialization and the process of disciplinization in degree course curricula need to be rethought. For this reason, extension actions have interdisciplinarity as a guideline, based on the understanding that extension can contribute to preparing a professional who understands this complex and fragmented reality and who demands the replacement of abstract and out of context teaching by teaching that is concrete and everyday, and which establishes the dialogue between the world as it is lived, conceived and perceived.

In order to promote social changes, intervening in reality must enable the interaction of concepts and methodologies coming from various disciplines and areas of knowledge, in addition to fostering intersectoral, interorganizational and interprofessional partnerships. Working in society and with disadvantaged groups requires the contribution of knowledge areas that need to dialogue in order to meet demands which involve a multiplicity of needs. This interaction between different areas and sectors provides students with the opportunity of confronting disciplinary limitations and interdisciplinary imposition in order to understand phenomena of a multiple nature.

Demands put forward by society require the conjugation of different disciplinary knowledge. Disciplinary knowledge is understood to mean: knowledge gained through experience, technical knowledge and theoretical knowledge interacting in a dynamic way with no linearity or hierarchization that subjugates the professionals taking part.

C) Inseparability of teaching, research and extension

This principle intends to generate a movement in the process of higher education knowledge production and socialization, by relating teaching (ownership by students of knowledge historically produced by humankind), research (production of new knowledge) and extension (intervention in social processes and identification of problems related to practice and which require new research).

Extension cannot dispense with solid theoretical foundations, arising from knowledge generated by research and forming part of teaching activities. In other words, a transformative intervention depends on research and teaching being integrated in educational activities while, at the same time, interventions awaken new questions that direct investigation, fomenting research that contributes to social transformation; and knowledge, methodologies and results arising from extension activities should be structured as teaching units, boosting teaching activities and contributing to students being prepared to exercise citizenship.

D) Impact on student development

University extension activities are decisive in preparing students, given that they instigate the expansion of theoretical, methodological and interdisciplinary benchmarks in the context of the communities where they operate and, above all, because they foment direct contact with the main contemporary problems.

Extension actions that provide students with experiences in communities and social groups in situations of social, economic and cultural vulnerability, make them perceive the world around them in another manner, including resignifying and transforming their practice and their knowledge.

Experience gained through university extension enables students to reassess the pathways they will follow. In their university courses, it can influence the way they perform academically and enable the creation of excellent work. This experience also provides the opportunity of relating with the academic community in a broader and more in-depth manner. This means that extension plays an important role in student preparation because it enables articulation with society to be present not only in intervention processes, but also and above all because of the role it plays in the foundation and justification of research that provides the basis for enhancing professional performance, in addition to enabling teaching to be integrated with social reality.

E) Social impact and transformation

A principle of university extension is doing activities with society, with the aim of generating impacts and producing social transformations capable of reducing inequalities and addressing social exclusion.

Extension looks towards respecting the characteristics, needs and interests of the community where extension activities are carried out, with the aim of creating conditions for the consolidation of activities that contribute to its development, to regional development and to the strengthening of public policies, always in such a manner as not to replace the State in the development of public policies, but rather cooperating in the sense of analyzing them critically. Intervention should focus priority issues, and be sufficiently wide-reaching so as to enable activities to be carried out in a manner that is integrated with the community, making it autonomous and capable of maintaining actions committed to social change.

This principle intends to give priority to issues by acting without ignoring the scope of the complexity and diversity of social reality, so that the action, or set of actions, may be sufficient to offer contributions that are relevant for the transformation of the area, sector or community on which they are brought to bear in order to effectively solve the problem.

Extension cannot be the mere transmission of knowledge that is repetitive both for the university and for the community, but rather it must be the continual process of transforming all those involved, students, teachers, community, companies, State.

Articulation between these different stakeholders enables us to think about the present and plan the future, the destiny of our political community.

Classification of extension actions

Extension actions are classified into program, project, course, event and service provision, and are defined as follows:

- Programme "Articulated set of projects and other extension actions (courses, events, service provision), preferably integrating extension, research and teaching actions. It is of an organic or institutional nature, has clear directives and guidance for achieving a common objective, and is implemented in the medium to long term"
- Project "Procedural and continuous action of an educational, social, cultural, scientific or technological nature, having a specific objective and a fixed time limit". A project can be:
 - Linked to a program (preferential form – the project is part of a cluster of actions)
 - Not linked to a program (project in isolation)
- Course "Teaching action, of a theoretical or practical nature, which can either be classroom or distance education, planned and organized in a systematic manner, lasting for at least eight hours and having defined evaluation criteria"
- Event "An action implying public presentation and/or exposition, open to all or with a specific audience, of cultural, artistic, sporting, scientific or technological knowledge or products developed, conserved or recognized by the university"
- Service Provision "Performance of work offered by the Higher Education Institution or hired by third parties (community, company, public body, etc.); service provision is characterized by intangibility, inseparability of process/product and does not result in ownership of assets"

In order to achieve its fundamental mission, namely that of responding to the needs of society, the option was made to systematize public university extension activities in accordance with the following thematic areas:

- | | | |
|----------------------------|---------------|-----------------------------|
| ▪ Communication | ▪ Education | ▪ Technology and Production |
| ▪ Culture | ▪ Environment | ▪ Labor |
| ▪ Human Rights and Justice | ▪ Health | |

In each thematic area, actions are to be carried out in accordance with defined programmatic contents, taking care to stimulate interdisciplinarity. This in turn presumes the existence of thematic interfaces and interactions. Special emphasis must be placed on the participation of university extension sectors aimed at the majority of the population, at the continuing qualification and education of managers of social systems and at the provision of new means and processes of production, innovation and transfer of knowledge, thus enabling increased access to knowledge and technological and social development of the country.

Extension: Current situation and challenges

Today Brazil combines traits of its conservative and authoritarian past with institutional innovations wrought in the fight for redemocratization. We still keep to our longstanding tradition of modernizing without changing social structures. Clientelism, patrimonialism and corruption are still part of the practices that we want to be democratic and transparent. Inequality with regard to income and ownership of land, differences in access to goods and services, regional disparities, discrimination against the Black, the indigenous and women, among other ills, live alongside economic dynamism, technological innovation and development as a whole. We are proud to be one of the world's ten largest economies, but we frequently neglect the fact of being in 84th place in the global ranking of the Human Development Index (HDI).

In our cities, affluence and modernity live side by side with the most abject poverty and archaic structures of economic production and supply of public goods; when it is satiated, hunger is still satiated with scraps of food found in rubbish bins; natural phenomena, such as rainfall, still destroy lives and property because of the lack of urban infrastructure; people still die while on the waiting lists of

public hospitals; children and the elderly still wander abandoned on city streets. Although the poorest are always the most affected by the lack of public facilities, it is undeniable that everyone suffers from violence and pollution, everyone loses hours of work and rest owing to chaotic transport, among other ills. In rural areas, unequal income and unequal land ownership persist and fuel violence. Modernization of agriculture and lack of perspectives of improved living conditions continue to expel large numbers of youth, or even entire families, from rural areas so that they turn to larger cities, especially in Southern and South-Eastern Brazil. Moreover, despite some progress made in the early years of the 21st century, more recently there have been setbacks in guaranteeing rights.

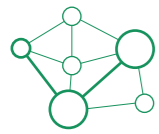
It is important to describe the Brazilian context in order to analyze how the public university and its extension actions have articulated themselves in the face of these national challenges. Among the setbacks indicated above, we have the approval of Constitutional Amendment 95/2016, which imposed a ceiling for Federal Government expenditure on Education and Health, which has directly impacted the public universities and their teaching, research and extension actions.

On the other hand, progress has been made with the national institutionalization of extension in public universities through two actions: The National Education Plan (PNE) 2014-2024 and the National Education Council's Resolution on Extension. PNE has a commitment to continuing efforts to eliminate inequalities, which are historic in Brazil. Its targets are directed, above all, to overcoming barriers to student permanence in educational establishments; educational inequalities in each territory, focusing on the specificities of their populations; preparation for the job market, identifying the potentialities of local dynamics; and exercising citizenship. The drafting of a National Education Plan cannot leave to one side the incorporation of the principles of respect for human rights, socio-environmental sustainability, the valuing of diversity and inclusion and the valuing of professionals who work to provide the education of thousands of people every day (MEC/SASE, 2014, page 9). PNE target 12 is part of the fourth group of targets referring to higher education, which, in general, is the responsibility of the federal and state governments. The objective is to raise to gross rate of enrolment in higher education to 50% and the net rate to 33% of the population aged 18 to 24 years-old, ensuring the quality of supply and expanding to at least 40% new enrolments in the public sector. As such, strategy 12.7 aims to "ensure that, at least, 10% of the total of curricular credits required for graduation relate to university extension programs and projects, the actions of which shall be directed, as a priority, to areas of greater social pertinence" (BRASIL, 2014). In this way, not only part of the students undergo the experience of university extension, but rather all of them, since extension activities will be included in the curricula of all Degree Courses, changing the way knowledge is taught, so as to potentialize the social commitment of the public university.

Furthermore, the highest body of the Brazilian National Education System, the National Education Council, is in the process of approving a resolution on guidelines for extension in public, private and community universities. When approved, this document will standardize and bind all universities to the principles and guidelines contained in it and which point in the direction of the discussions that have taken place for years within FORPROEX and its National Extension Policy.

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Example

6.2.2 Third Mission Success Stories at UFPR

Prof. Dr. Leandro Franklin Gorsdorf
Vice-Director of Extension, UFPR

Prof. Dr. Alessandro Zimmer
Professor of the Department
of Electrical Engineering, UFPR
Invited Professor and CARISSMA Researcher, THI

Prof. Dr. Ivan Eidt Colling
Professor of the Department of Polish,
German and Classical Letters, UFPR

Prof. Dr. James Baraniuk
Professor of the Department of
Electrical Engineering, UFPR

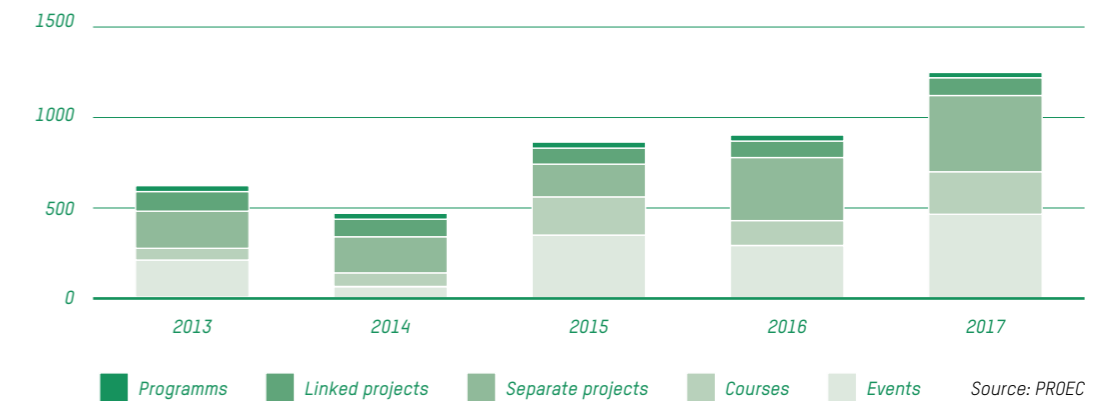
The earliest extension efforts at the Federal University of Paraná (UFPR) date from the 1940s, whereby the first records of extension activities show that they took place in the form of extension courses in the areas of Health and Engineering. In the years that followed, cultural actions were also added to that perspective of extension, such as the UFPR Choir (1958) and the Philharmonic Youth Orchestra (1962).

Within UFPR's organization chart, it was only in 1990, following an administrative reform inspired by the discussions of the National Forum of Public University Pro-Vice-Chancellors for Extension, that the Pro-Vice-Chancellor's Office for Extension and Culture (PROEC) was created at UFPR, with defined objectives, a staff team and a budget.

Since then there have been few changes and PROEC is structured as follows: Extension Coordinating Body; Culture Coordinating Body; Museum of Archaeology and Ethnology; and UFPR Press. Its mission is to promote and disseminate UFPR's policy on culture and extension, through information, production and interaction of knowledge with the community, based on values that aim to strengthen citizenship and diversity by means of dialogue with the community, aimed at democratization of knowledge, social justice and plurality of thought.

With regard to extension, we have Resolution 72/11 that regulates the process of recording, monitoring and evaluating extension. Since then, several actions have fomented the building of new extension actions and activities. Today we have the following data:

Overview of activities of extension



This process has become intensified and through extension being included in all curricula at UFPR it is our understanding that strengthening extension actions tends to create the possibility of producing scientific and popular knowledge and dialogues. It comes along with all the richness, conflicts and potentiality including extrapolating our territories, advancing in partnerships with other national and international universities, in the belief that exchange in this area can only enhance the involvement of students and teachers in social transformation.

Success story "Eletrizar" – Bringing Electrical Engineering to Schools

One of the extension activities developed by the Program of Tutorial Education (PET) in the Undergraduate Course of Electrical Engineering of UFPR involved the interaction with schools. This initiative gave birth to an independent project called Eletrizar – Levando a Engenharia Elétrica para as Escolas (Electrify – Bringing Electrical Engineering to Schools).

Eletrizar was created in May 2013, and its initial goal was to interact with children and teenagers in primary and secondary schools in order to show them applications, dangers, and rational use of electrical energy. The project started with two lecturers and seven students. After contacting administrators – head teachers, teachers, pedagogues – to present the project, to receive permission to visit the school, and to be informed of classes and ages, the students prepare presentations, experiments, and playful, interactive activities. The main focus is on public – state or municipal – schools.

Over time, the scope of the project was broadened, both by the interests of the members and by the suggestions made by the public, embracing different topics of electricity and magnetism, and of physics as a whole, as well as logic and computer programming. Another branch of activities is the promotion of guided tours in the University Campus with visits to laboratories; most of these activities are done in partnership with another extension project, Science for All⁴⁸.

⁴⁸ <http://cienciaufpr.blogspot.com/>, accessed on 18/10/2018.



Pupils experimenting at an event of Eletrizar © UFPR

Eletrizar is currently in its second edition. Every year, three to four students receive stipends (approx. € 80/month) from the Pro-Vice-Chancellor's Office of UFPR. These students act as a leading team, which motivates the whole group – whose vast majority consists of volunteers. In five years, a total of six lecturers and 43 students participated in the project – some of them for many years. In the last three weeks, we accepted nine new members, so that at present the group comprises four lecturers and 18 students (state September 2018). The majority of the students come from Electrical Engineering. Business Administration, Letters, Pedagogy, Physics, Chemistry are also present. 14 public schools and four private ones are in our register. By direct interaction or through its internet pages⁴⁹, the project reached 2,400 people.

Activities

There is a variety of experiments: electroscope, triboelectric run, writing with electricity, magnetic field lines, homemade battery, electric generator, electric motor, linear motor, Faraday's experiment, electromagnet, magnet-based accelerator, Hero's engine and chair of nails, which are adapted according to the age of the public. Since there is no specific budget for the project, prototypes must be as cheap as possible, being at the same time attractive, fun and educational – a constant challenge to creativity.

In 2013 and 2014, there was a partnership between Eletrizar and COPEL (Energy Company of Paraná). The company had an SUV equipped with interactive activities showing the path of energy, from the production power plant to the family houses. It was used in expositions, public schools and visits to communities. Students joined the activities, bringing experiments, interacting with people, and helping in the explanations done by the company technicians.

⁴⁹ <https://www.facebook.com/projetoelétrizar> and: <https://projetoelétrizar.wordpress.com/>, accessed on 18/10/2018.

⁵⁰ <https://scratch.mit.edu>, accessed on 18/10/2018.

⁵¹ <http://www.ufpr.br/portalfufr/noticias/exposicao-interativa-luz-ciencia-e-emocao-mostra-conceitos-de-optica-para-alunos-do-ensino-fundamental/>, accessed on 18/10/2018.

In 2014, a branch on logic and computer programming using Scratch was opened, a programming language developed by MIT that allows young people to create interactive stories, games and animations⁵⁰. Each year since then the group has taken part in Scratch Day, an event in which children and adults are challenged to create a computer game by their own. Workshops on Scratch are also very well accepted in schools (currently, there are workshops for seventeen classes in a state school).

In 2017, Eletrizar helped the organization of the three-month exposition Light, Science and Emotion⁵¹, and gave birth to another project: Lux – Educational Videos about Experiments on Light for Children. The event was an interactive exposition about light, destined for children between four and ten years old. There were more than 20 experiments involving art and technology, aiming at stimulating children to science studies. The experiments were developed by a voluntary architect, by the students of the extension project Eletrizar and by electrical engineering professors from Federal University of Parana. The exposition remained open from March to June of 2017 in the Municipal Museum of Art of Curitiba – MuMA and had more than 8,000 visitors, among them 100 guided visits from municipal schools. The project represents a new learning approach by integrating the university and the community through playful activities aligned to the curriculum of the elementary school. The use of art and technology led to broad public acceptance.

Final remarks

Students who get involved with Eletrizar deal with situations that are not usual in an engineering course – some of their tasks are: to meet school administrators, to create attractive, didactic experiments, to contact people with different ages and with a variety of profiles and to adapt their language to this public, to return to the school where they studied, or to get acquainted with the reality of public schools, to improve their creativity, to solve problems with a restricted budget and strict time constraints, to develop administrative, planning and collaborative skills. School teachers receive the benefits of a different experience to their pupils. Children and teens benefit from the interaction with this enthusiastic group – their interest in science, technology and knowledge is stimulated, and we hope that some scientific principles and applications are demystified, and that many of them realize that higher education at a public university can be on their horizon.



Experimenting with an electroscope © UFPR



BEST PRACTICE AWARE

Joint Project SAFE Nominated for Hermes Award 2018

Cooperation AWARE & Continental

With their joint research project SAFE for a novel integral safety system, THI and Continental made it to the top five of the internationally prestigious Hermes Award, the industrial technology prize awarded at Hannover Messe, the world's leading tradeshow for manufacturing technology held annually in Hannover. SAFE was presented to the public in the presence of German Chancellor Dr. Angela Merkel and Mexican President Enrique Peña Nieto at the fair's opening ceremony. The SAFE team includes two Brazilian junior scientists working at the research and test center CARISSMA.

Georg Overbeck

Administrative Director Research Center
(ZAF), THI

Funded by

Deutsche Messe AG,
Bavarian State/ Bayern
Innovativ GmbH

Project period

2017/2018

Project partner

THI, Continental

Contact

Prof. Dr. Thomas
Brandmeier &
Prof. Dr. Christian Birkner
(THI),
Michael Feser
(Continental)



Federal traffic minister Andreas Scheuer (on the left) informs himself about SAFIR and the nomination of the SAFIR partners THI and Continental AG for the Hermes Award 2018 at the Hannover Messe. On the right: Matheus Zimmermann (THI) © Bayern Innovativ

The acronym SAFE stands for Integrated Safety System for Autonomous Driving and Electromobility. Among all the nominees, SAFE was the only research cooperation between a university and a company that was nominated for this industry award of worldwide significance. The team in Ingolstadt also included two scientific assistants from Brazil who work at THI respectively at the research and test center CARISSMA simultaneously to their PhD in cooperation with their Brazilian partner universities.

The aim of SAFE is to predict precisely the severity of an impending crash and to trigger the vehicle's protective systems prior to and at the moment of the collision using cameras, radar and LIDAR sensors. The overall goal is to contribute to the further reduction of road fatalities by around half in the long term, while the long-term potential in emerging markets is much greater. An integrated safety domain control unit monitors which decision the security measurements will take.

THI-Professor Christian Birkner as well as both Brazilian CARISSMA employees Matheus Zimmermann and Fabio Reway presented the project to both national and international decision-makers and politicians including federal traffic minister Andreas Scheuer at the Bavarian joint stand in the hall Research & Technology. Naturally, SAFE was also presented at the booth of Continental and furthermore at a separate exhibition space exclusively designated to the Hermes Award nominees by Deutsche Messe AG itself. The exhibitors' message: predictive vehicle safety systems are crucial for autonomous driving as they contribute significantly to the acceptance of driverless mobility and guarantee customer acceptance. The Federal Minister of Education and Research Anja Karliczek solemnly handed over the nomination certificate to Professor Christian Birkner from THI.



BEST PRACTICE AWARE

Berlin – Brussels – Riga: AWARE Joining Pan-European Network Conferences

Until some time ago, universities often merely tried to attain a high number of university partnerships. Nowadays, they instead prefer a smaller number of strategically focused and result-oriented partnerships that match and enhance their institutional profile. Thus, these strategic partnerships also link with extramural research, businesses, and the related political institutions. In this light, representatives from AWARE are frequently invited to pan-European level conferences to talk about their experiences.

Georg Overbeck

Administrative Director Research Center (ZAF), THI

Funded by

DAAD, Academic Cooperation Association (ACA), Riga Stradins University

Since

2016

Project partner

DAAD, Academic Cooperation Association (ACA), Riga Stradins University

Contact

Georg Overbeck,
Anne-Sophie Lohmeier,
Fabio Reway
(all THI)



Key success factors for efficient network management © Anne-Sophie Lohmeier

⁵² Further information (in German): <https://eu.daad.de/service/veranstaltungen/2017/de/53594-staff-mobil-perspektiven-und-wege-fuer-die-mobilitaet-des-nichtwissenschaftlichen-hochschulpersonals>, accessed on 18/10/2018.

⁵³ Further information: <http://www.aca-secretariat.be/index.php?id=995>, accessed on 18/10/2018.

⁵⁴ Further information: <https://www.rsu.lv/en/events/conference-internationalisation-words-action>, accessed on 18/10/2018.

In Berlin, the National Agency for EU-Universities' Cooperation held its DAAD conference "Staff mobil", which dealt with lateral thinking in order to discover new paths and perspectives regarding future mobility and international exchange of non-academic and especially administrative staff. Within this context, AWARE gave insight into the comprehensive integration of THI's administrative staff into exchange activities. Due to AWARE's result-oriented approach, activities of academic and non-academic staff are increasingly interwoven both at a strategic and at an operational level. Thus, the respective activities comprise, among others, matchmaking between Brazilian and German academics, or preparation of double degrees and research proposals⁵².

It was the overall aim of the Brussels seminar held by the Academic Cooperation Association (ACA) to discuss the main trends in international partnership development with particular emphasis placed on the quality of these partnerships. In its presentation, AWARE addressed the specific challenges of the multidimensional nature of its governance. The goal is to gain mutual benefits despite the varying interests of the partners involved⁵³.

The main topic of Riga Stradins University's conference "Internationalization: from Words to Action" was the condensation and acceleration of cross-border interaction between education, research and social cohesion. Regarding the latter, AWARE has embarked upon its self-set goal to include wider society into its events whenever possible, e.g. our joint German-Brazilian eMobility Forum (see page 192-193)⁵⁴.



BEST PRACTICE AWARE

eMobility Forum: Working on Joint Challenges in Mixed Formula Student Teams

Cooperation THI, UFPR & UFSC

The eMobility Forum today is known as a hub for industry and academia in Germany and Brazil in order to discuss new trends and challenges for electric mobility of the future. Working jointly on current challenges of future mobility, after six years of regular meetings the forum today counts on a considerable network with a strong team spirit and long lasting personal connections.

Prof. Dr. Harald Göllinger
Professor of the Department
of Mechanical Engineering and
Scientific Director of AWARE, THI

Nils Strauch & Felix Becker
Schanzer Racing Electric, THI

Gustavo Nolla
Ampera Racing, UFSC

Funded by
BMBF/DAAD (AWARE)

Project partner
THI, UFSC, UFPR and
industry partners

Since
2013 (7 days / year)

Contact
Prof. Dr. Harald Göllinger
(THI)
Prof. Dr. Ewaldo Luiz de
Mattos Mehl
(UFPR)
Prof. Dr. Mauricio Porath
(UFSC)

Formula Student is an international design competition which challenges the teams to construct and build up a formula-style race car. It provides hands-on experience from the design to the construction of every part of a vehicle, contrasting with the reality of managing a team in the short and long scenario. The vehicles compete in various static and dynamic disciplines at events all around the globe.

Founded in 2013 within the AWARE network, the eMobility Forum today is considered a unique opportunity for international exchange between Brazilian and German formula student teams, researchers and industry to approach electric mobility in interdisciplinary and intercultural teams.

The basic idea of the forum is to gather student racing teams from Germany and Brazil, in order to exchange knowhow, experience and hands-on advice from academia and industry. Due to the fact that the different teams face similar challenges and competition rules, they enter directly into technical discussions without any major intercultural or linguistic obstacles to overcome.

In 2018, three Brazilian student racing teams visited THI in order to work together with THI's racing team Schanzer Racing on projects and exchange experience in marketing, internal organization and sponsoring. Besides a public panel discussion and a practice-oriented workshop on Reinforcement Learning, the four teams worked jointly on the concept and realization of a telemetry app, which visualizes dynamic parameters from the race car on smartphones, creating a thrilling feeling of being directly on the track. The forum ended up in a public testing event where the four teams presented their developed apps to a broader public.



eMobility Forum 2018 at THI © THI



BEST PRACTICE AWARE

Transferring Knowledge to Society: CARISSMA at SEPEX Week in Brazil

Cooperation AWARE & UFSC

SEPEX – *Semana de Ensino, Pesquisa e Extensão* – is a yearly event at UFSC campus where UFSC researchers and their partners present their main results and success stories in teaching, research and further outreach to a broad public. It is the biggest scientific promotion event in Santa Catarina. In 2018, THI was for the first time offered the chance to present its pedestrian simulator that uses virtual reality glasses, developed in Ingolstadt by CARISSMA researchers in order to test pedestrian behaviour in different traffic situations.

Matheus Zimmermann

Research assistant and PhD Student, THI

Funded by

BMBF / DAAD (AWARE)

Project period

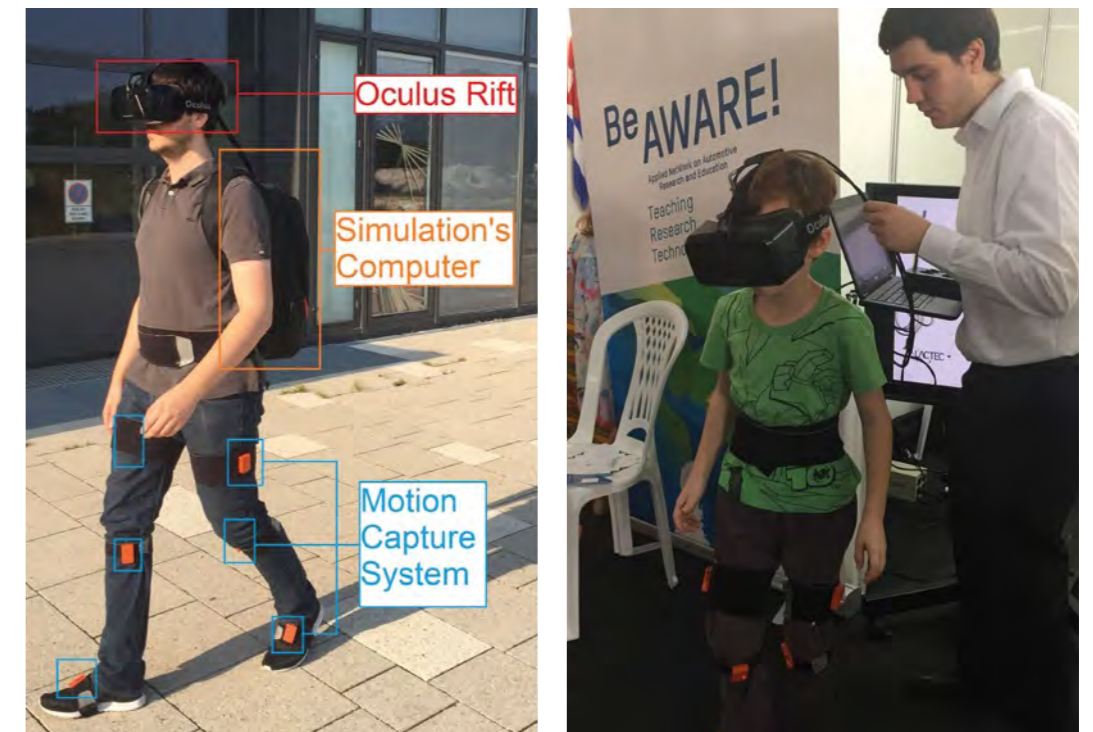
October 2018

Project partner

THI, UFSC

Contact

Prof. Dr. Rodrigo Vieira (UFSC)
Matheus Zimmermann (THI)



Equipment description. Pedestrian using the simulator © THI

Demonstration of the CARISSMA virtual reality glasses at SEPEX week © THI

SEPEX is a yearly opportunity for the academic community of UFSC to share their results with the broad society in the state of Santa Catarina. The event takes place at UFSC campus, on an open area of round about 5,000m². Completely open to the public, the exposition week includes around 200 stands with projects on areas such as communication, culture, education, technology, environment, work, human rights and health. The multimedia character of the exposition allows the public to experience research and created knowledge. A comprehensive program of mini-courses, lectures, cultural events and seminars on scientific initiation helps to deepen knowledge and understanding of those interested.

In the past, a CARISSMA research group had the opportunity to run tests with its self-developed pedestrian simulator at UFSC in order to collect data regarding pedestrian behaviour in a variety of different road scenarios. The researchers, both from Brazil and Germany, subsequently discovered and compared different behaviours in different countries. The results serve to develop an on-board pedestrian detection system for vehicles, adjusted to different countries and markets.

In 2018, the whole pedestrian simulator project of CARISSMA was exposed at SEPEX week and most of the public could experience virtual reality for the very first time.



BEST PRACTICE AWARE

Brazilian Guest Lecture “Social Corporate Responsibility from a Brazilian Perspective”

Cooperation THI & UFSC

In order to internationalize teaching at Business School of THI, a Brazilian professor who is specialized in corporate social responsibility was invited as a guest lecturer for one semester to Ingolstadt. Funded by a DAAD-guest lecturer scholarship, Prof. Dr. Evelize Welzel stayed for one semester at THI offering international insights within the recently launched new master program in English “Retail & Consumer Management”.

Prof. Dr. Marc Knoppe
Head of Strategic Partnerships, Retail and Consumer Management, THI

Prof. Dr. Evelize Welzel
Professor for Corporate Social Responsibility, UFSC

Funded by
DAAD-Program “Guest Lecturers in Germany”

Project period
Winter term 2018/2019

Partners
THI, UFSC

Contact
Prof. Dr. Marc Knoppe (THI)
Prof. Dr. Evelize Welzel (UFSC)

Prof. Dr. Evelize Welzel from UFSC, Santa Catarina, has joined the THI Business School during winter term 2018/19 in order to extend THI’s offer in Corporate Social Responsibility in the new master program Retail & Consumer Management. The master program students will be able to determine the specific features of sustainable Brazilian retailing and consumption. In addition, Professor Welzel will cooperate in different research projects between Ingolstadt and Florianópolis. Her research and teaching stay are part of the close cooperation between the THI Business School and the UFSC as part of AWARE. Her stay is supported by DAAD and the funding line “DAAD guest lectures in Germany” with the specific goal to foster internationalization of teaching at German universities. Her lectures contribute a significant international perspective on retail and consumer management and thus to the recently launched master program at THI.

As an additional milestone, Prof. Dr. Marc Knoppe established an exchange program on research stays in Brazil in order to conduct research on electric mobility in Brazil, benchmarking of Brazilian Shopping Centers or a food discount for Brazil. None of these projects were possible without the support by DAAD, the close and trustful cooperation between UFSC and Senac in Florianópolis and the support of Professor Welzel and her colleagues at UFSC.



Bistek Supermarket, a leading Brazilian retailer and subject of analysis within the guest lecture of Evelize Welzel at THI © THI

List of Abbreviations

German Partners and Further Institutions

BAYLAT	Bayerisches Hochschulzentrum für Lateinamerika / Bavarian Academic Center for Latin America	IHK	Industrie und Handelskammer / Chamber of Industry and Commerce
BayWISS	Bayerisches Wissenschaftsforum / Bavarian Science Forum	IFG	Wirtschaftsförderungsgesellschaft der Stadt Ingolstadt / Association of Economy Development Ingolstadt
BS	Business School (THI)	IIMO	Institute of Innovative Mobility (THI)
BMBF	Bundesministerium für Bildung und Forschung / Federal Ministry of Education and Research	INCHER	International Centre for Higher Education Research Kassel
BMWi	Bundesministerium für Wirtschaft und Energie / Federal Ministry for Economic Affairs and Energy	InES	Institute of new Energy Systems (THI)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung / Federal Ministry for Economic Cooperation and Development	KU	Katholische Universität Eichstätt-Ingolstadt / Catholic University Eichstätt-Ingolstadt
CARISSMA	Center of Automotive Research on Integrated Safety Systems and Measurement Area	StMWK	Bayerisches Staatsministerium für Wissenschaft und Kunst / Bavarian State Ministry for Science and the Arts
CoE	Center of Entrepreneurship (THI)	THI	Technische Hochschule Ingolstadt (University of Applied Sciences)
DAAD	Deutscher Akademischer Austauschdienst / German Academic Exchange Service	TUM	Technische Universität München / Technical University of Munich
HRK	Hochschullektorenkonferenz / German Rectors' Conference	ZAF	Zentrum für Angewandte Forschung (THI) / Research Center (THI)
IAW	Institut für Akademische Weiterbildung (THI) / Institute of Executive Education (THI)	ZD.B	Zentrum Digitalisierung.Bayern / Center Digitalization.Bavaria

Brazilian Partners and Further Institutions

Anprotec	Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores / National Association of Entities Promoting Innovative Enterprises	CONFAP	Conselho Nacional das Fundações Estaduais de Amparo à Pesquisa / Brazilian National Council of State Research Support Foundations
AUI	Agência UFPR Internacional / UFPR International Agency	COPEL	Companhia Paranaense de Energia / Energy Company of Paraná
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior / Coordination for Improvement of Higher Education Personnel (compare DAAD)	Enap	Escola Nacional de Administração Pública / National School of Public Administration
CERNE	Centro de Referência para Apoio a Novos Empreendimentos / Reference Center for Business Incubation	FA	Fundação Araucária de Apoio ao Desenvolvimento Científico e Tecnológico do Estado do Paraná / Araucária Foundation for Scientific and Technological Development of Paraná State
CERTI	Centros de Referência em Tecnologias Inovadoras / Reference Centers in Innovative Technologies	FAPESC	Fundação de Apoio à Pesquisa Científica e Inovação do Estado de Santa Catarina / Research and Innovation Support Foundation of Santa Catarina State
CNC	Confederação Nacional do Comércio / National Confederation of Commerce	FGV	Fundação Getúlio Vargas / Getúlio Vargas Foundation
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico / National Council for Scientific and Technological Development	ICE	Instituto de Cidadania Empresarial / Business Citizenship Institute

ICT	Instituições de Ciência e Tecnologia / Scientific and Technological Institutions	PIBIC	Programa Institucional de Bolsas de Iniciação Científica / Institutional Program of Scholarships of Research Initiatives
INPI	Instituto Nacional de Propriedade Industrial / National Institute of Industrial Property	PROEC	Pró-Reitoria de Extensão e Cultura / Pro-Vice-Chancellor's Office for Extension and Culture (UFPR)
Ipea	Instituto de Pesquisa Econômica Aplicada / Institute for Applied Economic Research	Sebrae	Serviço Brasileiro de Apoio às Micro e Pequenas Empresas / Brazilian National Service for Support to Micro and Small Companies
IPHAN	Instituto do Patrimônio Histórico e Artístico Nacional / National Institute of Historic and Artistic Heritage	Senac	Serviço Nacional de Aprendizagem Comercial / National Service of Commercial Apprenticeship
MCTIC	Ministério de Ciência, Tecnologia, Inovação e Comunicação / Ministry of Science, Technology, Innovation and Communications	Senai	Serviço Nacional de Aprendizagem Industrial / National Service for Industrial Apprenticeship
MEC	Ministério da Educação / Ministry of Education and Culture	SESC	Serviço Social do Comércio / Social Service of Commerce
MINTER	Ministério do Interior / Ministry of the Interior	UFPR	Universidade Federal do Paraná / Federal University of Paraná
NEJ	Núcleo de Empresas Juniores da Universidade Federal do Paraná / Center of Junior Enterprises of UFPR	UFSC	Universidade Federal de Santa Catarina / Federal University of Santa Catarina
PET	Programa de Educação Tutorial / Program of Tutorial Education	UNE	União Nacional dos Estudantes / National Union of Students
PGT	Núcleo de Política e Gestão Tecnológica (Universidade de São Paulo) / Center of Technology Policy and Management (University São Paulo)	UNICAMP	Universidade Estadual de Campinas / University of Campinas (São Paulo State)

Further Abbreviations

ACA	Academic Cooperation Association	PrInt	Programa Institucional de Internacionalização / Institutional Program of Internationalization
AIM	Automotive. Innovation. Momentum.	R&D	Research and Development
AWARE	Applied Network on Automotive Research and Education	R&S	Responsibility and Sustainability
BRICS	Brazil, Russia, India, China and South Africa	R&DI	Research, Development and Innovation
BRL	Brazilian Reals (currency)	RITUSS	Retail, Responsibility, Industry, Innovation, Technology and Sustainability (THI, UFSC)
EMM	Europäische Metropolregion München / European Metropolitan Region Munich	SAFE	Safety System for Autonomous Driving and Electromobility (THI, Continental)
HDI	Human Development Index	SAFIR	Safety for all – Innovative Research Partnership on Global Vehicle and Road Safety System
GDP	Gross Domestic Product	SEPEX	Semana de Ensino, Pesquisa e Extensão / Week of teaching, research and outreach
GEM	Global Entrepreneurship Monitor	SME	Small and Medium-sized Enterprise
IoT	Internet of Things	ST&I	Science, Technology and Innovation
JADE	European Confederation of Junior Enterprises	SwB	Ciência sem Fronteiras / Brazilian Science without Borders program
MiB	Mensch in Bewegung	UAS	University of Applied Sciences
MIT	Massachusetts Institute of Technology	UTN	Universidad Tecnológica Nacional / National Technological University Argentina
OECD	Organization for Economic Cooperation and Development	WIPO	World Intellectual Property Organization
PCT	Patent Cooperation Treaty		
PNE	Plano Nacional de Educação / National Education Plan		

Authors and Others Involved

THI

Bader, Martin (Prof. Dr.)
Bartholomé, Thomas
Becker, Felix
Bedington, Sonja
Bhavsar, Divyam
Brandmeier, Thomas (Prof. Dr.)
Da Silva Junior, Amauri
Duft, Christian
Facchi, Christian (Prof. Dr.)
Göllinger, Harald (Prof. Dr.)
Hagerer, Andreas (Prof. Dr.)
Hermesen, Lisa
Huber, Susanne
Huber, Werner (Prof. Dr.)
Kapfhammer, Sabine
Kiehl, Maximilian
Knöbl, Nicola
Knoppe, Marc (Prof. Dr.)
Kortright Barbosa, Christian David
Lohmeier, Anne-Sophie
Mattis, Krisztina
Navarro, Daniel (Prof. Dr.)
Overbeck, Georg
Reszat, Marcus (M.A.)
Reway, Fabio
Ritzl, Florian
Sauerbrey, Stefanie
Schmidt, Thomas
Schober, Walter (Prof. Dr.)
Schollmeier, Vera
Schuster, Isabell
Sinha, Anuj
Stowasser, Melanie
Strauch, Nils
Suchandt, Thomas (Prof. Dr.)
Tetzlaff, Ulrich (Prof. Dr.-Ing.)
Tscharntke, Elvira
Tomanek, Dagmar Piotr (Dr.)
Wilken, Esther
Zimmermann, Matheus
Zimmer, Alessandro (Prof. Dr.)

UFPR

Baraniuk, James (Prof. Dr.)
Barra, Eduardo Salles de Oliveira (Prof. Dr.)
Blasi, Thaís Marzalek
Colling, Ivan Eidt (Prof. Dr.)
Da Cunha, Cleverson Renan (Prof. Dr.)
De Liz Giese Marçal, Waleska
Donizete Lopes de Moraes, Alexandre
Duarte, André (Prof. Dr.)
Fonseca, Ricardo Marcelo (Prof. Dr.)
García Fernández, Evelio Martín (Prof. Dr.)
Gorsdorf, Leandro (Prof. Dr.)
Graf, Karin (Prof. Dr.)
Heller Marba, Rodrigo
Mehl, Ewaldo Luiz de Mattos (Prof. Dr.)
Parente, Eduardo (Prof. Dr.)
Rohloff, Bruna
Scheid, Adriano (Prof. Dr.)
Tertuliano dos Santos Filho, Horacio
 (Prof. Dr.)
Tháise First, Ilana
Zimmer, Alessandro (Prof. Dr.)

UFSC

Balthazar, Ubaldo Cesar (Prof. Dr.)
Barros, Ludmila
Nolla, Gustavo
Porath, Mauricio (Prof. Dr.)
Travassos, Lucas (Prof. Dr.)
Vieira, Rodrigo de Souza (Prof. Dr.)
Welzel, Evelize (Prof. Dr.)

Further

Ackermann, Rainer
 Airbus Defence and Space GmbH
Allende, Carla
Bode, Arndt (Prof. Dr. Dr. h.c. (NAS RA))
 Bavarian Research Foundation
Brofmann, Paulo Roberto (Prof. Dr.) FA
Carioni, Leandro CERTI
De Azevedo Tutui e Silva, Marcus V.
 Senac
De Melo, Irma (Dr.) BAYLAT
De Rosso Manços, Guilherme Emerge
 Brazil & São Paulo University
Erras, Marc brigk
Ferreira Marques, Thiago Rafael
 Senac (Santa Catarina)
Gargioni, Sérgio Luiz (Prof. Dr.) FAPESC
Häring, Benedikt SPARKS GmbH
Hoeltgebaum, Thiago Mobilis
Konradt de Campos, Fernanda
 Sinapse da Inovação
Kopytynski, Witold arculus GmbH
Krücken, Georg (Prof. Dr.) INCHER
Kühnke, Lutz (Dr.-Ing.) Continental AG
Lohwasser, Maria Pixida GmbH
Löser, Henning (Dr.) AUDI AG
Magerkort, Sören INCHER
Pimentel Neves, Daniel
 Junior Enterprises & Entrepreneurial
 Universities Index
Reich, Marina Airbus Defence and
 Space GmbH
Rodrigues Maciel, Janice Inovativa Brasil
Rüland, Dorothea (Dr.) DAAD
Quinalha, Luiz LATAM Renault Nissan
 Mitsubishi Alliance
Schneider, Carlos Alberto (Prof. Dr.) CERTI
Schweiger, Andreas (Dr.) Airbus Defence
 and Space GmbH
Steidle, Manuel CERTI
Vianna, Luis Lactec

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Prof. Dr. Walter Schober,
Präsident der Technischen Hochschule
Ingolstadt (V.i.S.d.P.)
Esplanade 10
85049 Ingolstadt
Deutschland
www.thi.de

Prof. Dr. Horacio Tertuliano
dos Santos Filho
Univeridade Federal do Paraná
Rua XV de Novembro
1299 – Centro
Curitiba – Paraná
Brasilien
<http://www.ufpr.br>

Coordination

Georg Overbeck
Anne-Sophie Lohmeier
Lisa Hermsen
Telefon: +49 (0) 841 / 9348-6469
lisa.hermsen@thi.de

Content

Prof. Dr. Christian Facchi
Anne-Sophie Lohmeier
Georg Overbeck
Zentrum für Angewandte Forschung (ZAF)
Telefon: +49 (0) 841 / 9348-7410

Translation

Thiago Borba
Lisa Hermsen
Sabine Kapfhamer
Anne-Sophie Lohmeier
Georg Overbeck
Sonja Bedington
Susanne Huber

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Sylvia Bird

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