

Thai-German Innovation Linkages and Cooperation

Extraction of Main Findings from the Study

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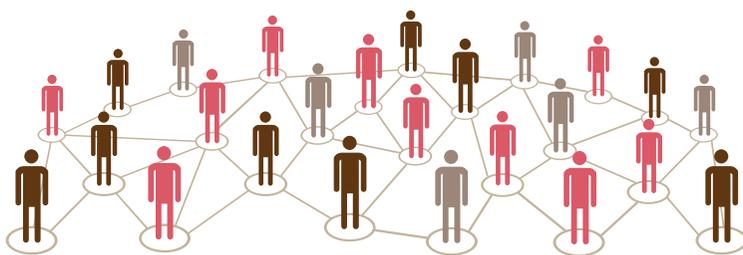
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Extraction of Main Findings from the Study ^[1]



^[1] The full report can be obtained from GIZ Thailand; please email to giz-thailand@giz.de



Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

GIZ (German International Cooperation), a non-profit global cooperation enterprise for sustainable development, was formed on 1 January 2011 and owned by German Federal Government. It brings together the long-standing expertise of the Deutscher Entwicklungsdienst (DED) gGmbH (German Development Service), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Technical Cooperation) and Inwent-Capacity Building International, Germany.

It provides technical, managerial and advisory services that support complex development and reform processes. GTZ implements projects for the German Government, international organisations (such as the European Commission, United Nations organisations, the World Bank, and the Asian Development Bank) as well as national governments and private-sector clients. In 2011, GIZ operates in more than 130 countries worldwide. It's registered offices are in Bonn and Eschborn. In 2011, GIZ employs approximately 17,000 staff members worldwide, more than 60 % of whom are local personnel. In addition, there are 1,135 technical advisors, 750 integrated and 324 returning experts, 700 local experts in partner organisations and 850 'weltwärts' volunteers. With an estimated turnover of EUR 1.9 billion, GIZ can look to the future with confidence.

GIZ in Thailand

Thai-German Technical Cooperation started in 1956 with the first agreement between Thailand and Germany on technical assistance. Based on different development focuses in each period, projects have been implemented in many sectors, e.g. Rural Development, Agriculture, Fisheries and Food, Education, Health, Good Governance. The focus in the 1990s shifted towards the fields of industrialization process, economic development, state modernization, energy, environmental and climate protection. Moreover, regional projects such as German-ASEAN programmes, e.g. on sustainable port development and clean air are being implemented from the GIZ Bangkok office.

Thai German Programme for Enterprise Competitiveness

This report is an activity under the Thai-German Programme for Enterprise Competitiveness implemented by GIZ Thailand which has a particular emphasis on promoting Small and Medium-sized Enterprises (SMEs) in the agricultural industry.^[2] The project is implemented by GIZ Thailand, which is commissioned of the Federal Ministry of Economic Cooperation and Development (BMZ) The targeted sectors are palm oil, shrimp, tapioca, fruit and vegetables and mulberry (Saa) paper plus energy and innovation as main cross-cutting sector. It aims to improve productivity and business performance, facilitate innovations and reduce environmental impacts. Moreover, the programme provides policy advice on legal frameworks, laws and regulations to promote enabling environment for competitive SMEs.

^[2] This report is a personal opinion of the authors only and does not necessarily reflect the opinion of GIZ.

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List of abbreviations

AEC	ASEAN Economic Community
ASEAN	Association of South East Asian Nations
BOI	Thailand Board of Investment
CHE	Commission on Higher Education, Thailand
CIM	Centre for International Migration and Development
DAAD	German Academic Exchange Service, Office Thailand
DFG	Deutsche Forschungsgemeinschaft/German Research Foundation
EAPHD	East Asia and the Pacific Department, Human Development Unit, World Bank
EC	European Commission
EU	European Union
FDI	Foreign Direct Investment
FP7	Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (2007–2013)
FTA	Free Trade Agreement
GIZ	Gesellschaft für Internationale Zusammenarbeit/German International Cooperation “German Agency for International Cooperation” (as of 2011, after merger of DED, GTZ, InWEnt)
GTaI	German Trade and Invest
GTCC	German–Thai Chamber of Commerce
GTZ	German Technical Cooperation (as of 2011 merged under GIZ)
GTZ/T-G PEC	German Technical Cooperation/Thai–German Programme for Enterprise Competitiveness
HEI	Higher Education Institution
IB BMBF	International Bureau of the German Federal Ministry of Education and Research
IPR	Intellectual Property Rights
IRPUS	Industry and Research Project for Undergraduate Students
ITAP	Industrial Technology Assistance Program
KTT	Knowledge and Technology Transfer
ODA	Official Development Assistance
Office for STI Policy	National Office for Science, Technology and Innovation Policy
PRO	Public Research Organisations
PICS	Productivity and Investment Climate Survey
R&D	Research and Development
RE	Renewable Energies
RGJ	Royal Golden Jubilee Programme
RIS	Regional Innovation System
RMUT	Rajamangala University of Technology
S&T	Science and Technology
SES	Senior Expert Service
SMEs	Small and Medium-sized Enterprises
SOP	Standard Operating Procedure
T-G	Thai–German
TGGS	The Sirindhorn International Thai–German Graduate School of Engineering
T-G PEC	Thai–German Programme for Enterprise Competitiveness and Eco-Efficiency
TOR	Terms of References
TRF	Thailand Research Fund
TVET	Technical and Vocational Education and Training
UBI	University Business Incubator
UIL	University Industry Linkage
WTZ	Scientific–Technical Agreement

Since 1858 Germany and Thailand have maintained trade and economic relations. Germany is Thailand's most significant trading partner in the European Union. Around 500 German companies operate in Thailand. There are 83 cooperation agreements between German and Thai Higher Education Institutions (HEIs). There are university-industry linkages (UIL) between Thai and German institutions. German-Thai development cooperation started in 1956. Substantial financial and technical input of this assistance was targeted at developing the enterprise and educational (including universities) sectors. The first example of such form of development cooperation started 1959 when the Royal Thai Government and the Federal Republic of Germany jointly founded a technical school, now known as King Mongkut's University of Technology North Bangkok (KMUTNB), which today is the home of a Thai-German university partnership between KMUTNB and Technical University (RWTH) Aachen.

There has been and will continue to be a visible shift in Thai-German cooperation patterns with Thailand's transition from technical assistance to broader international cooperation, the economic developments in ASEAN (ASEAN Economic Community in 2015, regionalisation trends), the scientific and technological developments in ASEAN (emergence of a S&T area) and taking account of Thailand's position in ASEAN. The German Federal Government's "2008 Internationalisation Strategy for Research and Education" and the "2009 Research and Academic Relations Initiative" launched under the previous strategy by the German Federal Foreign Office gradually seem to create an increasing interest in Thailand and more so in ASEAN as a region. There are new opportunities and challenges arising in the cooperation. In terms of competitiveness, innovation will be essential also in both countries' collaborative efforts. The 2010 Global Competitiveness Index and the country reports for Thailand and Germany confirm this.

Over the past ten years (expiring in 2011), the Thai-German Programme for Enterprise Competitiveness (T-G PEC) has been the strategic framework programme for activities of the German Technical Cooperation (GTZ) in Thailand, now as of 2011 "GIZ" (German International Cooperation), the German Agency for International Cooperation. Starting from 2010 onward, the focus within the T-G PEC has shifted from innovation linkages within Thailand to innovation linkages between Thailand and Germany to assess the existing situation and to contribute to an increase of innovation-related activities between Thai and German stakeholders. But there is a lack of an overview on the extent to which knowledge and technology transfer and innovation play a role in Thai-German cooperations. This paper summarises main findings from an exploratory study "Mapping and promoting Thai-German innovation linkages and cooperations".^[3] The full report in addition to some statistical data puts a focus on narrative examples (case studies) to provide a lifelier picture of the Thai-German linkages.

This study attempts to explore the innovation linkages between Germany and Thailand in industry, academia and government. In this relationship, typically speaking, new knowledge, technology and innovations are primarily transferred from Germany to Thailand.

Within the industrial sector, this is done through the importation of capital goods with embodied German knowledge and technology, or through the exportation of Thai goods to German consumers who require specific standards to be met. In Academia, we find various channels for active Knowledge and Technology Transfer between the two countries, ranging from informal networking, movement of students, joint publications to collaborative research and horizontal innovation cooperation. In the governmental sector, transfer and innovation take place through cooperation projects, such as policy advisement, capacity development and technical assistance.

An exploratory, exemplary research on Thai-German innovation cooperation was carried out during June-October 2010, involving desk and empirical research between July-September. The study focused more on public sector sources i.e. HEIs, research institutes, donor organisations, government agencies and ministries.

A total of 52 interviews (33 face-to-face and 19 phone interviews) were conducted with 42 organisations from the different stakeholder groups involved in Thai-German innovation cooperation activities (ministries, government agencies, research funding agencies and implementation bodies, HEIs, research institutes). An e-mail based member survey was sent out by the German-Thai Chamber of Commerce to its 500 members. 14 questionnaires were answered.

^[3] Rink, D., U. Assavavichai (2010): Mapping and promoting Thai-German innovation linkages and cooperations. The full report can be obtained from GIZ Thailand; please email to giz-thailand@giz.de

2. Current Situation of Thai-German Innovation Linkages within the Last Three Years, 2007-2009

In this section we provide information on the findings from the survey among companies (2.1); findings from the interviews with HEIs and research institutes (2.2) on channels used for knowledge and technology transfer and innovation cooperation with more in-depth information on the different channels used; unilateral and bilateral support available from Thai and German side for Knowledge and Technology Transfer (KTT) and innovation cooperations (2.3).

2.1 Innovation and Linkages of Companies

In this area, Thai-German linkage is primarily through the importation from and exportation of goods to Germany. There is not much learning from German FDI in terms of local knowledge spillover as subsidiaries do mostly assembly work or are service operations. Linkages with HEIs and research institutes are weak, because their services do not seem to match well with the companies' needs. Companies seem to be unaware and unsure as to how they can contact these institutions, as was brought to light by the Thailand investment climate survey.¹⁴¹ Companies are motivated to enter into cooperative arrangements for innovation in order to gain access to new markets, R&D and critical expertise.

In the GTCC member survey, local Thai operations were asked to elaborate on the types of innovation they had performed over the previous three years (2007-2009). The results are displayed in Table 1 below. More than half of the respondent companies were involved in product, process, organisational and marketing innovations; several of them having introduced more than one type of innovation.

Table 1: Types of Innovation Introduced by the Companies, 2007-2009

	Number	Percent
a. Product innovation (i.e. market introduction of new / improved goods and services. The innovation must be new to the operation, and exclude the simple resale of goods purchased from other plants, or changes of a solely aesthetic nature.)	10	71.4
b. Process innovation (i.e. new or significantly improved production process, distribution method, or support activity for goods or services. The innovation must be new to the plant.)	7	50.0
c. Organisational innovation (i.e. new organisational method in your plant's business practices (including knowledge management), workplace organisation or external relations that have not been previously used by the enterprise. Exclude mergers and acquisitions.)	8	57.1
d. Marketing innovation (i.e. marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your plant's existing marketing methods and which has not been used before. It requires significant changes in product design or packaging, product placement, product promotion, or pricing. Exclude seasonal, regular and other routine changes in marketing methods.)	9	64.3

Source: T-G innovation cooperation survey 2010: GTCC member survey. n=14; Percentage values relate to the valid percent.

¹⁴¹ World Bank (2008): Thailand Investment Climate Assessment Update 2008, Update of Thailand PICS 2007: http://siteresources.worldbank.org/THAILANDEXTN/Resources/333295-1249970320257/TH_ICA_Update08_fullreport.pdf



In terms of communication channels, open Thai/German information sources are used by the majority of operations, on top of which networking/ informal contacts are often utilized. Trade and industry associations as an open information source were less often used. One of the reasons might be an argument that we have come across in desk research: In general the Thai business associations should play a crucial role in organising exchange between companies and supporting their upgrading effort. "Yet the associations have been much less involved in and successful at productivity and technology promotion."^[5]

In comparison to other forms of knowledge and technology acquisition (purchase) from Thai/ German sources, the importation of capital goods, in which foreign knowledge and technology is already embedded, and the use of consultancy services are the top-ranked forms among company survey respondents.

Due to the small company sample, one must be careful in deriving conclusions based on it alone. A paper on "Ideas and Innovation in East Asia"^[6] confirms that the "single most important source of knowledge for firms [...] was technology embodied in new machinery or equipment (most of which can be assumed to be imported)." (Brahmbhatt, M. 2007:8) This can be assumed because Thailand, along with most other East Asian economies, has high levels of international trade.

The survey sample included some large, German-owned firms, which are likely to have better access to finance from their mother organisations in order to perform innovation-related activities in Thai-German cooperation. In terms of UIL, findings from the Thailand Productivity and Investment Climate Survey (PICS) show that solutions offered by HEIs and public institutions in Thailand are rarely demanded: "Technological innovations originating from universities and public institutions are used by 1 percent of surveyed (manufacturing) firms only. This clearly reflects weak linkages between manufacturing firms and research centres or universities-institutions that are essential for the generation of new technology." (Thailand PICS 2007, updated 2008: 64)

In terms of partners for cooperation, clients based in Germany, Thailand and other countries are the top partners for innovation cooperations in our sample (Table 2). For Thailand, consultants were second most frequently listed by the sample companies as an innovation cooperation partner, followed by other plants within the firm. In cooperation with German partners, suppliers of equipment were most frequently mentioned, followed by clients and universities (i.e. half of the surveyed companies with local operations in Thailand cooperates with German HEIs; in comparison, 28.6% indicate that they cooperate with Thai HEIs).

^[5] Doner, R., P. Intarakumnerd, B.K. Ritchie (2010): Higher Education and Thailand's National Innovation System. In: Report to EAPHD, World Bank, p.18.

^[6] Brahmbhatt, M., A. Hu (2007): Ideas and Innovation in East Asia. World Bank.

Table 2: Innovation Cooperation Partners of Companies During 2007-2009

		Thailand		Germany		Other Countries	
		Number	Percent	Number	Percent	Number	Percent
a.	Other plants within firm	5	35.7	5	35.7	6	42.9
b.	Suppliers of equipment, materials, services etc.	4	28.6	9	64.3	6	42.9
c.	Clients or customers	10	71.4	7	50.0	8	57.1
d.	Competitors or other enterprises in industry	4	28.6	3	21.4	4	28.6
e.	Consultants	8	57.1	6	42.9	3	21.4
f.	Commercial labs/R&D enterprises	1	7.1	4	28.6	2	14.3
g.	Universities/other HEIs	4	28.6	7	50.0	3	21.4
h.	Colleges/technical institutes	2	14.3	3	21.4	2	14.3
i.	Government labs/research institutes	3	21.4	2	14.3	0	0.0
j.	Private non-profit research institutes	0	0.0	1	7.1	1	7.1
k.	Professional associations	4	28.6	3	21.4	3	21.4

Source: T-G innovation cooperation survey 2010: GTCC member survey. n=14; Percentage values relate to the valid percent.

In terms of motivations for cooperation, nine out of fourteen companies mentioned access to new markets as a reason. Second most frequently listed is access to R&D and critical expertise. Only three out of fourteen companies mention the sharing of innovation development costs. There are two possible explanations for this: innovations undertaken by the respondent companies could be minor improvements or be less technology-intensive innovations, or large and German-owned companies have sufficient access to financing from their mother organisation (however, as stated before, the sample is too small to lend sufficient evidence to this claim). We cannot apply other than descriptive statistics due to the small sample size and the varied nature of companies in the sample.

Table 3: Reasons for Cooperative Arrangements for Developing or Commercialising Innovations

Reasons Related to the Development of Innovation	Number	Percent
a. Sharing the cost of developing innovations	3	21.4
b. Accessing research and development (R&D)	8	57.1
c. Accessing critical expertise	8	57.1
d. Prototype development	4	28.6
e. Scaling up production processes	1	7.1
f. Accessing new markets	9	64.3
g. Accessing new distribution channels	6	42.9

Source: T-6 innovation cooperation survey 2010: GTCC member survey. n=14; Percentage values relate to the valid percent.

2.2 Channels for Knowledge and Technology Transfer Used By Higher Education Institutions and Research Institutes in Thai-German Innovation Linkages

The list below shows a range of channels (Table 4) which were explored during the study. The main findings from exploratory interviews and desk research are summarised. The scope of information varies widely between the individual channels: more in-depth information was available on channels such as networking, informal contacts, movement of people, joint publishing, collaborative research; but hardly obtainable on contract research, consultancy and technical services, which are all relevant channels in UIL due to confidentiality about who the clients are.

Table 4: Channels of Knowledge, Technology Transfer and Innovation in Thai-German Innovation Linkages

Channel	Overview on Main Results
<ul style="list-style-type: none"> • Networking, informal contacts (networks of researchers, specialists) 	Most utilised linkage that opens the way to further cooperation and KTT activities; Majority of our interview partners confirmed the importance of personal contact (tacit knowledge, trust-related) and networking via alumni networks
<ul style="list-style-type: none"> • Conferencing 	Open source of information that is generally used by researchers to update themselves on their specific field of work; bilaterally organised conferences or seminars for HEIs and industry between Thai and German partner HEIs; An international conference (focus on ASEAN) in various fields of science/sectors is also jointly organised among Thai and German HEI/PROs in cooperation with public/private organisations;

Channel	Overview on Main Results
<ul style="list-style-type: none"> • Joint publishing 	<p>Most innovation-related linkages between Thai and German HEIs have joint publications as one outcome; these are well monitored as one of the KPIs in bilateral funding programmes is “Number of joint publications”; 1998-2007: Five times increase in international cooperation between Germany and Thailand in terms of co-publications, rising from 28 to 142 co-publications (2007). Number of publications between the USA and Thailand: 4x increase from 215 to 870 co-publications (2007); the USA has eight times more co-publications with Thailand than Germany has with Thailand (IB of BMBF 2009); Thailand publishes mostly in: medicine, biology and biotechnology and chemistry; accounting for 64% of Thailand’s publication output; (ibid) Germany publishes mostly in: medicine; physics; biology and biotechnology; accounting for 64.4% of all German publications; (ibid)</p>
<ul style="list-style-type: none"> • Joint patenting 	<p>Rarely found; one case between CMU and BII (in pharmaceuticals)</p>
<ul style="list-style-type: none"> • Licensing of patents, non-patented inventions, trademarks, other know-how 	<p>Intellectual Property (IP) and its protection is an issue for cooperation partners in bilateral T-G projects (e.g. for projects funded by NRCT-DFG, FP7); For UIL, there are a couple examples of licensing from HEIs to industry partners within T-G cooperation projects; if a functioning TLO exists at the HEI, it is involved in the negotiations; In one case, a company had been set up by a HEI to handle IP issues more flexibly (e.g. TGGs has set up TGGs company Ltd: here, securing IP is part of the contract procedures; however, the IP required to build equipment is transferred by the HEI to the company); Under the Upland Programme, licensing of an energy efficient system for high-quality fruit drying to a company selling the fruit drying machine in Chiang Mai took place;</p>
<ul style="list-style-type: none"> • Contract research (with no active collaboration) 	<p>Relevant channel in UIL; Contract research performed by HEIs for industry partners ranks over real, active cooperations with collaborative research or horizontal innovation cooperations in our sample; Cases of Thai and German HEIs mutually involving each other in third party contracts with industry; there are also examples where Thai HEIs directly did contract research for German companies in Thailand;</p>
<ul style="list-style-type: none"> • Consultancy services 	<p>Relevant channel in UIL: majority of support by HEIs to industry via consultancy services, even bilaterally (i.e. from German HEIs to Thai or German companies in Thailand; or from Thai HEIs to German companies based in Thailand or Germany); There are schemes for supporting Thai partners with German expertise, e.g. Senior Expert Scheme (SES) and CIM Expert Scheme;</p>
<ul style="list-style-type: none"> • Technical services (testing, evaluation, trial production) 	<p>Set up of test track under negotiation with TÜV Rheinland with lab near KMUTNB; Plan to set up testing laboratory at Center for Veterinary Public Health for Asia-Pacific Region (VPHCAP, joint T-G initiative);</p>
<ul style="list-style-type: none"> • Sale/purchase of products with embodied knowledge, technology (e.g. equipment) 	<p>Sale of products not found between partnering T-G HEIs, rather lease or donation of equipment between partner HEIs; Thai HEIs purchased products from German industry, e.g. for their laboratories;</p>
<ul style="list-style-type: none"> • Equipment & facility sharing 	<p>Channel frequently used in joint research projects; can be also in joint labs;</p>
<ul style="list-style-type: none"> • Teaching 	<p>Teaching (incl. joint laboratory work) seems to be mostly the case when German faculty teaches at Thai HEIs for short courses (challenging to find time slot that fits both Thai and German sides);</p>

we have not as often encountered Thai faculty who teach in Germany (although there are examples, e.g. within Upland Programme); (Research collaboration seems to be more strongly pronounced when Thai academics and researchers come to Germany). In 2008, 127 Thai academics and researchers were in Germany (data referring to faculty who received scholarships); 18 German academics and researchers in Thailand (in teaching and/or research); Per semester: 15 colleagues of RWTH Aachen go to TGGGS; DAAD supports lectureships in Thailand; Under DAAD "Herder Programme" emerited German professors can come to teach at Thai HEIs (min. stay 1 semester): currently 3 professors em. teach at Thai HEIs in the areas of social needs, welding and German studies; Senior Expert Service (SES) scheme also enabled German experts to teach at a Thai HEI or to support industry based in Thailand; CPG-Spring Academy is held annually in Germany, and is organised by the German Southeast Asian Center of Excellence for Public Policy and Good Governance (CPG) at Thammasat University; Summer Academy by network of Greater Munich UAS is planned; existing programmes: three joint Master degree programmes, (plus Master or Ph.D. programmes by TGGGS); programmes in planning phase, respectively to be started in 2011: one joint Master degree programme, three Ph.D. programmes; Bavarian Thai Academic Cooperation Centre (BTACC) as example;

- Continuing professional development (CPD), training

TGI offers courses for CPD; Bilaterally organised conferences, seminars for industry by HEIs; Short courses by German profs. held at Thai HEI which are also visited by industry representatives for upgrading their knowledge;

- Spin-offs/spin-outs

M&E of joint research projects do not often follow up on whether spin-offs happen from joint cooperation projects (since it is no KPI, it is not monitored); In our sample, we have found: two spin-offs from T-G cooperation under preparation; one spin-off under Upland Programme;

- Movement of people (e.g. student exchange, student placement, secondment, exchange of researchers, double positions, hiring)

Movement of faculty is connected to work on joint projects and teaching at the hosting HEI; In 2008: 18 German academics and researchers went abroad to Thailand; 127 Thai academics and researchers went to Germany in the same year (ratio of 1:7); In 2009: 215 German students were enrolled at Thai HEIs; 993 Thai students enrolled at German HEIs (ratio of 1:4).

- Collaborative research (structured res. project with two or more partners in addition to the HEI/PRO, all parties work together toward common goal by sharing knowledge, learning and building consensus)

Several examples from NRCT-DFG funded projects (on average 8-10 project p.a. accepted; under the Upland programme a total of 30 projects implemented so far), TRF-DAAD funded projects; RGJ grant programme: 145 German co-advisors supervised Thai RGJ PhD students; in FP7 projects in which Thailand is involved as third country partner, it has 15 cooperation linkages with German partners (Germany ranked second most important partner for Thailand, after UK);

- Horizontal innovation cooperation (active participation with HEIs/PRO or firms in joint development of new technologies, or other innovations)

Several T-G collaborative research projects result in innovation or outputs with commercialisation potential (e.g. within Upland programme, TGGGS, CMU-TU-BAF, CMU-BII)

Networking/informal contacts, movement of students and joint publications seem to be three most frequently used channels for KTT in Thai-German cooperation between HEIs. In our case, most of the Thai-German cooperation projects we have encountered are the result of a Thai scholar who, as student, had studied in Germany. Movement of students can pave the way for more intense contact between their supervisors from both countries, which then may lead to other forms of cooperation. Often researchers collaborate on their joint research, co-advising students and expanding their activities to other channels of cooperation

involving the movement of people (i.e. exchange of faculty/ student). The agreement between the institutes is then established to officially acknowledge their staff's cooperating activities. A MoU is then generally deployed to broadly define the bilateral agreement on cooperation between the two HEIs, thus facilitating further cooperation and the related administration process. Apart from networking/informal contacts, the main formal channels are discussed below.

2.2.1 Joint Publishing

Joint publications resp. co-publications^[7] can be considered as one indicator for international scientific cooperation. Thai-German co-publications have been increasing in number over the last ten years (measurement period: 1998-2007). Between 1998 and 2007 there had been a fivefold increase in Thai-German cooperation in terms of co-publications: from 28 to 142 co-publications, totalling 598 co-publications (Table 5). This is 2.5% of the total number of publications^[8] from Thailand and 0.1% of publications from Germany.

Table 5: Total number of co-publications between 1998-2007

	Number of co-publications with Gemany	Weighting from the country's perspective	Weighting from Germany's perspective
Japan	16514	1.9%	1.9%
Australia	10417	3.3%	1.2%
China	8248	1.5%	0.9%
South Korea	3366	1.5%	0.4%
New Zealand	1910	3.1%	0.2%
Taiwan	1820	1.3%	0.2%
Singapore	996	1.8%	0.1%
Iran	656	1.7%	0.1%
Thailand	598	2.5%	0.1%
Indonesia	396	6.6%	0.04%
Vietnam	315	6.4%	0.04%
Malaysia	269	1.9%	0.03%

Source: International Bureau of BMBF 2009:6.

^[7] Source: Hausteil, S., B. Mittermaier, D. Tunger, FZ Jülich commissioned by International Bureau of German Federal Ministry of Education and Research (BMBF) (2009): *Bibliometric Analysis Asia-Pacific Research Area* : www.kooperation-international.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/redaktion/doc/Bibliometrie_Asien_englisch_neu.pdf&t=1287054315&hash=91650066dcfde45e3bce8a6d78972f04

^[8] The publications screened refer to the "Web of Science" screening approx. 9,300 international scientific journals. It encompasses the Science Citation Index (SCI), the Social Sciences Citation Index (SSCI) and the Arts & Humanities Citation Index (A&HCI). "The indexed journals are referred to as the "core journals" and they publish the majority of scientific research results." (IB of BMBF (ed.) 2009:III)

**Table 6: Co-publications of Thailand with Germany by Research Disciplines 1998-2007
with Ranking of Germany Among the Top Ten Co-publication Countries**

Research discipline/ subject category	1998-2007		1998-2002		2003-2007	
	Rank DE	Co-publications	Rank DE	Co-publications	Rank DE	Co-publications
Multidisciplinary journals	8	7	-	-	7	7
Agricultural science	5	53	6	11	5	42
Biology and biotechnology	6	172	6	50	6	122
Chemistry	5	92	6	24	5	68
Energy	8	7	5	3	-	-
Geosciences	7	50	6	22	7	28
Information and computer science	9	7	-	-	8	7
Engineering	10	29	-	-	8	24
Materials science	8	31	8	6	8	25
Mathematics	3	11	3	3	3	8
Medicine	8	240	8	69	7	171
Nanotechnology	-	-	low number of publications, ranking for entire period of observation only			
Physics	4	75	4	19	4	56

Source: IB of BMBF 2009:59-63, data compiled in one Table for co-publications with Germany. Empty fields indicate that Germany is not among the top ten co-publication countries. For nanotechnology also no disaggregation was made due to low number of publications.

In terms of co-publications between Thailand and Germany by research discipline, it can be detected that Germany is among the top ten countries co-publishing articles with Thailand in each of the disciplines for the overall period 1998-2007 (Table 6). The ranking of Germany in the individual disciplines has remained relatively stable without major changes in ranking between the two five-year periods 1998-2002 and 2003-2007. Research disciplines in which both countries are most active (top three ranks; see previous Table) are highlighted blue: medicine, biology and biotechnology, chemistry and physics are the top disciplines of co-publication activities.



2.2.2 Movement of People

In 2009, there were 993 Thai students enrolled at German HEIs: Thailand ranks 42nd in terms of the number of foreign students by country of origin enrolled in Germany. The number of Thai students in Germany slightly increased by 6% compared to the year before (DAAD).^[9]

Engineering is the dominant subject group of study, with 36% of Thai students enrolled in Germany with engineering as their main subject during the winter semester 2007/2008 (updated information for 2008/2009 not yet available). Ranked second is mathematics and natural sciences with 23% of Thai students, followed by law, economics/business administration, and social sciences (20%). (Destatis, DAAD)^[10]

In 2009/10, there were 215 German students enrolled at Thai HEIs (compared to 993 Thai students in German HEIs). This is a 36% increase over the previous academic year. The dominant subject group is law, economics/business administration, social sciences, which was chosen by nearly half of the German students. Language, cultural studies and sports was the second most preferred subject group, in which 16% of German students enrolled. 10% of German students in Thailand enrolled in human medicine and health sciences. Only 7% of students studied engineering. (Thai Commission on Higher Education 2010)

The ratio of outgoing Thai students to German HEIs compared with incoming German students to Thailand is 4 to 1, in 2009.

In 2008, 127 Thai academics and researchers came to research or teach in Germany, of which 64% are graduates, 15% postdocs and 7% academics, researchers and university teachers; Thailand ranks 43rd in terms of the number of foreign academics and researchers by countries of origin. Compared to the two preceding years, the ranking has improved by five and six ranks, respectively. (DAAD)

Mathematics and natural sciences rank at the top among the subject groups for Thai academics and researchers when going to Germany. This group was chosen by 41% of Thai academics and researchers in 2008. The engineering subject group ranks second (23%). (DAAD)

This is similar to the ranking of subjects of study by Thai students coming to Germany (in this case, engineering ranks first and math/ natural sciences second). This could lend evidence to the finding from our interviews that personal contact as student or researcher and academic affects further exchange of students and staff.

18 German academics and researchers went abroad to Thailand in 2008 (0.3% of all funded German recipients). This number is considerably lower than the number of 127 outgoing Thai academics and researchers to Germany; Thailand ranks only 37th among the quantitatively most important target countries for outgoing German researchers and scholars. The ranking dropped compared to the previous years. (DAAD)

The ratio between outgoing Thai academics and researchers to Germany compared with incoming German academics and researchers in Thailand was 7 to 1, in 2008.

2.2.3 Teaching

There is also a growing number of cooperations between Thai and German partners in the area of teaching through joint and dual degrees as well as sandwich programmes in which e.g. PhD students spend a part of their studies in the partner country and are jointly supervised by a German and Thai supervisor. There are four existing joint programmes and four further programmes, which are to start in 2011 or are in the planning to be set up (Table 7; the ongoing programmes are highlighted with blue). According to the Thailand Commission on Higher Education's survey,^[11] Germany ranks 7th in the number of its collaborative degree programmes with Thailand. Given the number of new joint programmes that are currently in the planning process or about to start in 2011, this ranking might change within the year. An increasing number of international programmes have been offered at Thai HEIs, increasing by 100% within five years, from 465 programmes (2004) to 884 (2008).^[12] The majority of them are offered in collaboration with foreign partner universities. The number shows growing demands and popularity of the international education programmes in Thailand.

^[9] Sources: DAAD (ed.): *Wissenschaft weltoffen 2010, 2009, 2008*: Data can be accessed : www.wissenschaft-weltoffen.de/about/index_html?lang=en (Status of search: 15.07.2010); DAAD Handout Thailand

^[10] Source: Bundesamt für Statistik, Fachserie 11, R.4.1, DAAD Handout Thailand. Data for 2009/10 not yet fully available.

^[11] Source: CHE (03/2010): Thai Higher Education: Policy & Issue paper;

^[12] Source: CHE survey on international programmes in Thai HEIs, Oct 2009; <http://inter.mua.go.th/main2/list.php?id=fa02.x>

**Table 7: Joint and Dual Degrees as well as Sandwich Programmes Between Thai and German HEIs
(Ongoing and Planned)**

Programme	Thai HEI	German HEI
1 Sustainable Agriculture and Integrated Watershed Management (SAIWAM) Joint degree master of science programme	Chiang Mai University	University of Hohenheim
2 Master of Veterinary Public Health Joint Master degree sandwich programme; (with 3 months in Thailand, 5 months in Berlin, 5 months in Vienna, 3 months in Thailand (<u>since 2003</u> ; established under Asia-Link; supported by DAAD)	Chiang Mai University	Free University of Berlin
3 PhD of Veterinary Public Health Joint PhD degree sandwich programme with 3 stations (<u>planned to be set up in 2011</u> ; under Erasmus Mundus Programme with DAAD support)	Chiang Mai University	Free University of Berlin (in partnership with universities in Utrecht, London, South Africa, Japan; self-financed participation Japan to get access to European research landscape)
4 PhD in Industrial Chemistry Joint PhD degree sandwich programme (with 2 years at CMU and 2 years at TU-BAF; <u>starting in 2011</u>);	Chiang Mai University	Technische Universität Bergakademie Freiberg
5 Master of Science and MBA in International Management of Resources and Environment Dual degree program (<u>since 2007</u>)	King Mongkut's Institute of Technology Ladkrabang (KMITL)	Technische Universität Bergakademie Freiberg
6 Master degree in Logistics Sandwich programme (<u>planned to be set up</u>)	Kasetsart University, Center of Excellence in Logistic	University of Magdeburg
7 Ph.D degree in Logistics Sandwich programme (<u>planned to be set up</u>)	Kasetsart University, Center of Excellence in Logistic	University of Magdeburg
8,9 Master/ Ph.D degree in Engineering with eight international MSc programmes and two PhD programmes; Thai students going to Germany have a Thai and German supervisor. No joint degree, but TGGGS is a joint institution of RWTH Aachen and KMUTNB	King Mongkut's University of Technology North Bangkok (KMUTNB)	RWTH Aachen University

Source: T-G innovation cooperation survey 2010. Websites.



2.2.4 Collaborative Research

Another channel strengthening cooperation is collaborative research between Thai and German partner organisations. There are several examples of NRCT-DFG funded projects. On average, eight-to-ten projects per annum are approved. Under the Upland programme "Research for Sustainable Land Use and Rural Development in Mountainous Regions of Southeast Asia," a total of 30 projects have been implemented so far. There are also TRF-DAAD funded projects. So far, 145 German co-advisors have supervised Thai RGJ Ph.D students under the RDJ grant programme. Thai organisations are involved (as non-EU, so-called "Third-Country Partners") in the 7th Framework Programme of the European Community for Research and Technological Development.

There are several examples for collaborative research projects funded bilaterally from Thai and German organisations. Two programmes are explored further: the Upland programme and the FP7. The Upland Programme has been in operation since 2000. It is a long-term collaborative research programme initiated by Hohenheim University in cooperation with nine partners throughout Thailand and Vietnam. Now in its final phase, the programme has implemented thirty projects, with evidence of interesting transfer projects involving licensing, spin-off and vertical innovation cooperation. Within FP7 Thailand has 15 cooperation linkages with German partners in eight projects in the thematic areas of health, environment (including climate change), food/agriculture/biotechnology, transport (Status as of 01/2010).^[13] Germany is ranked as Thailand's second-most important partner within FP7, after the UK. The ongoing FP7 project "SEA-EU-NET" aims to expand scientific collaboration between European and South-East Asia.

In 2012, there will be the EU-ASEAN Science Year with Germany taking over a leading role and it should be ensured that Thailand is also well represented there.

2.2.5 University-Industry Linkages (UIL), incl. Contract Research, Consultancy Services, Technical Services

For channels that are more application-oriented and involve contact with industry, i.e. consultancy services, technical services and contract research, horizontal innovation cooperation, Thai HEIs are encouraged, as part of the national HEI policy on university financing, to generate more income from products of universities such as research and academic services. UIL is a cross-cutting issue, relevant for the movement of people, training, consultancy/technical services, contract research, collaborative research and horizontal innovation cooperation etc.

Thai HEIs are still behind German HEIs in terms of UIL, while German UIL continue to improve. A study on Thai UIL modes among Thai HEIs on their projects with industry found that consulting and technical services to be the most frequently mentioned content of cooperation between Thai HEIs and industry (both foreign and domestic). Although these services can lead to the introduction of innovation within industry, it is not an active form of cooperation as would be the case with joint R&D and joint innovation projects. Studies on UIL in Thailand estimate that approximately 25% of professors have personal contacts with industry providing consultancy and technical services "without tangible or intangible effects for the respective universities [...] without deeper research involvement and (limited) to linear modes of knowledge transfer" (Schiller 2006 quoted in Intarakumnerd 2009:19)^[14] And as we could see from the World Bank's 2008 Update of the Thailand PICS 2007 for manufacturing companies: only 1.2% of the manufacturing companies in Thailand used universities or research institutes as channel for innovation.

^[13] Source: Data provided by Elineau, C., PT-DLR/ IB-BMBF (International Bureau of the German Federal Ministry of Education and Research at the German Aerospace Center). Website: www.dlr.de/en; <http://www.internationales-buero.de/>; SEA-EU-NET: <http://www.sea-eu.net/>

^[14] Intarakumnerd, P., D. Schiller (2009): University-Industry Linkages in Thailand: Successes, Failures and Lessons Learned for other Developing Countries. Paper presented in the IV Globelics Conference at Mexico City, September 22-24 2008.

2.3 Support for Bilateral Knowledge and Technology Transfer (KTT) and Innovation Cooperation Between Thailand and Germany

We have not found binational schemes which explicitly promote German-Thai innovation cooperations between companies or between companies and universities (UIL). The Table below summarises the main funding sources for bilateral cooperation, either provided uni-laterally or jointly, by Thai and German organisations. Bilateral cooperation support is mostly at the academic and research level. Organisations support Knowledge and Technology Transfer through these channels range from research funding, funding from governments and ODA as well as private/charity foundations. Support from the German side is mainly provided by DAAD (student/academic scholarships and grants) and DFG (collaborative research grants); on the Thai side there are TRF (student/academic scholarships and grants), the Thai Commission on Higher Education (exchange programme/student scholarships) and the NRCT (collaborative research grants).

Table 8: Overview on Bilateral Support Programmes for Promoting Knowledge, Technology Transfer and Innovation in Thai-German Cooperation (Non Exhaustive)

Bilateral	German Side	Thai Side
DFG-NRCT support DAAD-TRF support	No German S&T cooperation agreement (WTZ Abkommen) with Thailand-affecting S&T cooperation at governmental level; BMBF: Internationalisation strategy for German education and research; Under coalition treaty funding for science cooperations with "Schwellenländern" (emerging economies) Funding from BMBF via IB-BMBF, DAAD, AvH, DFG; DFG funding oriented towards basis research, IB-BMBF implementing body of BMBF supporting scientific cooperation; DAAD for academic exchange support;	NRCT funding TRF-IRPUS funding TRF-RGJ (Royal Golden Jubilee Programme (administered by DAAD for TRF) ASEM-DUO Thailand Fellowships, funding by CHE
	Ministry for Foreign Affairs/ Foreign Office: "2009 Research and Academic Relations Initiative" (Initiative Außenwissenschaftspolitik" with support e.g. for four German Centres of Excellence->CPG at TU one of them)	
No <u>bilateral innovation</u> cooperation scheme for Thai-German inter-company cooperations or UIL	BMWI : Export initiative for German companies; Incentives for FDI in Germany GTCC, GTal	Mol/BOI : STI and R&D incentives for FDI in Thailand
	BMZ : via GIZ (from 2011 on including Thailand only as part of the regional level (i.e. ASEAN)	
	CIM, SES, DAAD Herder Programme (see section 3.2)	ITAP
EU programme support: Erasmus Mundus FP7 for Research and Technological Development (for Thailand as third country partners)		

Source: T-G innovation cooperation survey 2010 , Websites

In terms of investment incentives by the investment promotion agencies of both countries (BOI, GTAI), in particular, the BOI's schemes for FDI in Thailand, which aim at stimulating investments in skill-, technology- and innovation-intensive activities (BOI-STI incentives, BOI-R&D incentives) are pointing in the right direction for more knowledge-intensive activities by German companies in Thailand. Procedures are considered time-consuming by the companies, which is a particular disadvantage for SMEs interested in cooperating on more STI intensive activities in Thailand.

"The majority of enterprises (in Thailand) innovate without incentives from government. In 2004, 12 percent of all surveyed firms participated in government schemes to conduct R&D. This fell to 8 percent in 2007. [...] Between 40 and 60 percent of all firms surveyed reported that they had never heard about these schemes." (Thailand PICS 2007, Update 2008:68-69)

Towards the application/commercialisation of knowledge and technology and the introduction of innovation, there are hardly any bilateral support programmes; there seems to be a lack of bilateral funding for innovation and innovation cooperation. A bilateral innovation cooperation support scheme should be discussed.

3. Critical Issues in the Cooperation



3.1 Critical Success Factors

Personal contact is the most critical success factor for cooperations, with most Thai-German cooperations having developed because alumni play a connecting role. Identifying the right cooperation partner organisation and individuals, which appropriately compliment existing in terms of organisation and individual skills traits and personality is one of the most frequent challenges for the interviewed stakeholders. HEIs, government agencies and implementation bodies mentioned these challenges as well.

Interview partners noted that the biggest challenge was that too often when personal contact is interrupted (e.g. someone retires or the project is completed), then the cooperation comes to a halt and the MoU is

dormant. The challenge is the same when the cooperation shall be expanded. In particular for Thai-German UIL: there is no systematic opening up of new Thai-German contacts and UIL projects, and there is a perceived need to have this process more systematised/structured (i.e. from contact to networking to integrating people in projects and acquiring the according funds from private and public sector sources) weaving in standard operating procedures (SOPs) or linkage quality management.

3.2 Barriers (with focus on HEI perspective)

The language barrier is one of the most critical barriers for Thai undergraduate or Master students to study in Germany. It has been suggested that German HEIs offer more degree programmes in English. Difficulties in accessing funding for bilateral linkages is majorly related to a perceived need for more support for travel visits to meet personally with the (potential, future) cooperation partners. The bench fee^[15] is mentioned as a major problem by both parties in Thai-German research collaboration.

Cultural barriers in cooperation seem to be less a problem for the Thai side. One Thai university interview partner highlighted the importance of preparing German partners in their attitude for match-making meetings. Administrative barriers within their own organisation play mostly no more role once a MoU is signed. Some universities, which are more hierarchically organised, require the individual researcher to go through long reporting procedures before contact may be established.

Lack of time, along with the existence of outside responsibilities was mentioned as an obstacle in some cooperations. Differing capacities, performances in terms of the quality of education, research and

[15] Bench fee is charged in order to cover the costs for use of laboratory facilities and research materials.

development are considered as a reason for the low interest of German students to study in Thailand and also partly as a reason for the relatively low number of Thai-German HEI cooperations.

3.3 Perceived Potential and Challenges

Potential is seen in ASEAN, and in particular the fact that as of 2015, the ASEAN Economic Community (AEC) shall be fully operational. ASEAN is seen as a strong procurement and supply market with potential as a free trade area. Interview partners see Thailand's strong future potential and hub functionality with regard to ASEAN.

In terms of the effect of FTAs with China and India on the potential locational benefit for German or Thai companies serving the Chinese and Indian markets from Thailand, the opinion among interview partners is mixed. According to the Thailand BOI it seems that there is now a growing trend for German FDI to invest in other Asian countries after China and India, which include Thailand, in order to diversify their investments in the region. Companies try to have their R&D facilities in Thailand. Thailand has a good ranking regarding risks in business according to the BOI's Foreign Investor Confidence Survey 2009.^[16]

Thailand also has potential as a hub for Thai-German innovation linkages, to serve the region with international education and be connected to the SEA research area and business opportunities within the ASEAN Economic Community. There is also high interest on the Thai side in learning from German HEIs about UIL and in establishing joint programmes in industrial education between Thai and German HEIs.

Value-creation for SMEs and micro-enterprises is a major issue for Thai companies. Thus, Thai-German cooperation is strongly demanded in terms of product design, engineering/value-adding functions and very application-oriented cooperations.

Upgrading the technological and innovative capabilities of Thai companies would be an important prerequisite in order to not get stuck in the "middle-income trap" and in order to increase local content in Thai-German cooperations.

Upgrading Thai-German cooperations with more value-creation requires also an enforceable IP system. In terms of IP protection, Thailand ranks

84th out of 139 countries ranked in the 2010 Global Competitiveness Report, Germany ranks 9th out of 139 countries (GCR 2010:322-323,165-166).

A 2009 IPR enforcement report of the European Commission^[17] states that IPR enforcement in Thailand "remains weak in general and some areas seem to have deteriorated." Specific problems relate to: "civil procedures (which are lengthy and expensive; civil actions are not adapted to infringing activities), provisional measures (injunctions are rarely granted), criminal procedures (search warrants are difficult to obtain, criminal sanctions are not deterrent enough, there is a lack of experienced judges) and customs procedures (available only against trademarks and copyright infringement; lack of transparency and burdensome nature of evidence to submit to the customs)." (CEC 2009:7)

3.4 Critical Issues in Thai-German Innovation Cooperation along Four Levels of Systemic Competitiveness

As we aim to derive basic concepts and recommendations for promoting Thai-German innovation linkages and cooperations, we try to arrange the critical issues mentioned before in a matrix alongside four analytical levels: micro, meso, macro and meta levels. These four analytical levels are addressed in the concept of "Systemic Competitiveness" in order to better cope with factors determining economic performance. Factors at each level, and the interaction of factors among the four levels "shape the ability of countries, and the locations in them, to thrive in an increasingly competitive world economy." (Meyer-Stamer, J. 2008:2) The concept of systemic competitiveness is an analytical concept elaborated by researchers of German Development Institute (DIE) since the 1990s.^[18]

This concept is useful in analysing different geographical levels of aggregation, i.e. the national, sub- and supra-national economies.

In this work, we would like to apply the concept to summarise critical issues in bilateral Thai-German innovation cooperation we have come across. In the following Table (Table 9), we arrange the findings adopted from a list of criteria for assessing territorial systemic competitiveness.

^[16] BOI (2009): Foreign Investor Confidence Survey Report; http://thailand.prd.go.th/view_around_thailand.php?id=4708

^[17] European Commission: IPR Enforcement Report 2009. Commission Staff Working Document; The IPR Enforcement Report is based on an Enforcement Survey outside the EU among right holders, associations, EU Delegations and Embassies of EU member States. Aim of the report is to raise the attention of SMEs towards IP issues when collaborating with Third Countries. It is also utilised by the EU to prioritise countries with which cooperation on IP shall be strengthened (CEC 2009:2).

^[18] Meyer-Stamer, J. 2008: Systemic Competitiveness and Local Economic Development. In: Bodhana, S. (ed.): Large Scale Systemic Change: Theories, Modelling and Practices.

Table 9: Summary of Critical Issues in Thai-German Innovation Cooperation Along the Four Levels of Systemic Competitiveness

Level:	Critical issues:
Meta	<p>Government, government agencies, implementing bodies: The German side interested in internationalisation of German R&D and education with German government having launched a strategy on this; The Thai side is positive on the topic of innovation and innovation cooperation; creative economy, decentralised equality are top priorities; STI and R&D are high on the agenda;</p>
	<p>Innovation: no explicit goal in Thai-German cooperation, no German strategy on innovation policy toward Thailand; for companies mostly one-way KTT; Shift in cooperation patterns between Thailand and Germany due to phasing-out of ODA; Germany's Internationalisation Strategy for R&D and Education in 2008 and "2009 Research and Academic Relations Initiative"-Increasing interest in Thailand and ASEAN as a region;</p>
	<p>Organisations: Innovation cooperation as cross-cutting issue: three-pillar concept and other innovation-related German stakeholders in Thailand; Lack of insight and access to German innovation system by Thai stakeholders interested in R&D and innovation cooperation with German organisations;</p>
	<p>Policy: For Thailand innovation is high on national policy agenda;</p>
	<p>Vision, development strategy: Thai key policy making and implementing stakeholders in R&D and innovation not well interconnected – interagency fragmentation and weak linkage among Thai innovation system stakeholders;</p>
	<p>Image: Tourism-related image of Thailand, not as business or location for STI; political demonstrations and reporting abroad have affected image of Thailand and investors' confidence; Both German and Thai sides do not know much about each other in terms of market opportunities for business, R&D and innovation landscape</p>
	<p>Personal contact: most critical success factor; identifying right contact person; funding for more/specific follow-up needed; no systematic opening up of new T-G contacts and UIL projects;</p>
	<p>Language: one of the critical barriers;</p>
	<p>Cultural barriers less of a problem; German side should be proactive</p>
	<p>Perceived potential in ASEAN/AEC: strong procurement and supply market with Thailand as hub function; sub-optimal position of Germany's strength in environmental policy-related issues due to lack of coordination at ASEAN level; German interest: International education business and connection to SEA research area and business opportunities within AEC;</p>
	<p>Perceived challenge for Thailand in ASEAN integration process: Learning from German experiences with European integration process;</p>
	<p>German community in Thailand not very much connected to Thai community;</p>
Macro	<p>Financing/tax: Positive: Various tax incentives for R&D and innovation in Thailand; three-staged tax redemption procedure for BOI, STI and R&D incentives complicated: bottleneck; Lack of bilateral support for R&D/innovation cooperations; Lack of equity funding; Lack of grants for companies for innovation and innovation cooperation in Thailand;</p>
	<p>FTAs: Influence China-ASEAN FTA/India-ASEAN FTA: growing trend for German FDI to invest in countries in second row after China and India, but missing FTA between EU and Thailand might hinder the German involvement in Thailand;</p>
	<p>Effects of political unrest at the beginning of the year;</p>

Meso **Policy, Thai-German innovation linkages:** Thailand (efficiency-driven stage of development): needs to step up efforts to improve educational systems and encourage wider adoption of new technologies for productivity enhancements; IPR protection/enforcement needs better follow-through. Germany (innovation-driven stage of development): focus needs to be on business sophistication and innovation; Lack of Thai-German innovation cooperation support schemes between companies; Lack of systematic opening up and follow-up on Thai-German contacts and UIL projects that lead to innovation cooperations; Difficulties in accessing funding for bilateral linkages; bench fee; Restricted human resource mobility: facilitation of secondment of staff; **Cross-cutting theme of innovation-Need for a German action framework for Thailand/ASEAN in innovation** to give innovation policy an adequate space in German foreign relations with Thailand and ASEAN?

Chambers of Commerce: GTCC has a strong connecting role between Thai and German businesses;

Business associations: Should play crucial role in Thailand in organising exchange between companies and supporting their upgrading effort;

Secondary training: German TVET model of high interest in Thailand; mode of Thai-German TVET already been implemented at TGI; Lack of skilled labour (e.g. technicians) in Thailand

Higher education: Thai interest in German experiences in developing education and training systems in order to attract more investment and to make technological progress; Thai interest in learning from German HEIs about UIL and establishing joint programmes in industrial education; Differing capacities of Thai HEIs in responding to companies' needs: Upgrading UIL needs different approaches; Lack of S&T personnel and engineers;

Innovation financing institutions: weak venture capital market in Thailand; Lack of innovation grants (without matching funds)

Communication: Communication and coordination among meso level institutions needs improvement on both sides for better cooperations; for improving UIL: self-interest of companies needs to be stimulated (companies need to see benefit); German-Thai Joint Economic Committee: revived recently by BMWI;

Micro **Specialisation:** Significant gap between advanced nature of Thailand's export structure and modest technological levels of domestic firms in production processes and labour force

Knowledge and technology transfer: Mostly one-way KTT through import of capital equipment with embedded knowledge;

Absorption capacities for technology and innovation, **value-adding** capacities of companies need to be strengthened; intra-firm efforts to improve product design, engineering; **Absorption capacities:** Lack of qualified work opportunities for Thai qualified Master degree engineers;

Thai-German cooperation strongly demanded in terms of product design, engineering, value-adding functions and application-oriented cooperations; supply-chain innovation as avenue for more value-chain links between T-G companies?

Source: Matrix adopted, but based on Meyer-Stamer, J. (2008): *Systemic Competitiveness and Local Economic Development: 3, Annex "Benchmarking-Table to assess territorial systemic competitiveness"* and adopted to assess bilateral innovation linkages.

Source of contents: T-G innovation cooperation survey 2010; contents summarised from section 4 of full report (pls. refer section 4 there for individual reference sources);

3.5 Fields for Future Cooperation

The Table below shows the list of sectors, fields of science, or topics for future Thai-German innovation cooperation, as suggested by the interview partners and the companies from the company survey, taking into account a win-win perspective for Thai and German partners. The suggested cooperation fields distribute widely, based on perceived strengths and opportunities, as well as the organisation's own focus and the area of specialisation of each interview partner. Most frequently mentioned are environment-related topics. The second most frequently listed issue is on improving manufacturing design and engineering. The third most frequently listed topic is food processing and technologies.

Table 10: Sectors, Fields of Sciences, Topics Proposed During the Survey for Stimulating Further Thai-German Innovation Cooperation

Sector, Field of Science, Topic	Specification
Agriculture, forestry	Agriculture, crop sciences; Forestry (deforestation, soil erosion); wood engineering;
Biodiversity	As research area
Food processing, food products	Third most frequently listed topic; Organic food; Food-processing technologies; Food-related resources management; Food security, public and animal health related to food products;
Environmental sciences, technologies and engineering	Most frequently listed topic; Renewable, clean energy: photovoltaic, thermal, solar energy, bioenergy; Bioproducts: biomaterials, bioplastics, biodegradable packaging, biofuels, bioderived bulk and fine chemicals, bio-derived novel materials; industrial and environmental biotechnology: bioremediation, diagnostic biotechnologies in environmental management; Water resource management, watershed management; Green building materials, eco-commercial building programme; Eco-labelling, eco-certification; Green procurement; Green marketing; Dust control and safe removal at factories; Natural disaster management;
Manufacturing engineering, manufacturing design	Second most frequently listed topic; Advanced creative activities in manufacturing, process and production engineering; machinery; mechanical engineering;
Prefabricated construction	Prefabricated construction of houses, Prefabricated construction technologies;
Automotive	
Mass transit/transportation system	Mass transit system technologies, manufacture of railway equipment; in connection with urban planning;
Logistics	Logistics management, supply-chain management, RFID chip management;
Glass and enamel industry	Glass technology, manufacture and products; enamel manufacture; material engineering
Chemicals, chemical products (less pharmaceuticals)	Chemical engineering (plants, products), chemical process engineering; chemical testing laboratory;
Pharmaceuticals	Pharmacology, biochemistry; pharmaceutical products; biodiversity of Thailand with medicinal plants, herbs;
Health	Health care sciences and services/tourism: medical and health-related tourism; Centre for clinical testing; Medical biotechnology: diagnostics, imaging; Health care, haematology, oncology,

Public health and animal health; tropical medicine and veterinary science combined for zoonosis research; Tropical and infectious disease research; Occupational health/safety at work, safety when handling hazardous and explosive substances;

Medical devices	Medical engineering, medical laboratory technologies (including laboratory sample analysis, diagnostic technologies) and medical devices standards; Centre for clinical testing;
ICT	ICT, ICT services; Digital engineering;
Security technologies	not specified
Laboratory partnerships of standard bodies	Laboratory partnerships of standardisation bodies: certification as incentive for innovation to reach required standards for exports (e.g. certification of food exports);
Tourism	in combination with health
S&T policy and foresight, innovation policy, innovation systems	
IP protection	regional (ASEAN) issue;
Public law	Public law, judiciary cooperation, good governance
Cross-border security	
Leadership development, strategic thinking, planning	

Source: T-G innovation cooperation survey 2010;

4. Basic Concept for Further Promoting Thai-German Innovation

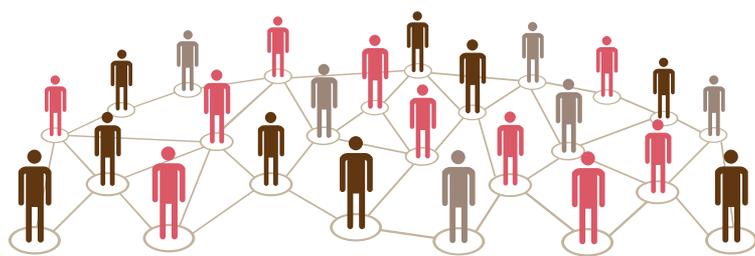


This section summarises basic concepts how Thai-German innovation cooperation could be stimulated more systematically. The full report contains a set of 33 proposed basic actions which are derived from the suggestions, the perceived needs of the surveyed stakeholders, together with the areas where they see an opportunity and have a vested interest for further cooperation. The proposed actions are still raw ideas, which need further validation. Sectors of interest include education, E3 (energy, environment and eco-efficiency), transportation, health and good governance. Cross-cutting issues include improvement of coordination, bilateral support for innovation cooperation, UIL, innovation policy and promoting decentralised regional innovation.

We recommended to combine actions and to target only a few key sectors or topics in order to create momentum for Thai-German innovation cooperation at different levels of systemic competitiveness (meta, macro, meso, micro level). As innovation is a cross-cutting theme in cooperation, we raise the question whether there is a need for a German action framework for Thailand (and respectively ASEAN as a region) and whether innovation has otherwise adequate space in German foreign relations with Thailand (and ASEAN) without such a common framework for action. A strategy definition, topic identification process is recommended in order to identify lead markets for future Thai-German innovation cooperation.

The major suggestions can be seen as follows:

- **Innovation roundtable of German stakeholders in Thailand:** In order to stimulate coordination among the German stakeholders a monthly/or twice-monthly innovation roundtable is proposed. Similar to in Singapore, where a committee of German stakeholders has been set up on R&D issues, a roundtable focusing on innovation could be set up in Thailand.
- **German-Thai policy dialogue on innovation policy and STI development:** The National Science, Technology and Innovation Policy Office has expressed its interest in a policy dialogue on innovation policy and STI development with annual meetings and executive visits between German and Thai innovation policy stakeholders in order to exchange information and perspectives on innovation policy.
- **Concentrated/Focussed approach of German & Thai public assistance:** Public funding from the German side for research/innovation/business should be concentrated around some specific and officially defined areas. Based on German-Thai dialogue, these areas could be jointly agreed to. Such promotion could be focused around well-functioning Thai-German joint/dual-degree study programmes.
- **More coordination of German policies and actions in ASEAN related to environment, renewable energies:** (Renewable) energy is a focus area of GIZ's interventions as well as the activities of DAAD or the Heinrich-Boell-Foundation. German businesses are very active in this field. Based on a sequence of German integrated experts (CIM), the Joint Graduate School for Energy and Environment (JGSEE) is currently a key player in the Thai energy policy field.
- **Follow-up in the field of agriculture:** Thai-German cooperation provided substantial support in the field of agriculture over the last fifty years. Thai-German cooperation in the field of agriculture at Chiang Mai University is a unique success. There is an increase in agricultural/food exports from Germany to Thailand and Thailand is a major food exporter on global level.
- **Urban sustainability and eco-efficiency:** Germany is well advanced in engineering technology, (environmentally friendly) infrastructure development, energy-efficient construction technology as well as urban planning. The new Centre for Urban Sustainability at KMUTL is attached to the International College, which hosts among others also a Thai-German double degree master programme in engineering.
- **Thai-German cooperation in decentralised, regional innovation promotion in Thai regions:** The National Science, Technology and Innovation Policy Office has expressed its interest to continue the work on regional, decentralised innovation promotion initiated under a prior TMC/ITAP and GIZ/T-G PEC project "Mapping and matching innovation".
- **Systemise the opening up of Thai-German UIL projects:** It has been proposed to work on how to make the process of opening up contacts (integrating people quickly into projects) and acquiring funding for projects more systematic. There are good practices, which could be shared as to how UIL and projects with industry are opened up and maintained and how either the Thai or the German HEIs involve their counterpart HEIs from either Thailand or Germany in these third-party contracts with industry.
- **Thai-German training programme "Managing licensing and business incubation" for BI/TLO teams of advanced universities:** Advanced universities in Thailand, i.e. the comprehensive and more specialised S&T universities still lack experience and need more capacity building in managing their university business incubators (UBI) and technology licensing offices (TLO).
- **Thai-German training programme "Upgrading industry linkages" of UIL teams of Rajamangala universities:** The RMUTs need support in upgrading their industry linkages: on how to solve existing production-, design- and engineering-related problems of SMEs in Thailand.
- **Concerted action by European industry in Thailand for a joint TVET model-Establishing German TVET model schools in Thailand:** A concerted action of foreign industry under the lead of the European countries' chambers of commerce has been proposed to develop a TVET model which addresses the needs of companies and to propose this TVET model to the Thai government and BOI.
- **Thai-German cooperation on "Value creation for MSMEs - value-adding functions":** There is a need to focus Thai-German inter-company cooperations more on upgrading companies' abilities to perform value-adding functions. Comparative industry studies between selected German and Thai industries could help to identify the particular skills needed to be upgraded and then to develop targeted actions to stimulate this value-creation.
- **Stimulating Bavarian-Thai innovation cooperations:** Thai-German cooperation could be stimulated from the provincial level as well: Similar to Baden-Württemberg, which is very active in Singapore, Bavaria could be this province with stronger ties to Thailand.





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