Spotlight on: Science and Technology Cooperation Between Southeast Asia and Europe

Analyses and Recommendations from the SEA-EU-NET Project

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The ten member countries of the Association of South-East Asian Nations (ASEAN) are home to around 600 million inhabitants. Both the ASEAN member countries, as well as the organisation, which was founded in 1967, are currently undergoing rapid and wide-reaching development. A key component of this development is investment in, and the implementation of measures to strengthen research and education, both nationally and regionally.

Individual ASEAN countries are partly developing very rapidly in terms of education, research, technology development and innovation. Patent applications and scientific publications are on the rise, competitiveness is increasing and a regional education area is developing. ASEAN countries’ higher education systems are increasingly attractive to students from neighbouring countries.

Whilst the EU is working towards maximising the capacity and impact of research and innovation around the 2020 horizon through the “Innovation Union” initiative, the ASEAN nations are striving to increase their integration measures and to establish a union by 2015, which will share similarities with the EU model. Research and education will be an important part of this integration process and cooperation in research and education is gaining importance. The ASEAN Committee on Science and Technology (ASEAN COST) has a long standing history in ASEAN and is a platform for continuous dialogue and coordination. In twice yearly meetings, annually at ministerial level, common priorities are agreed and project proposals discussed. These meetings are increasingly used to discuss research and development cooperation between the ASEAN countries and partner regions or countries, and China, Japan, Korea and the EU are now involved in a structural and continuous exchange with ASEAN COST.

ASEAN countries are characterized by large differences in economic and S&T- indicators, for instance: GDP and per capita income, average education levels, level of investment in research and research capacity, development of innovation systems. Balancing the drive to rapidly develop scientific excellence, whilst smoothing inequalities in the standard of living within the countries of ASEAN and across the region as a whole, is a challenge for governments, businesses and academia across Southeast Asia. An additional challenge is posed by the threat to the the countries and especially the large cities of the region by the effects of climate change. Climate change is also affecting Southeast Asia’s biodiversity: on about 5% of the earth’s surface, the region is home to 20% of the world’s species—many of these are endangered.

We are convinced that Southeast Asia and Europe are unique and exciting partners for each other. Combining their respective strengths in the areas of science and technology is a promising endeavour for both sides. S&T cooperation can, not only generate economic and social benefits for both regions, but is likely to contribute to addressing bi-regional and global challenges as well.

In order to maximise the potential for S&T cooperation and harness the opportunities, in depth dialogue and active cooperation are key. The SEA-EU-NET project, funded under the EU’s 7th Research Framework Programme, is born from this conviction. It aims to support both the S&T policy dialogue (such as between ASEAN COST and the European Union) as well as stimulate concrete cooperation between researchers and research institutions.

This book represents a compilation of SEA-EU-NET’s analysis work to inform the policy dialogue between the two regions and to develop a greater understanding of ASEAN strengths and priorities in research, as well as of current patterns of cooperation between Europe and Southeast Asia.

We hope you find it useful and informative.

Gerold Heinrichs, Christoph Elineau
SEA-EU-NET Coordination
Southeast Asia

Southeast Asia is a highly populated, demographically young region with a mostly tropical climate, spanning 5 million km² and including over 20,000 islands. It is rich in natural resources and biodiversity, comprising three of the world's seventeen 'megadiverse' countries and seven of the world’s twenty five biodiversity hotspots. The region consists of 10 countries, namely Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam and is inhabited by circa 600 million people. 1

Southeast Asia is one of the most economically dynamic regions of the world, showing rapid development, stable growth performance and high potential for innovation. Levels of incoming, but also outgoing investment are growing. Industrial production, for instance in the automotive and electronics sector, is significant and enterprises are increasingly performing research and technological development (R&D) in the region. Exports from Southeast Asia have doubled in the last decade. While ASEAN is the EU's third largest trading partner (after the US and China), for ASEAN, the EU is its second largest partner after China. 2

Southeast Asia has a highly diverse research landscape ranging from affluent city-state Singapore and emerging economies with pockets of scientific excellence. Scientific output from Southeast Asia, as registered by international citation databases, has quadrupled over the last decade: Elsevier’s Scopus database lists around 10,000 publications for the year 2000. For the year 2010, 40,000 Southeast Asian publications have been registered. Research strengths are recorded in engineering, biological sciences, food and medicine. The EU is ASEAN's most important partner in international scientific co-publications. The geo-political and economic region of Southeast Asia is institutionalised as the Association of Southeast Asian Nations (ASEAN). ASEAN was founded in 1967 and has been moving towards tighter regional integration since its formation, with the goal of forming an ASEAN Community by 2015. Built upon the principles of mutual respect for the independence, sovereignty, equality, territorial integrity and national identity of all nations, the Association's aims include the acceleration of economic growth, social progress, the protection of regional peace and stability, cultural development among its members, and the provision of opportunities for member countries to discuss differences peacefully. 3

Aside from the many differences in terms of natural resources, societal conditions, historical legacy and economic development, ASEAN shares similar political values and ambitions and is faced by similar challenges as the European Union. The diversity of the societies of Southeast Asia is a social and cultural capital, but at the same time poses an additional challenge to the regional integration not least of national S&T systems. Exchange on respective policy approaches is advantageous to both ASEAN, as well as the European Union. Cooperation between the two regions has mutual benefits on many levels.

ASEAN and the EU

As early as 2004, the European Commission published a Communication on the importance of its relationship with the emerging Southeast Asian region, in which it outlined “a new partnership with Southeast Asia”. 4 The paper mentions not only mutual strong economic interests as a reason for the enhancement of bi-regional ties, but also the global scope of societal challenges in the intertwined world of today. Whilst these are both drivers for fostering science and technology cooperation between Europe and Southeast Asia, the Communication also identifies S&T as one of the sectors where cooperation and dialogue could, and should, be extended.

There is mutual interest in ASEAN in expanding the bi-regional S&T cooperation and dialogue. The ASEAN Committee on Science and Technology (COST), and its subcommittees, provide a forum for discussing regional S&T cooperation in ASEAN, and have implemented a Plan of Action in S&T (APAST), which identifies thematic priorities for regional S&T cooperation, as well as defines guidelines for stronger international collaboration. Along these guidelines, ASEAN COST and the European Commission launched an S&T policy dialogue in 2008 with regular senior officials meetings. This dialogue was formalised in 2010, becoming the annual EU-ASEAN S&T Dialogue.

ASEAN-EU cooperation in the field of science, technology and innovation

Drivers and motivations for international cooperation in science, technology and innovation are manifold as reported by literature. 5 At the policy-making level, these can include (depending among other things on the current S&T output): tackling societal and global challenges through research, S&T capacity building, maintaining and developing competitiveness, achieving research excellence and facilitating the free exchange of ideas, as well as the will to guide researchers' mobility in a global competition for scarce human resources and research talent, and the growing importance of science as a means of achieving global diplomatic goals. All of these drivers are relevant for the European Union's process of implementing a European Research Area and for other regions' cooperation with Europe, for instance through participation of researchers in the 'Cooperation' programme of the current EU Research Framework Programme (FP7, running 2007-2013). Within its 'Capacities' programme, FP7 also supports a series of projects facilitating the bi-regional S&T policy dialogue with Southeast Asia and other regions with the aim of increasing international S&T cooperation levels and output. Internationally S&T cooperation, which will continue to be vital to deliver world class science and encourage innovation, is highlighted in the Innovation Union flagship initiative of the Europe 2020 Strategy. It will also be a strong element of the next Framework Programme to bring together research and innovation.

SEA-EU cooperation

The FP7-supported project SEA-EU-NET, “Facilitating the Bi-regional S&T Policy Dialogue between Southeast Asia and Europe”, has been running since the beginning of 2008 and brings together 9 Southeast Asian and 15 European institutions. Its mandate is to increase the quality, quantity, profile and impact of bi-regional S&T cooperation between the ASEAN states and the EU Member States and Associated Countries.

Following this mandate, the project supports the networking of both research areas through policy dialogue, thematic workshops as well as networking events. It increased the information flow to scientists on the growing and explored opportunities for scientists to make collaborations happen. Since the launch of SEA-EU-NET, there has been a notable increase in Southeast Asian participation in FP7. Inspired by SEA-EU-NET, 2012 will be the ASEAN-EU Year of Science, Technology and Innovation. This Year will highlight, promote and extend the reach of scientific cooperation between the regions and its benefits to society. It will further increase the networking on the policy level and the services and opportunities for scientists.

SEA-EU-NET also provides quantitative and qualitative analytical evidence for S&T policy making and identifying strategic areas for S&T collaboration. The project has developed a profound knowledge base of both the current and future cooperation, of the mutual relevance of both research areas for each other as well as of the strategies of both regions in terms of international S&T cooperation.

The following compilation brings together some of the most important accomplishments. It presents outcomes of a set of SEA-EU-NET analysis activities aiming at deepening cooperation and supporting shared scientific policy in and between Southeast Asia and Europe. In these analyses, quantitative studies have been conducted as well as a set of qualitative methods used.

The book is set out as follows: In three chapters, the first part presents the regions political and institutional policies on research strengths of Southeast Asian countries (chapter 1), co-publication activity between Southeast Asia and Europe (chapter 2) and participation of Southeast Asian partners in FP7 (chapter 3).

The second part of the book focuses on the results of a series of qualitative studies conducted by SEA-EU-NET. Chapter 4 sets the stage by introducing some of the political and legal frameworks for S&T policies and by pointing out areas of possible mutual interest between Europe and Southeast Asia. Chapter 5 identifies opportunities and pitfalls of S&T cooperation between the two regions based on expert assessments of current collaboration. Chapter 6 looks into the future of bi-regional S&T cooperation and asks what is driving scientists to cooperate and what successful cooperation might look like in the year 2040. Chapter 7 complements the aspects touched upon in earlier chapters and offers relevant information for the implementation of a successful cooperation future: it takes a close look at the internationalisation of ASEAN countries’ S&T policies, their goals and patterns in the current practice. Finally, chapter 8 presents cases of bi-regional science cooperation tackling global challenges, which is a highly relevant issue for future cooperation.
The current state of science and technology (S&T) in Southeast Asian countries is varied: from global leader in research and technological development, Singapore, to countries only recently starting to invest in S&T, like Laos or Cambodia. The patterns of science cooperation of Southeast Asia globally, and with Europe in particular, are wide ranging and diverse in their form and maturity. There are no comparative datasets to measure the research performance of these countries and their inclusion in the global academic community. Bibliometric analyses were thus conducted by the SEA-EU-NET project (chapters 2 and 3) and commissioned by it (chapter 1) to partly fill this gap. This chapter provides quantitative evidence on research strengths of the Southeast Asian countries, as well as on the joint output of scientific cooperation between this region and Europe.

The primary aim of this work is to show there are pockets of scientific excellence across different thematic areas in Southeast Asia offering a rich cooperation potential. The second aim is to explore how to maximise the opportunities flowing from this cooperation potential. Identifying research priorities is a political task, taking into account joint visions and common social, environmental and economic challenges. However, there is much to be gained from taking into account current strengths in output and cooperation to identify new priorities and niche areas of common interest, and to effectively implement predetermined priorities.

Chapter 1 summarizes a comparative study of research output within Southeast Asia in a selected number of thematic areas, as well as its international impact. It also includes a comparative study of the research performance within top universities of Southeast Asia, partly drilling down to the level of individual researchers. Chapter 2 complements these findings by presenting trends and dimensions in academic co-publications that were published by European and Southeast Asian scientists collaboratively during 2000–2010. Finally, chapter 3 offers a breakdown of participation of the ASEAN countries in the EU’s 7th Research Framework Programme (FP7, 2007–2013), providing supplementary information that enables a more comprehensive understanding of patterns, trends and developments in scientific cooperation between Europe and Southeast Asia.

The findings presented are extracts from the analysis work that was done within SEA-EU-NET during 2010 and 2011. For any specific data that is not accomplished in this chapter, you may refer to the authors of the different chapters or visit www.sea-eu.net/bibliometrics.
The following section summarises a comparative study of research output within Southeast Asia that was commissioned by SEA-EU-NET and conducted by UNU-IIST using quantitative bibliometric measures. The analysis presents overall country, as well as institutions’ publication figures for the period from 2000 to 2008 and gives exemplary evidence on the most relevant individual authors.

1.1 Methodology
This chapter covers the following FP7 thematic areas:
- Nanotechnology
- Information and Communication Technology
- Industrial Technology
- Energy
- Food, Agriculture and Biotechnology
- Environment
- Health

For thematic areas that match with a particular discipline, i.e. Energy and Environment, we have simply used Elsevier’s defined Scopus subject areas for procuring publications. For interdisciplinary areas like Nanotechnology and for areas where there is a particular sub-area of the discipline to be emphasized like ICT, Industrial Technology, Food, Agriculture and Biotechnology and Health, a keyword based approach is used. The lists of keywords have been vetted by the relevant National Bodies of the discipline to be emphasized like ICT, Industrial Technology, Food, Agriculture and Biotechnology.

1.1.1 Bibliometric indicators
A range of bibliometric indicators is used to measure research performance. Research strength is analysed in terms of publication and citation volumes, market share and research internationality. The absolute number of publications and citations are counted which provide actual research output and scholarly impact. The relative proportion of publications for each country gives the country’s publication market share amongst the selected countries, and the relative proportion of citations shared by the country amongst the selected countries indicates its citations market share. This provides a direct quantitative measure of a country’s relative research position. To analyse research internationality of countries, percentage international collaborations and international citations are calculated. Percentage international collaborations indicate the international research linkages relative to a country’s total research output. It is calculated as the volume of publications produced by a country with an international co-authorship in a given research area divided by the total volume of publications produced by that country in that research area.

International citations show the international impact of the research work produced by a country relative to its total research impact. It is calculated as the ratio of citations received by one country from all other countries to the total citations received by this country in the certain research area.

The analyses are conducted over the time period of 2000 to 2008, but a five year sliding window has been selected for ease and to smooth the graphs in order to make trends more evident. A publication time window of 2000–2004 shows the volume of publications during these five years. A citation time window of 2000–2004 shows the number of citations received during these five years by the papers published within this timeframe. Elsevier’s Scopus database is used as data source for all analyses and the data was obtained in November 2010. Publication numbers reported represent all publication types indexed in Elsevier’s Scopus database.

1.1.2 Chapter structure
This chapter is organized as follows:
- Comparison of ASEAN with EU across all seven subject areas in terms of publication and citation volumes.
- Five analyses for each subject area:
  - Global analysis in terms of publication volume
  - ASEAN against some major countries in Asia-Pacific region
  - Analyses among ASEAN countries and top institutes in ASEAN in terms of publication and citation volumes and research internationality.
  - Analyses among ASEAN countries and top universities in ASEAN.

A comprehensive set of analyses is presented in the body of the subchapter for Nanotechnology. For the remaining thematic areas, only the most relevant findings are presented. The full analysis results are presented in the article: “Analysis of research strengths of SEA countries for SEA-EU-NET under task 4.9 bibliometric analysis of S&T strengths in Southeast Asia,” which is available to download at www.sea-eu.net/bibliometrics.

1.2 Bibliometric analysis
Figure 1 compares scientific output (number of publications) and impact (number of citations) of the ASEAN countries with the EU for the seven thematic areas analysed. Relative to the EU, ASEAN is strongest in Nanotechnology with 8.96% the publication output of the EU and 6.40% the citation count. ASEAN is also relatively strong in relation to the EU in the areas of ICT, Industrial Technology, and Energy. There is then a clear drop in relative strength to the next three areas.

The country level analysis has been conducted as two different sets: One compares the ASEAN region as a whole with some major countries of the Asia-Pacific region like China, Japan, South Korea and Australia. The other compares research strengths among the countries in ASEAN region. The comparison was made along the dimensions of publication and citation volumes, international collaboration and international citations.

Figure 2 benchmarks the research performance of ASEAN against that of China, Japan, South Korea, and Australia. China is leading in terms of publications in Nanotechnology, followed by Japan, then South Korea and finally ASEAN and Australia, which are close in terms of publication volume. Citations show a similar pattern to publications with China as the leading country followed by Japan, South Korea, ASEAN and Australia.

Figures 3 and 4 show the comparison of international collaborations and international citations for the benchmarking countries. Interestingly, ASEAN has overtaken Australia in recent years and now has the highest percentage of international citations. ASEAN is second, behind Australia, in terms of international collaboration. While China excels in publications and citations, it is quite low in terms of percentage of international collaboration and citations.
Comparing relative strengths of the countries within ASEAN in Nanotechnology, Singapore is dominant, as can be seen in figure 5. The publication count for Singapore is almost 4000, which is significantly ahead of the second largest publishing country, Thailand (157). It is similar for citation volume. This evidences ASEAN’s strength in Nanotechnology is driven by Singapore. Regarding the other ASEAN countries, we see that Thailand is relatively strong, followed by Malaysia and Vietnam.

Drilling further down to the University level, figure 6 can be seen in figure 5. The publication count for Singapore is the second largest publishing country, Thailand (757). It is not surprising that Singapore’s National University of Singapore and Nanyang Technological University are taking the lead. Both universities are close in publications but the National University of Singapore leads in terms of citation output.

The above figure shows the top authors in ASEAN in the field of nanotechnology. Their corresponding affiliations are listed in the table below. Affiliations shown in the SCOPUS database were manually verified. Nine of the top researchers in Nanotechnology in ASEAN are from National University of Singapore and seven are from Nanyang Technological University. Overall, Singapore is home to 18 of the top 20 researchers. The remaining two researchers are from Malaysia and Thailand.

### Table 1: Southeast Asian authors with most publications in the field of Nanotechnology

<table>
<thead>
<tr>
<th>Author</th>
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<tbody>
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<td>Kang, E.T.</td>
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<td>National University of Singapore, Department of Chemical and Biomedical Engineering</td>
</tr>
<tr>
<td>Neo, K.G.</td>
<td>National University of Singapore, Department of Chemical and Biomedical Engineering</td>
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<tr>
<td>Chua, S.J.</td>
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<tr>
<td>Chong, T.C.</td>
<td>National University of Singapore, Department of Electrical and Computer Engineering</td>
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<tr>
<td>Lim, E.T.</td>
<td>National University of Singapore, Department of Mechanical Engineering</td>
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<tr>
<td>Ramakrishna, S.</td>
<td>National University of Singapore, Department of Mechanical Engineering</td>
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<tr>
<td>Sow, C.R.</td>
<td>National University of Singapore, Department of Physics</td>
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<tr>
<td>Tan, A.T.S.</td>
<td>National University of Singapore, Faculty of Medicine</td>
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#### 1.2.2 Information and Communication Technology

The Southeast Asian research output in Information and Communication Technology shows similar patterns to research performance in Nanotechnology, but although Singapore is dominant, it is not to the same extent as for Nanotechnology. In terms of publications in figure 8, we can see a clustering of countries with Singapore leading, followed by Malaysia and Thailand, and then followed by the other countries.

#### 1.2.3 Industrial Technology

As regards Industrial Technology, it can be clearly seen from figure 11 that within the time span of 2003 to 2008, there has been an explosion of research activity in China. The rate of growth is remarkably high.
1.2.4 Energy

In Energy, the picture looks different than that for previous subject areas where Singapore was dominant. Now, Singapore, Thailand, and Malaysia form one cluster in terms of publications (figure 14). Indonesia is also comparatively ranked higher in this subject area. However, in citations (figure 15), Singapore is again leading, followed by Thailand and Malaysia, and then the remaining countries.

1.2.5 Food, Agriculture and Biotechnology

In Food, Agriculture and Biotechnology, Thailand is ahead of the other ASEAN countries in terms of publications (figure 17). We again see some clustering of countries: After Thailand, Singapore, and Malaysia, the countries Philippines, Indonesia, and Vietnam form one cluster, followed by the cluster of Cambodia, Laos, Myanmar, and Brunei Darussalam. In terms of citations, Thailand is ranked after Singapore (figure 18). Apart from Thailand and Singapore, we can see a cluster formed by Malaysia, Vietnam, Philippines, and Indonesia, with Cambodia and Myanmar clustered at the bottom.

1.2.6 Environment

Although Thailand leads in terms of publications at country level analysis, it is very surprising to note there are not any Thai universities on the top at university level publication analysis (figure 19).

When we look at the publication market share (figure 20), we can see that there is no single Thai university which is leading in this subject area, but activity is distributed across many Thai universities.
When ASEAN countries are analyzed, Thailand and Singapore are leading in terms of publications (figure 23) with Malaysia not significantly behind these leading countries. Following these, two clusters can be identified: Indonesia, Philippines, and Vietnam in one cluster and Cambodia, Laos, and Myanmar in another. In terms of citations, Singapore leads with Thailand a close second.

University level analysis is similar to Food, Agriculture and Biotechnology. Although Thailand is leading in terms of publication volume (figure 24), no single Thai university has an exceptionally high number of publications and activity is distributed among the Thai universities in this subject area (figure 25). In terms of citations, the National University of Singapore is leading.

When it comes to the area of health, at the country level analysis, Singapore and Thailand are close in terms of both publications (figure 26) and citation volumes. Malaysia is comparable in terms of publication volume but has much lower citation volumes.

At the university level analysis, Mahidol University of Thailand is clearly leading in terms of publication volume (figure 27), while in terms of citations (figure 28), there is a tie between Mahidol University and National University of Singapore. The National University of Singapore is separated from the National University Hospital, Singapore because both have different affiliation IDs in Scopus.

1.3 Conclusion

Based on the analyses conducted at various levels, the following points can be concluded:

The ASEAN region’s research output is comparatively strong compared to EU output in Nanotechnology, Information and Communication technology and Industrial Technology. Singapore is dominant among ASEAN countries in these areas, followed by Malaysia and Thailand.

In other areas, strengths are more distributed among ASEAN countries: • In Energy, Singapore, Thailand and Malaysia are similar in terms of publication volume while Singapore is ahead in citations followed by Thailand and Malaysia and then Indonesia.
• In Food, Agriculture, and Biotechnology, • Thailand leads in publications, but has near half the citations of Singapore.
• Research strength in Thailand is distributed among universities with no single dominant university in the area. This has important implications for Thailand in terms of leveraging their research strength in this area.
• Good distribution of strength can be seen in the ASEAN region among countries like Thailand, Singapore, Malaysia, Philippines, Indonesia and Vietnam.
• In Environment, • Thailand and Singapore are close in terms of publication and citation volumes.
• Thailand’s strength is again distributed amongst different universities.
• There is a good distribution of strength among ASEAN countries like Thailand, Singapore, Malaysia, Philippines, Indonesia and Vietnam.
• In Health, • The highest number of publications in the ASEAN region is in the area of health.
• Thailand and Singapore are close in publication and citation volume.
• Mahidol is dominant in publications, while it is essentially tied with the National University of Singapore in terms of citations.
• ASEAN has a high percentage of international collaborations and international citations.

The preceding analysis results offer a detailed view into the scientific output of the ASEAN region, its individual member countries, the main research performing institutions as well as, individual researchers. For discussions on S&T cooperation between ASEAN and Europe, not only evidence on the respective strengths in terms of research output, but also insights into the current level of science cooperation can play a supportive role. The following two sections will offer these insights, first by looking at international academic co-publications between ASEAN and EU and then by reporting on the participation of ASEAN researchers in the EU’s 7th Framework Programme.
The following chapter identifies patterns and trends of scientific cooperation between Europe and Southeast Asia by analysing respective co-publications, i.e. publications with at least one author from each of the two regions. To have as comprehensive a picture of outputs as possible, within the scope of the given project resources, data for the years 2000-2010 was retrieved from Thomson Web of Science and Scopus.

2.1 Methodology

The SEA-EU-NET international co-publication study started as a preparatory part of the project’s foresight exercise on the future of ASEAN-EU S&T cooperation. Together with the above work on research strengths in Southeast Asia, it has grown to analyse collaborative scientific output for increasing and deepening our analytical understanding to support the policy-dialogue. The study identifies current cooperation output patterns, which can be used as indicators helping to identify and implement strategic and emerging fields. The goal is to:

- generate evidence-based support for STI policy-makers in priority setting,
- help to implement politically chosen and socially relevant priorities (e.g. by indicating strong existing links to build upon) and
- perform other S&T policy planning tasks such as defining programme goals.

Publication refers to scientific publications in acknowledged scientific journals, or conference proceedings, such as papers, articles, letters, etc. that are indexed in one of the major academic databases. An international co-publication is a publication with at least two authors from institutions located in at least two different countries – in our case in at least one country in Southeast Asia (ASEAN Member States) and one within the European Union (EU27 plus candidate countries plus the countries associated to the 7th Research Framework Programme).

Our data is acquired from two different sources, namely the two major scientific literature and citation databases: Scopus (Elsevier) and Web of Science (Thomson Reuters). We retrieved meta-data of all co-publications published in the years from 2000 to 2010 by at least one Southeast Asia-based and one EU-based researcher. As the two sources might still be in the process of completing the data compilation for the year 2010, numbers for this year should not be considered final, although any pending modifications should be minor compared to the data already available. In addition, each of the two source databases has limitations in its coverage. Scopus offers better overall coverage of the region, whereas Web of Science reports higher numbers of publications particularly in engineering-related areas and in relation to Singapore. Non-English publications are inconsistently collected in both databases. However, by combining the two sources and with supplementation, we can minimise incomplete, faulty or missing records and improve data quality and coverage in order to offer insight from the broadest range of literature as possible.

The following figure compares ASEAN-EU co-publications that we focus on, answering questions like: Are the co-authors mostly professors and students or colleagues at the same level of seniority? What contact has been established (actual physical contact at a conference or research stay; virtual contacts) between the authors? Who tends to contribute what? Although a comprehensive coverage is impossible, much could be learned from these studies for the task of translating STI cooperation programmes into cooperation and, ultimately, into publication impact.

2.2 Co-publication analysis

2.2.1 Comparing EU-ASEAN scientific co-authorship with ASEAN cooperation with other major players

Europe and Southeast Asia have become important partners in cooperative academic production. From 2000 until 2010, 55,524 distinct academic co-publications between Europe and the Southeast Asian region have been published and listed in at least one of the two databases assessed for this analysis (Elsevier’s Scopus and its Web of Science). Co-publication rates have accelerated at the beginning of this decade and have been at a continuous high over the past seven years.

In order to contextualise these figures, we have also retrieved and analysed co-publications between South- East Asian researchers and those based in one of the major scientific players worldwide. Based on pre-analyses and qualitative evidence from SEA-EU-NET work (cf. chapter 7 on ASEAN countries’ internationalization strategies) we identified Australia, China, Europe, India, Japan, Taiwan, South Korea and the USA to be the global S&T players most important to ASEAN.
Looking at ASEAN's internationality with regard to its neighboring countries, China is the most important cooperation partner in the Asian region, followed by Japan and Australia. As can be seen from this data, co-publication numbers have been growing between ASEAN and all major scientific communities. However, in comparing the growth rates over the same time series, one can see that ASEAN-Indian and ASEAN-South Korea co-publications registered the highest relative growth rates (together with the highly fluctuating ASEAN-Taiwan co-publication growth rate).

Comparing absolute co-publication counts of the individual ASEAN countries with other major world regions (USA, Japan, China and Europe) during 2005-2010, thus disintegrating the above data, Singapore is leading with more than 20,000 co-publications. It is followed by Thailand with almost 15,000 co-publications, while the other countries show less than one third of the Singaporean co-publication output. When looking at the relevance of each of the four major world regions co-publishing with Southeast Asian authors, the US is the dominant partner for Singapore, Thailand and the Philippines. For all other 7 ASEAN member countries, Europe is the most important partner region for co-publications. Summarizing the co-publications, relatively, strongest scientific linkages between Europe and Southeast Asia are to be found with Malaysia, Vietnam and Indonesia in terms of absolute numbers and with Vietnam, Cambodia and Laos in terms of relative share.

With regard to the European countries, the United Kingdom is the leading research partner of the Southeast Asian countries, being most present in academic co-publications with Brunei, Indonesia, Laos, Malaysia, Singapore, Thailand and Vietnam.

### 2.2.2 Thematic fields of cooperation

This section gives insight into the thematic patterns of the Southeast Asia-Europe cooperation. The thematic fields are taken from Scopus’ ASJC subject categories. These over 300 categories are journal subject categories, i.e. each journal is attributed to one or more (in our data set, to an average of 2,5 different) thematic categories. Co-publications are assigned to the thematic field of the journal where they appear. Co-publications can appear in different thematic fields when the journal is assigned more than one subject category.

To measure the average impact of co-publications in the different subject areas, a data query on the number of citations made within each of the thematic fields has been analysed. The results show that the thematic areas that have the highest output (number of published articles) are not at all congruent with the impact (number of citations) of the scientific writings within these subject areas.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Subject category name</th>
<th># of articles</th>
<th># of times cited</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General</td>
<td>428</td>
<td>365,043</td>
<td>61.85</td>
</tr>
<tr>
<td>2</td>
<td>Medical Surgery</td>
<td>318</td>
<td>69,744</td>
<td>22.00</td>
</tr>
<tr>
<td>3</td>
<td>Medicine (all)</td>
<td>1,650</td>
<td>45,860</td>
<td>28.90</td>
</tr>
<tr>
<td>4</td>
<td>Neuroscience and Physiological Psychology</td>
<td>79</td>
<td>4,444</td>
<td>57.57</td>
</tr>
<tr>
<td>5</td>
<td>Morphology</td>
<td>208</td>
<td>1,571</td>
<td>76.27</td>
</tr>
<tr>
<td>6</td>
<td>Gastroenterology</td>
<td>163</td>
<td>2,385</td>
<td>21.38</td>
</tr>
<tr>
<td>7</td>
<td>Neurochemistry (all)</td>
<td>187</td>
<td>3,774</td>
<td>20.71</td>
</tr>
<tr>
<td>8</td>
<td>Chemistry (miscellaneous)</td>
<td>10</td>
<td>190</td>
<td>19.00</td>
</tr>
<tr>
<td>9</td>
<td>Physics (medical)</td>
<td>72</td>
<td>1,177</td>
<td>16.59</td>
</tr>
<tr>
<td>10</td>
<td>Neurology and Psychiatry</td>
<td>465</td>
<td>5,514</td>
<td>12.00</td>
</tr>
<tr>
<td>11</td>
<td>Information Systems</td>
<td>59</td>
<td>9,932</td>
<td>17.11</td>
</tr>
<tr>
<td>12</td>
<td>Management and Information Systems</td>
<td>37</td>
<td>315</td>
<td>8.36</td>
</tr>
<tr>
<td>13</td>
<td>Genetics</td>
<td>106</td>
<td>1,155</td>
<td>10.92</td>
</tr>
<tr>
<td>14</td>
<td>Cell Biology</td>
<td>207</td>
<td>1,158</td>
<td>17.10</td>
</tr>
<tr>
<td>15</td>
<td>Virology</td>
<td>463</td>
<td>7,936</td>
<td>17.71</td>
</tr>
</tbody>
</table>

The following table sorts thematic areas following their amount of average citations per article. We see that Infectious Diseases or Electrical & Electronic Engineering are not among the most cited fields while health and biology-related fields are. In some categories, the numbers of co-publications are too low to get reliable results (medical-surgical, neuropsychology, chemistry miscellaneous).
Summarizing all EU-ASEAN co-publications with regard to their thematic focus in Frascati terminology\(^\text{12}\), our analyses show that biological sciences (over 12,000 co-publications since 2000), health sciences/medicine (over 11,000 in clinical medicine, over 6,000 in health sciences and over 4,000 in basic medicine), physical sciences (over 6,000), chemical sciences (over 5,000), and earth and related environmental sciences (over 5,000) are the top fields of collaboration. The following table shows each Southeast Asian country with its most important cooperation partner and the subject category, in which cooperation with this partner is strongest. Great Britain is dominant in most of the ASEAN countries, but there are variations in the cases of Cambodia, Philippines and Myanmar. In terms of thematic fields of the strongest country-country links, health, environmental sciences, plant sciences and engineering are most prominent.

Table 4: Most important country linkages and ASJC subject categories for ASEAN countries co-publications with the EU since 2000

<table>
<thead>
<tr>
<th>ASEAN country</th>
<th>Subject area</th>
<th>N° of co-pub since 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH</td>
<td>Biology</td>
<td>23</td>
</tr>
<tr>
<td>VN</td>
<td>Mathematics</td>
<td>23</td>
</tr>
<tr>
<td>PH</td>
<td>Agricultural and Biological Sciences</td>
<td>34</td>
</tr>
<tr>
<td>MY</td>
<td>Engineering</td>
<td>36</td>
</tr>
<tr>
<td>ID</td>
<td>Chemical sciences</td>
<td>34</td>
</tr>
<tr>
<td>BN</td>
<td>Environmental sciences</td>
<td>34</td>
</tr>
<tr>
<td>ID</td>
<td>Ecology</td>
<td>38</td>
</tr>
<tr>
<td>ID</td>
<td>Plant sciences</td>
<td>38</td>
</tr>
<tr>
<td>SG</td>
<td>Electrical and Electronic Engineering</td>
<td>40</td>
</tr>
<tr>
<td>TH</td>
<td>Infectional diseases</td>
<td>40</td>
</tr>
<tr>
<td>VN</td>
<td>Microbiology</td>
<td>40</td>
</tr>
</tbody>
</table>

Each of the co-publication linkages between the ASEAN countries and their European partner can be shown in a form of a radial chart. Some of the most prominent SEA subject categories; co-publications can appear in several Frascati subject areas. All the other country-country combinations will be made available at www.sea-eu.net/bibliometrics.

This form of analyses can show us, for instance, that German and Singaporean authors publish cooperatively above all in the depicted thematic fields within the areas of plant and environmental sciences. In the case of Cambodia’s links with the UK, medicine is the most prominent topic.

By means of comparison, we add radial charts displaying the main subject categories in co-publication linkages between Indonesia, Vietnam and Malaysia with some of their strongest European partners (we selected the European country with which the ASEAN country shows the strongest ASJC subject category link).

If we compare this with UK’s co-publication activity with Singapore, we get a different picture again. Links are also strong in areas relating to engineering, physics and materials sciences. Readers who know Singapore’s innovation system in more detail might find parallels of co-publication patterns to the country’s industrial landscape. It is interesting to see that most of the relevant industry branches are also the ones most active in academic publications with international partners. Ophthalmology seems to be a specifically important case in cooperation with the UK only. Co-publications between Singaporean authors and scientists from other major European countries do not focus on this issue.

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Continuing to relate the thematic priorities in co-publications to policy framework’s and regional programmes’ thematic focus, we will now turn to Europe’s regional priorities. In the following, we present co-publication data for the seven FP7 thematic areas the preceding chapter has focused on, therefore delivering comparable results. To this aim, the data source was limited to Scopus for this subsection and co-publications in FP7 thematic areas were retrieved using keyword clusters and Scopus categories as it is outlined in 2.1.1.

To a certain degree, it is thus natural that these ‘big’ subject areas appear as the most relevant ones.

\(^{12}\) A limited number of larger subject areas that we assigned journal subject categories; co-publications can appear in several Frascati subject areas (this is particularly relevant in the health-related topics). It should also be taken into account that the Frascati areas of biological, health and physical sciences cover larger groups of journals than, for instance, civil engineering.
2.2.3 Co-publications in FP7 priorities thematic areas

Following the utilisation of Scopus journal subject categories to provide an overview of the thematic patterns in EU-ASEAN co-publications, keyword-based queries will be utilised to analyse co-publication patterns in the same FP7 thematic areas that were used in the chapter above. This exercise is particularly interesting for two reasons. First, it allows us to draw a more detailed picture of co-publication patterns, which is comparable to our analysis of research strengths in ASEAN. Secondly, it offers a different perspective on some subject areas that would not be possible when using journal subject categories or the Frascati terminology.

Here is a table with the number of ASEAN-EU co-publications from 2000 until 2010 in the seven FP7 thematic areas taken into account:

<table>
<thead>
<tr>
<th>Year</th>
<th>Health</th>
<th>Environmental Sciences</th>
<th>Energy</th>
<th>Food, Agriculture, and Biotechnology</th>
<th>Nanotechnology</th>
<th>ICT</th>
<th>Industrial Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2001</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2002</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2003</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2004</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2005</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2006</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2007</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2008</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2009</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>2010</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

What can be seen from the differences between the two columns in this table, is that in the field of nanotechnology, for instance, EU-ASEAN co-publications tend to involve one ASEAN country only, while in the area of health, it is more common that authors from more than one ASEAN country are involved in the same Europe-ASEAN co-publication.

Looking at the total counts in table 6 as well as at figure 45, we also observe that health is the dominant field of co-publications since 2000. If we compare this with the data presented above, we see that it is also the topic which shows highest scientific output on a regional level in ASEAN. It is followed by Food, Agriculture and Biotechnology and then Environment and Nanotechnology, both in terms of publications as well as in terms of co-publications (with Nanotechnology relating to a dominant number of publications from Singapore and a rather low percentage of co-publications).

If one counts relatively, i.e., setting co-publication counts in relation to overall ASEAN publications, the picture changes: Environment is then the most important field (that is the field with most ASEAN EU-co-publications per ASEAN publication), followed by Energy and Food, Agriculture and Biotechnology, the latter two being very close.

The following graphs show the development of co-publications between the individual ASEAN countries and the EU27 (incl. AC/CC) in these four thematic fields.

2.3 Summary

2.3.1 General trends and patterns of ASEAN-EU co-publications

When analyzing publications published by European and Southeast Asian researchers collaboratively, and comparing this cooperation with co-publications between ASEAN countries and other major scientific players, we observe that Europe has become the most important scientific cooperation partner of ASEAN. ASEAN-EU co-publications grow at a pace comparable to ASEAN publications. Relative growth rates of European publications are lower than ASEAN’s.

Looking at total figures, Great Britain is the most important cooperation partner for Southeast Asian countries. However, particularly in the case of Cambodia, Myanmar and the Philippines, France and Germany are among the most important partners as well (for Cambodia, France is the most important partner). Comparing the ASEAN countries, Thailand and Singapore have the highest co-publication output. Analyzing ASEAN countries’ cooperation with Europe in relation to their cooperation with other major players, Vietnam and Laos have the biggest share of co-publications with Europe.

Assessing data alongside the thematic fields given in the Frascati manual, ASEAN’s links with Europe are closest in the following areas: biological sciences, health sciences/medicine, physical sciences, chemical sciences, earth and related environmental sciences.

With the exception of ICT (which is more relevant in Europe), the ASEAN countries, Thailand and Singapore have the highest number of co-publications with Europe in the areas scrutinized here during the years of observation, followed by Singapore with 2,510 and then Indonesia with 1,995 cooperative scientific papers.

While the first two countries cooperate mostly in health, environment is dominating the Indonesian-European cooperation. Considering that Indonesia is the biggest Archipelago worldwide with a huge biodiversity, this seems understandable. With 1,077 co-publications, Malaysia is very close to Indonesia, with most of its co-publications with Europe in the areas of environment and food, agriculture and biotechnology. In the following table, we depict the co-publication share of each of the Southeast Asian countries.
2.3.2 Co-publications in FP7 thematic areas

With regard to the total number of European-Southeast Asian co-publications listed in Scopus, a significant proportion (30.24%) falls into one of the seven FP7 thematic areas scrutinized here. Comparing the number of co-publications with the overall number of publications in these thematic areas, Health shows by far the highest counts in collaborative publications. The thematic fields Environment and Food, Agriculture and Biotechnology are dominant too.

Comparing the overall co-publications of the ASEAN countries with EU partners, Singapore is the leading cooperation partner followed by Thailand. However, in terms of co-publications in the FP7 areas analysed here, Singapore is not significantly leading ahead of the other ASEAN countries in overall national publications. Especially Environment shows a different situation with Thailand being dominant and Singapore behind Indonesia and Malaysia. Thailand is ahead of Singapore if one summarises co-publication counts in all the seven FP7 areas.

Comparing co-publication numbers with overall publications per priority in the ASEAN region, Environment is clearly the area with most co-publications per publication, followed by Energy and Food, Agriculture and Biotechnology. Taking into account total counts of publications in Europe, Environment has the highest rate of co-publications per publications, followed by Energy. Third is Nanotechnology but Food, Agriculture and Biotechnology is only a minor step behind. The overall share of EU-ASEAN co-publications in overall European publications in the respective priorities is much lower than in the ASEAN countries, as are the differences between the different thematic fields.

With the exception of ICT, the results presented in this section correspond well with the participation of ASEAN countries in FP7 projects as will be outlined in the following chapter. 13

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13 We have seen above that physical sciences are a prominent field in EU-ASEAN co-publications. The fact that they do not appear as prominent in this and the next section results from the fact that FP7 has no specific focus on physical sciences (only parts of the work in the field falls under the nanotechnology heading).

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3 Analysis of ASEAN participation in FP7

Olivier Küttel, Veronique Sordet 14

The last chapter in this part deals with the participation of scientists and institutions from ASEAN within the European Research Framework Programme 7, overall statistics will be presented first, followed by a focus on priorities and, subsequently, on countries.

3.1 Methodology

Data was gathered by counting the total of research proposals or applications within FP7 and comparing them along the dimension of the country of origin of the applicants. Source data was taken from the proposal database eCorda release number 6 in October 2010. These data represent the outcome of the evaluation process before negotiation. Some projects might not have made it through the negotiation phase while some others from the back up list might have got funded. The eventually funded projects are stored in the funded project database of eCorda only.

3.2 Analysis

In the following, we show the main results as they were visualised in graphs. The general statistics show absolute numbers per country, first in the whole comparative region, and then for ASEAN only (figures 48 and 49).

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14 Both authors are at Euresearch, Switzerland. Corresponding author’s email address: olivier.kuettel@euresearch.ch
As visualised below, ASEAN countries have different foci towards the priorities analysed, first in absolute figures (figure 51), then in a relative form of display (figure 52).

In the following graphs we narrow down our focus to the main priorities and subject areas that have been of interest in the preceding sections and look at the applications from all countries in the ASEAN region (as far as proposal participants came from one of these countries) in absolute numbers.

In figures 59 and 60 we deal with the specific programmes, ERC and Galileo and the evaluation successes for those countries of ASEAN that have had submissions.
As findings for the general statistics on the overview of FP7 participation in 365 main-listed proposals, before India (229) and Australia (179) in the given selection of countries that equals to two tenths of Chinese participations. Together they form an amount of main-listed projects. With regard to the other priorities, success rates see more stable and comparable, with Vietnam generally achieving higher rates.

Comparing the individual ASEAN countries application patterns, scientists from Thailand have a very broad interest from Environment (ENV) to Information- and Communication Technologies (ICT), Food, Agriculture, Fisheries and Biotechnology (KBBE), PEPs in Social Science and Humanities (SSH), Sustainable Surface Transport (SST) and ENERGY, while Vietnam is mostly focused on ENV, HEALTH and KBBE.

The analyses of the preceding chapters clearly demonstrate that Southeast Asia is enjoying constant growth in research output and has developed pockets of excellence in several thematic research areas. The earlier chapters have looked at total research output, research output in relation to EU output, ASEAN-EU co-publication output and participation in FP7 to indicate where ASEAN research strengths are. Depending on the indicators used, there is a degree of variation in the set of research areas identified as strong.

Comparing ASEAN research output with EU output, ASEAN output is greatest in the areas of nanotechnologies, ICT and industrial technology. However, looking at overall research output, the highest volume of ASEAN publications were produced in the areas of health, food, agriculture, fisheries and biotechnology (FAFB), as well as environment.

With a few exceptions, the thematic strengths in research output are also reflected in ASEAN scientists’ co-publications with Europe, as well as in levels of ASEAN participation in 7th Research Framework Programme (FP7) funded projects. Health, FAFB and environment figure as the most prominent thematic areas. However, there are some deviations in the patterns identified. For instance, stand the different dominance of ICT as an area where there is great ASEAN participation in FP7 is not reflected by equal strength in volume of co-publications. Nevertheless, ASEAN does perform well when comparing ASEAN overall research output to European authors’ output put in this field. In this instance, the explanation for the variation might be that there is more cooperation potential and/or that the current cooperation has the potential to increase its impact by producing collaborative output. There are additional ‘soft factors,’ which should be taken into consideration, such as in ICT, for strategic reasons, international co-publication might be less common, although cooperation is taking place. More relevant qualitative research is required to answer this question.

The most significant FP7 thematic areas for EU-ASEAN collaboration, as identified in the analysis, are health, FAFB and environment, which have the highest overall research output, co-publication and FP7 participation numbers (with ICT being particularly important in FP7 participation). It is noteworthy that the number of co-publications per publication is much higher in the area of environment than in other thematic areas (comparing figure 23 in chapter 1 and table 6 in chapter 2 with other thematic areas). ASEAN countries also have one of the highest FP7 participation rates in environment, although ASEAN total research output is only the fourth highest in environment in the seven FP thematic areas under consideration in the preceding chapters.

Trends in individual country strengths in the FP7 thematic areas can also be mapped across the different analyses. For instance, Indonesia is amongst the top co-publishing partners of European authors in FAFB and environment, whilst it is not one of the best performing countries in terms of overall research output in this area. This could indicate that Indonesian scientists in this area primarily co-publish or that the research is primarily driven or exploited by the European and not the Indonesian partners. The thematic focus of ASEAN countries’ FP7 participation is, predominantly, consistent with their research strengths and co-publication patterns (with the exception of Singapore which has different conditions for participation in FP7 projects compared to other ASEAN countries). For instance, Thailand is strong in FAFB participation in FP7 projects, as well as in publication output and co-publications. Malaysia is performing well in nanotechnology and FAFB across the board. Vietnam, on the other hand, is not a major player in FP7 projects in the areas of energy, environment, health, and FAFB, but it is not yet amongst Europe’s most relevant co-participation partners in the ASEAN region in these thematic areas. If the FP7 participation trigger impacts, both Vietnam’s research output and the amount of co-publications can be expected to rise in these areas given this current performance of the country in FP7.

Although different indicators point to some variety in the thematic areas of greatest strength across ASEAN, some clear strengths can be established. In addition to these clear strengths, precisely the highlighted varieties and apparent discrepancies can inform debate and help identify the most strategic and promising areas for future S&T cooperation between Southeast Asia and Europe. For instance, areas where FP7 participation is strong, but joint publication output low, can be expected to (or supported to) produce a higher impact of joint research in the future. Areas where research output on both sides is strong, but co-publication and cooperation levels low, indicate fields of future potential. Thematic areas where co-publication levels are high, but FP7 participation is low might hint at stronger EU-ASEAN programme links or might teach us when and where cooperation functions apart from dedicated international programmes. The next part of this book presents the results of SEA-EU NET’s qualitative analysis which can further enrich precisely this kind of discussions.
Qualitative evidence for science cooperation policy-making

The first part of this book compiles quantitative studies on ASEAN research strengths and the state of ASEAN-EU research cooperation. It analyses geographic and thematic patterns of bi-regional collaborative research including co-publication levels and ASEAN participation in FP7 projects.

In the second part, cooperation is analysed from a series of qualitative viewpoints, using different social scientific and participative methods to produce recommendations to drive future S&T cooperation. These results should be used in conjunction with the quantitative results in the first part of this book. The authors hope to inspire and inform policy debate in both regions as well as to support the bi-regional dialogue on S&T cooperation and related programme-making.

The contributions are structured as follows:

First, there is an overview of the importance and nature of international S&T cooperation as well as the shared characteristics and challenges of both regions. It further introduces major S&T policies of selected Southeast Asian countries.

This introduction is followed by two chapters focusing on opportunities and pitfalls of current (5) as well as on motivations and driving forces of future S&T cooperation between Southeast Asia and Europe (6). These sections are based on participatory, expert and stakeholder driven consultation processes - an adapted SWOT methodology was utilized for the former, and a small-scale bi-regional cooperation foresight exercise on the 2020 future of S&T cooperation between the regions was utilized for the latter. Chapter 6 offers a short success scenario of 2020 S&T cooperation between both regions that aims to inspire further debate about what successful collaboration means and about how we can implement it.

Chapter 7 then offers a detailed view of the Southeast Asian countries’ S&T landscape and, more concretely, their S&T policies’ thematic and geographic priorities for international collaboration. The result is a comprehensive guide to main ASEAN member states’ goals and practices of international S&T cooperation. The information collected is crucial when considering how to implement recommendations presented in the previous two chapters. They are particularly relevant when engaging in joint thematic priority setting, building on the quantitative evidence on current cooperation and strengths presented in the first part of this book, and the existing inner-regional or national priorities of the dialogue partners.

Chapter 8 looks at one of the major driving forces for current and, especially, future cooperation, namely using research to jointly solve global challenges. The analysis considers existing collaborative research, and looks at the opportunities and challenges involved in this collaborative research. Several relevant case studies are considered in this analysis.
The world today is faced with global challenges, which require global solutions developed from co-ordinated international research. Scientific collaboration can increase the standard of living of all citizens around the world, and assist in capacity building in less-developed nations. It is important for the advancement of individual researchers’ careers. Research funders can stimulate greater scientific collaboration through the creation of favourable conditions for collaboration, as well as ensuring resources are directed to areas where there are the greatest opportunities for mutual benefit. Southeast Asia is one of the key partners for European international scientific collaboration and partnerships. Southeast Asia has several characteristics such as a unique and diversified topography and prevalence of infectious diseases, making it an important partner of choice for Europe. When trying to direct resources to Europe-Southeast Asia collaboration, it is challenging to identify which thematic areas of research provide the greatest gains for both regions. However, certain areas such as within health or environment research provide obvious win-wins for both regions.

4.1 The rise of and global importance of international collaboration

The world today is faced with global issues. Science has long since overrun national borders to find global solutions to these global issues, which are faced by every national government. Solutions are required to address climate change, energy security, epidemics, food safety and security, and water security. Neither individual institutions nor national governments have sufficient resources to engage in the R&D to address any one of these issues nationally, let alone all of them. Thus, for both scientific and economic reasons, there is a trend towards increased international collaboration, which has been facilitated by the rise of instant communication, international travel and international funding programmes for collaborative research.

Ease of communication is widely recognised as key to the development and success of cooperation. We now live in an age where we can access vast quantities of information from all around the world and interact with a diverse range of people. Researchers no longer need to be in the same place at the same time. Increasingly available information has also augmented the role of science in the lives of citizens, generating a public demand for scientific solutions to address global issues. As government awareness and public demand for ‘global science’ has increased, so has the availability of funding for international cooperation through international collaborative research and development funding programmes.

The value of international collaboration and resulted need for international funding programmes for research and development is undeniable. Research and development cannot and will not advance at the same pace without collaboration. It is further necessary to enable researchers to gain access to a wide range of resources (human, research facilities, funding, data and samples). Collaboration, where targeted to key areas of mutual importance, results in mutual benefit for individuals, organisations, societies and national states.

A corollary benefit of increased cross-border cooperation is the role research collaborations play in international development. Science and innovation are intricately linked to development and vital to enable developing countries to move up the value chain. People who live in the developed world often forget the role science has had in transforming their lives. However, in the process of mapping out development plans for emerging nations, many industrialised countries have recognised the role that science and innovation have played in their own development.14

Life changing scientific developments to date include vaccinations, penicillin, high yield agriculture, electricity, silicon chips to name but a few. Scientific developments often go beyond their primary outcomes and scientific advances often spur economic growth, and lead to an improved standard of living.15 The challenges faced by developing countries cannot be addressed without scientific and technological solutions.16

Scientific knowledge and technologies generated from collaborations can be applied to specific development challenges and further, assist in the achievement of the Millennium Development Goals. Thus, international funding programmes can assist in the development of poorer countries, as well as engage in scientific excellence.

The majority of international partnerships are ‘best with best’ collaborations, indicating the research collaboration is between international experts, who have world leading knowledge and experience in their research field. Each partner will contribute equally to the joint research, and these partnerships significantly further scientific advancement. The European Commission’s Cooperation programme within the Seventh Framework Programme on ‘best with best’ research partnerships, funding research projects with the leading researchers in Europe, as well as in the rest of the world.

International collaboration is not a new phenomenon. International collaboration has always been an integral part of scientific activity. However, the raised profile of global issues, increased ease of communication and rise of international funding programmes has increased the incidence of cooperation. Moreover, many projects thrive on international collaboration. Collaboration is also essential for the advancement of individual researchers and to enable researchers to become international leaders. The increased participation in international cooperation is visible in the increase in the number of international co-publications as a total of all publications, evidenced below over the 11 year period from 1992 to 2003.

4.2 The nature of international collaboration results in an infinite number of forms

Every international collaboration is unique.17 There are a multiplicity of different situations in which collaborations can arise between different countries and in different research disciplines.18 Resultantly, international collaborations exist in a variety of different forms. The OECD provides the following scale of collaborative projects:

- Research collaborations between individual scientists. These can be relatively informal, for example by exchange of letter, with little or no exchange of funds.
- Similar, but bigger, agreements between research institutions. Usually a more formal arrangement is required, particularly if funding for the participants comes ultimately from government itself, or from associated agencies.
- Collaborations requiring significant injection of capital or operational funding. Even if funds do not cross national boundaries, a more formal approach is usually inevitable, with correspondingly more complex arrangements. Such collaborations can be based on an existing facility or facilities, or may require the establishment of a new structure.
- Collaborations designed to provide a new capital facility, for example a factory that would not be within the capability of a single country.19

International projects have a range of outcomes with varying degrees of societal and economic impact. An outcome may be as simple as achieving a project objective or as far reaching as providing a solution to an issue which will benefit society as a whole. Programmes need to take account of the variety of circumstances in which projects exist, including national and cultural considerations. Southeast Asia is a very diverse region and although it shares some similarities with Europe, the budget constraints and funding mechanisms can vary greatly within the region.20

Table 8: Share of international co-publications of total publications

<table>
<thead>
<tr>
<th>Year</th>
<th>UK</th>
<th>France</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>39.5</td>
<td>27.1</td>
<td>35.1</td>
</tr>
<tr>
<td>1995</td>
<td>34.0</td>
<td>30.1</td>
<td>29.6</td>
</tr>
<tr>
<td>1998</td>
<td>37.8</td>
<td>30.9</td>
<td>30.7</td>
</tr>
<tr>
<td>2001</td>
<td>36.8</td>
<td>37.9</td>
<td>45.9</td>
</tr>
<tr>
<td>2005</td>
<td>39.2</td>
<td>45.7</td>
<td>45.0</td>
</tr>
</tbody>
</table>

14 Ibid., p. 5
15 Compiled from data on Cordis website: cordis.europa.eu/
17 INCO-Net MIRA Workshop on scientific cooperation & impact measures intro paper, p. 2
18 OECD Global Science Forum (2005): p. 2
21 Conway / Waage (2010), p. 2
22 INCO-Net MIRA Workshop on scientific cooperation & impact measures intro paper, p. 2

the regions are also very distinct in a number of character-istics. These biregional differences must be acknowledged and addressed in international funding programmes.

It is also worth acknowledging that international collabora-tion is important to researcher career development and international recognition. European researchers must engage in international collaborations to be international leaders. This has corollary benefits - if European researchers are at the forefront of international research, Europe will continue to be one of the most dynamic and competitive knowledge based econo-mies in the world. It is very important for international funding programmes, such as the European Framework programmes, to provide, a mechanism to establish and fund collaborative research between the member and associated member states of the EU and the countries of Southeast Asia.

4.3 Opportunities for collaboration with Southeast Asia

4.3.1 Europe and Southeast Asia share many characteristics

Europe and Southeast Asia, both regionally and at the individual country level, are often confronted by the same challenges which form a common background for research: water, energy, and food safety and security challenges, sea level rises, biodiversity loss, increasing burdens on public healthcare systems from aging populations, lifestyle diseases and rapid spread of infectious diseases. These global challenges require global solutions and can only be addressed through international collaborative research. The scale of problems faced by every nation in Europe and Southeast Asia requires international action.

The similarities run deeper than the common challenges faced by both regions. Both regions have a rapidly growing population, with more than 300 million in the region.27 All the countries of Southeast Asia are still developing countries, albeit rapidly developing. Significant opportunities for EU-Southeast Asian collaboration currently exist, but as the region as a whole becomes more developed, the opportunities for scientific cooperation will increase appreciably.

Taking gross national income (GNI) per capita (Atlas method) as the strongest indicator of international competition, representing a country’s ability to earn income from exports or casual employment, we see a high level of disparity across four income brackets: high income, upper middle, lower middle and low income.

Table 9: Gross national income per capita (Atlas method) for countries of Southeast Asia* 28

<table>
<thead>
<tr>
<th>High income countries</th>
<th>Upper-middle income countries</th>
<th>Lower-middle income countries</th>
<th>Lower income countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore (US$ 69,780)</td>
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<td>Thailand (US$ 9,690)</td>
<td>Vietnam (US$ 1,890)</td>
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<td>Vietnam (US$ 26,740)</td>
<td>Myanmar (US$ 9,690)</td>
<td>(estimated to be low-income)</td>
</tr>
</tbody>
</table>

*World Bank GNI per capita (Atlas method) world average figures

That is not to undermine the significant differences that exist, ranging from Southeast Asia being predominately rural whereas as Europe is predominately urban, the different geographical locations and resultant climatic conditions, and the differences in the people and cultures between the two regions. However, these differences result in greater and deeper opportunities for both regions to significantly gain from research collaboration. There has never been a stronger need for collaborative research by Europe and Southeast Asia.

4.3.2 Introduction to Southeast Asia

Southeast Asia is a highly populated region rich in natural resources and biodiversity, with pockets of scientific excellence. Southeast Asia has been densely populated for a long time but its population is becoming increasingly urbanised, creating a new set of challenges for the region.

The countries of Southeast Asia have broadly similar geographical, ecological and climatic conditions, but there is a large disparity between the national development and research and development capacities of each country. The majority of Southeast Asian countries are still developing countries, albeit rapidly developing. Significant opportunities for EU-Southeast Asian collaboration currently exist, but as the region as a whole becomes more developed, the opportunities for scientific cooperation will increase appreciably.

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</tbody>
</table>

*World Bank GNI per capita (Atlas method) world average figures

As can be seen, the majority of Southeast Asian countries are categorised as lower-middle income to low-income countries. However, the pace of development in most of these states is extremely rapid and Southeast Asia is forecasted to be the next generation of scientifically proficient middle income countries. Furthermore, Southeast Asia is regarded as a rising economic powerhouse. In addition to the scientific benefits of collaborating with Southeast Asia, it will further develop important future ties with this emerging economy of global importance.

The current disparities in wealth in Southeast Asia are generally mirrored by equal disparities in scientific and technology capacity. Singapore, which enjoys the highest GNI per capita, has a very strong science and technology (S&T) base with world class research facilities and further promotes strong S&T policies, including a human capital policy to build up a supply of national research talent and attract the best researchers globally to Singapore.29 Singapore was also recently ranked the world’s most innovative country.30 Singapore has a high gross expenditure on research and development (GERD), and although GERD contracted during the recent economic downturn (2009), the government has set a target of achieving a GERD of 3.5% of total GDP by 2015. In contrast, and as an exception to the trend of higher GNI per capita being accompanied by a more developed S&T base, Brunei’s high GNI per capita does not correspond to a strongly developed S&T infrastructure or high ratio of GERD to GDP. Brunei’s GERD is less than 0.1% of GDP.31 With the one exception of Brunei, rapid economic development in the region has been accompanied by the development of other disparities. Thailand has surpassed Malaysia’s R&D intensity more than doubled between 1996 and 2007.32 In 2009, Thailand achieved a GERD of 0.26% of GDP33 and Malaysia 0.6%.34 Vietnam has a GERD and Indonesia and the Philippines have GERDs of less than 0.1% of GDP.35 All the countries of Southeast Asia have expressed a desire to develop their S&T bases and most have national S&T policies outlining their preferred way to achieve this and which thematic areas the countries will focus upon.

5.3 Unique characteristics of Southeast Asia

Before discussing the national S&T policies in Southeast Asia, it is worth outlining some of the unique characteristics of the region, which make it an obvious partner for EU-Southeast Asia collaboration.

Biodiversity

Southeast Asia has a unique richness of biodiversity. The region covers 5 per cent of the world’s total surface, but has 20 per cent of all known species. Furthermore, the region has 3 (Malaysia, Indonesia and the Philippines) of the world’s 17 ‘megadiverse’ countries36 and 7 of the world’s 25 officially recognised biodiversity hotspots.37 Southeast Asia has a wide range of landscape and habi-tat diversity with more than 24,000 islands, a coastline of about 175,000 km, significant marine areas (including mangroves and coral), large but declining forest coverage (45% of the total land area) and diversified topography.

Health

Southeast Asia has a unique position between two worlds, suffering from both infectious diseases and diseases of the developing world, as well as increasing cases of ‘lifestyle’ diseases. The region is increasingly becoming accessible for medical tourism, whilst healthcare must still be provided for the poor. The healthcare systems face a double burden and must simultaneously treat malnutrition brought about by poverty, and obesity and diabetes caused by lifestyle choices.

Southeast Asia is one of the world’s hotspots for the emergence of new infections and drug resistance. Malaria and Dengue are prevalent in the region, along with many other diseases that threaten Europe with changing climatic conditions. In 2009, the first malaria parasites resistant to the life-saving drug artesinin were discovered in Cambodia, which the WHO predicts “could seriously undermine the success of the global malaria control efforts.”38 Further, with the proximity of people and livestock and the related problem of inter-species transfusion of disease, the region is perceived to be an area from which future global epidemics could emerge and spread.

Climate change and environment

Southeast Asia as a region is highly vulnerable to changes brought about by climate change. The UK’s Met Office predicts that a four degree rise in temperature, could decrease rice yields by up to 30%, which is the stable food of most of Southeast Asia. If the sea-level rises by 53cm, 53 million people would be flooded in Southeast Asia. Further significant threats include the
salination of crops, significant increase in the incidence of droughts (1 in 10 year droughts occurring twice as often if a 4 degree rise in temperature occurs) and an increase in extreme weather.

In addition to the above unique characteristics of the region, there are further factors which make Europe-Southeast Asia research complementary. The two regions have different environments and climatic conditions. Whereas Europe broadly has a temperate climate, Southeast Asia has a broadly tropical climate thus creating two very different sets of conditions for research and technology development. (E.g. research and development of a battery for an electric vehicle must take into account the effect of the different climatic conditions on the battery, as well as the different user patterns and requirements this will result in.) The two regions have very different populations, which have shown different susceptibility to different diseases. (E.g. higher incidence of stomach cancer but much lower incidence of breast cancer in Asian populations compared to European populations.) By partnering, researchers can explore a broader data set, and different conditions. There are significant advantages from Europe and Southeast Asia collaborating across a broad range of disciplines.

### 4.3.4 National science and technology policies of Southeast Asia

Southeast Asia is broadly a developing region, but each country has identified the importance of developing a stronger science base and to do so, has produced a national science and technology policy. The region already has well established pockets of excellent research and each plan identifies, from the top down, where the greatest priority is. The plans also play an important role in capacity building in less-developed nations with developing S&T bases.

**Indonesia**

Indonesia has developed the ‘Vision and Mission 2025’ which aims to establish S&T as the main driving force for the sustainable development of the economy and the people. The plan sets out that this will be achieved by building an ethical foundation for developing S&T, creating a solid national system of innovation to increase global competitiveness, consolidating all Indonesian S&T actors, building S&T human capital and by creating a knowledge based society. In addition to this policy, Indonesia has developed six focus programmes, which originally ran from 2005 to 2009, but which have been extended to run from 2009 to 2014 to develop core S&T capacities in specific thematic areas. The government is focusing resources on:

- Food and agriculture: Food resilience through agriculture systems; aquaculture; agro-industry and agro-business
- Energy: Sustainable energy supply through the creation and use of new and renewable sources of energy
- Transport: Creating an efficient and effective multi-mode transportation system based on land, space, and sea transportation.
- ICT: Utilising information communication technology to increase economic prosperity and good governance
- Health and pharmaceutical: Utilising technology for pharmaceutical products (including herbal medicine) and medical equipment
- Defence: Develop defence technologies in ammunition as well as land, water and space military vehicles.

**Malaysia**

Malaysia’s science and technology plan, ‘Malaysia’s S&T Policy for the 21st Century’, is geared towards economic growth—generating value for the economy and jobs for the Malaysian people. Malaysia identifies itself as a ‘relatively’ resource deficient nation in the plan, underlying the need to allocate resources in line with national priorities to transform the country into a knowledge-driven economy. The idea of harnessing S&T for economic growth is reinforced continuously throughout the plan, which aims to develop a framework for improved performance and long term growth of the Malaysian economy by:

- Strengthening research and technological capability and capacity;
- Promoting the commercialisation of research outputs;
- Developing human resource capability and capacity;
- Promoting a culture for science, innovation and techno-entrepreneurship;
- Strengthening institutional framework and management of S&T and monitoring of S&T implementation; and
- Ensuring the widespread diffusion and application of technology leading to enhanced market driven R&D, resulting in new and improved technologies; and
- Building competences for specialisation in key emerging technologies.

During the course of the S&T Plan, Malaysia aims to increase total gross domestic product, as well as increase the total number of researchers, scientists and engineers (RSES) in the workforce to at least 60 RSES per 10,000 of the labour force. Malaysia set 2020 as the year by which these targets should be attained and the results should shortly be available.

Malaysia prioritises funding research programmes in high and new and emerging technology areas that it considers will yield the greatest economic gains, and where Malaysia perceives it has a natural advantage. In the S&T plan, Malaysia identifies the following technology areas in which they will focus resources and develop a knowledge base to build sustainable support for Malaysian industry:

- Advanced manufacturing;
- Advanced materials;
- Microelectronics;
- Biotechnology;
- Information and Communication Technology;
- Multimedia Technology;
- Energy;
- Aerospace;
- Nanotechnology;

**Philippines**

The National Science and Technology Plan (NSTP) of the Philippines runs from 2002 to 2020, and was formed as a reaction to the government’s call for S&T to be the foundation of future economic development. The plan promotes science and technology transfer, human resource development, S&T promotion, information dissemination and networking are identified as key elements to achieve short term growth, and in turn, long term growth, which in turn, are key to long term growth. The NSTP outlines the national challenges which the Philippines wants to overcome, which range from slow economic growth to the depletion of natural resources resulting in limited investment, especially in S&T, and talent being drained away from the Philippines to more attractive opportunities overseas. The Philippines experienced a decreasing gross expenditure on research and development (GERD), as a percentage of GDP during the 1990s. However, the Philippines has pockets of excellence (especially identified within areas of health research) and has one of the highest percentages of high-tech exports in Southeast Asia, although this is concentrated in electronics.

The NSTP sets out a vision for the Philippines to have a wide range of globally competitive products and services with a high technology content by 2020, as well as world class universities in S&T, a well-developed S&T based SME sector, internationally recognised scientists and engineers and for the Philippines to be considered a model of S&T management and governance. To achieve these aims, the Philippines will focus on...
The plan goes into specific detail on which areas of Singapore has the most developed S&T base in South:

- Microelectronics
- Natural Disaster Mitigation
- Earth and Marine Sciences
- Materials Science and Engineering
- Biotechnology
- Agriculture, Forestry and Natural Resources

4 SignPost to success

Singapore has 5 yearly Science and Technology Plans. The current plan, the Science and Technology Plan 2010

Under the STP 2010, €7.9 billion was earmarked to promote R&D for the duration of the 5 year plan. STP 2010 sets out the strategic direction for S&T policy for 2006 to 2010 and will anchor Singapore’s transition into a knowledge and innovation driven economy through the following key strategies:

- Use Singapore’s innovative capacity as a source of competitive advantage to find and create a comparative advantage in the changing economic landscape.
- Focus the strategic direction for S&T policy upon the industry sectors that the plan is targeting are pharmaceuticals, chemical synthesis, genomics & proteomics, molecular & cell biology, bioengineering and biotechnology.
- Create and develop technology enablers for sustained industry growth, through the concentration of resources in niche areas within industry clusters.
- Develop and manage R&D & human capital through pro-local and pro-foreign policies to draw the best talent to Singapore and groom the brightest Singaporeans.

Innovation and Enterprise Plan 2015 (RIE2015), including its science plan. Singapore has 12 thematic priority areas to strengthen linkages between government and industry, improving S&T governance and promoting S&T. The Philippines identifies 12 thematic priority areas for S&T development, where resources will be focused under the NSTP:

- Agriculture, Forestry and Natural Resources
- Health and Medical Sciences
- Biotechnology
- Information and Communications Technology
- Microelectronics
- Materials Science and Engineering
- Earth and Marine Sciences
- Fisheries and Aquaculture
- Environment
- Natural Disaster Mitigation
- Energy
- Manufacturing and Process Engineering

The plan goes into specific detail on which areas of R&D should be prioritised within each thematic area. For example, the agriculture theme aims to harness S&T to increase agricultural productivity through the modernisation of agriculture and development of new technologies. The Philippines has already developed core capabilities and pocket of excellence in the health and medical sciences, as well as in IT and telecommunications, whereas biotechnology is a new area but perceived to have the greatest potential for the Philippines. Microelectronics is the top export earner and expected to continue to be so. Materials is expected to play an important part in the country’s industrial development and earth and marine sciences, as well as aquaculture, are thought to be key to increasing the country’s food supply. The Philippines wants to remove its dependence on imported fossil fuels and thus is devoting resources to R&D on energy. They are also keen to channel resources to R&D related to the natural disasters the Philippines is prone to, as well as to the environment. The plan rounds off with the implementation and monitoring plans to realise their goals.

The Philippines has a strong international strand running through its science plan, mentioning technology transfer, to concern over brain drain, and a performance indicator related to the international recognition of Philippine scientists. This indicates a clear focus on international research and collaboration.

Singapore

Singapore has the most developed S&T base in South. It is strong in all four core technology areas: biotechnology, ICT, materials technology and nanotechnology. The clusters, to which three quarters of the research budget is directed, are targeted at addressing Thailand’s needs. The following clusters have been identified:

- Automobile and traffic
- Alternative energy
- Environment, Food and agriculture
- Medical and health
- Rural areas and the underprivileged
- Software, microchips and electronics
- Textiles

Within each of the clusters, specific programmes have been developed with the greatest number of programmes being focused on food and agriculture, followed by software and electronics clusters then the energy cluster. Each programme focuses on a specific research challenge. Thailand is aware that it still needs to build up its research capacities and one quarter of the research budget is directed towards capacity building.

As part of Thailand’s S&T Plan, they are also restructuring its administrators of public R&D.

Thailand

The Science and Technology Development Strategy (STDS), which ran from 2006 to 2010, aimed to promote research which would assist in the modernisation and industrialisation of Vietnam, as well as assist in international economic integration. Vietnam is in the process of formulating its new science plan, which is set to be finished and published in 2011.67
STDS aimed to speed up basic research in natural sciences, social sciences and humanities, as well as direct necessary attention to applied research in areas where Vietnam has the greatest strengths. The STDS also increase the R&D capacities of domestic technologies and master modern technologies, as well as build up S&T human capital. Specific mention is also given to investing in S&T related to national defence and security.

In addition to building capability in the social sciences and humanities, and natural sciences, Vietnam identifies key technologies which will have a significant impact on the modernisation of the economy, and ensuring national security, as well as make use of Vietnam’s tropical agriculture and abundant agricultural labour force.

- Information-communication technology
- Biology technology
- Advanced material technology
- Automation, mechanics and machinery technology
- Technology in energy
- Preserving and processing technology of agricultural products and foods
- Cosmology technology

For each sector, Vietnam outlines what research is prioritised and the objective of carrying out this research. Vietnam has developed significant strengths in food and agricultural related research over the last few years, capitalising on the agricultural industry, as well as trying to ensure food safety and security for Vietnam as climatic changes change in a country very vulnerable to climate change. Analysis of the country’s previous plan and new strategic and policy directions will be available in mid-2011.

Other countries of Southeast Asia

The other countries of Southeast Asia (including Cambodia, Laos, Myanmar) are now also focusing on growing their S&T bases. They show a strong intention to develop their S&T sector, as well as trying to increase their S&T export, and to ensure food safety and security for Vietnam as climatic changes change in a country very vulnerable to climate change. Analysis of the country’s previous plan and new strategic and policy directions will be available in mid-2011.

4.5.5 Research Strengths of Southeast Asia

The second highest research output of Southeast Asia, in terms of citations, is in research relating to food, agriculture and biotechnology (research in this field generates the third highest number of publications coming out of Southeast Asia). Similar to health, in 2008 Thailand led in producing the greatest number of publications of any country in Southeast Asia, but Singapore produced about twice the number of citations as Thailand. Where-as, there are clear strengths in health research in Thailand and Singapore, continuing to use total publication and citation output as a measure of research strength, Southeast Asia as a whole is consistently strong in food, agriculture and biotechnology research, with Thailand, Singapore, Malaysia, the Philippines, Indonesia and Vietnam producing similar numbers of publications. Cambodia produces around half the number of publications as the Philippines, Indonesia and Vietnam, but this is significant given the level of development of this less developed Southeast Asian nation. The National University of Singapore produces both the greatest number of publications and citations, with Mahidol University, Thailand, producing the second highest number of publications.

Food, agriculture and biotechnology research is identified as a national priority in the S&T plans of Singapore, Malaysia, Thailand, Indonesia, Vietnam and the Philippines. Singapore and Malaysia are focusing resources specifically on biotechnology, whereas Thailand, Vietnam and the Philippines are focusing on both biotechnology, and food and agriculture as research priorities. Indonesia includes food and agriculture as a national priority.

Singapore has identified biotechnology as an industry growth area that promises great economic and societal value. Biotechnology underpins a range of industry clusters, including electronics, precision engineering, transport engineering, chemicals, engineering services and the food industry, but Singapore’s strengths lie predominately in agriculture and health biotechnology, the biotechnology industry in Singapore is a vibrant and growing industry and six out of the top ten pharmaceutical companies have manufacturing facilities in Singapore) rather than agricultural research.

Thailand is one of the largest agriculture and food exporters in the world, and the world’s top rice exporter. Vietnam remains a predominantly agricultural country with 60% of the population engaged in agriculture, forestry and fisheries. Agriculture also continues to play an important role in Malaysia despite its move away from being an agriculture based economy, in the 1970s Malaysia recognised the importance of natural resources, primarily in terms of the wide diversity of its native flora and fauna, and compounds derived from native organisms may have applications in human and animal healthcare, food production, environmental sustainability and related technologies.

With widespread strengths across the whole of Southeast Asia, coupled with the importance of the food and agricultural industry and its vulnerability to climate change, food, agriculture and biotechnology research is a key area for Europe-Southeast Asia research partnerships.

Nanotechnology

Nanotechnology is an important area of research in Southeast Asia, being a strength of the region in terms of the number of publications and citations produced annually than Southeast Asia does. However, Southeast Asia is rapidly developing and going forward, is likely to see a significant rise in the total publications and citations from the current level. Current publications and citations from Southeast Asia have a high percentage of international collaborations and international citations, indicating a high impact of research output and quality and experience as an international partner. The percentage of international collaborations and international citations is high in comparison with other countries, notably the rest of Asia (China, Japan, South Korea) and Australia. Over the period 2004 to 2008, Southeast Asia has the highest publication and citation output in relation to the output of the EU in research in the fields of nanotechnology, followed by ICT, then industrial technology, then energy, and the lowest percentage of research output in relation to the EU in health research. Southeast Asia produced the highest overall number of publications and received the highest number of citations in health research in 2008, indicating health research is a significant strength and priority of research conducted across Southeast Asia.

In terms of the number of publications produced by Southeast Asia (2008), the highest number was produced in health, followed by research related to food, agriculture and biotechnology and then nanotechnology. The highest number of citations of Southeast Asian papers (2008) followed the same pattern with the highest number of citations in health, followed by food, agriculture and biotechnology research, then nanotechnology.

<table>
<thead>
<tr>
<th>Thematic area of research</th>
<th>Total publications produced by ASEAN</th>
<th>% international collaborations</th>
<th>Total citations generated by ASEAN</th>
<th>% international citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>48,045</td>
<td>(av. Asia-Pac. = 29 %)</td>
<td>29,226</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
<tr>
<td>Food</td>
<td>11,969</td>
<td>(av. Asia-Pac. = 27 %)</td>
<td>21,517</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
<tr>
<td>Nanotechnology</td>
<td>3,552</td>
<td>(av. Asia-Pac. = 27 %)</td>
<td>38,773</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
<tr>
<td>Environment</td>
<td>4,595</td>
<td>(av. Asia-Pac. = 27 %)</td>
<td>16,489</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
<tr>
<td>ICT</td>
<td>4,156</td>
<td>(av. Asia-Pac. = 27 %)</td>
<td>3,184</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
<tr>
<td>Energy</td>
<td>3,511</td>
<td>(av. Asia-Pac. = 27 %)</td>
<td>4,070</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
<tr>
<td>Industrial Technology</td>
<td>1,055</td>
<td>(av. Asia-Pac. = 27 %)</td>
<td>2,456</td>
<td>(av. Asia-Pac. = 27 %)</td>
</tr>
</tbody>
</table>

annually, as well as national research priority for Ma-
laya, Thailand and Vietnam. Nanotechnology is also
identified as an important technology cutting across
six of the eight target industries Singapore is focusing
upon in its national S&T plan, and therefore a key focus of re-
search in Singapore. Singapore dominates the research
output in nanotechnology in Southeast Asia, producing
more than four times the number of publications than the
next highest countries (Thailand and Malaysia) and more
than twelve times the number of citations than any
other country in Southeast Asia. Unsurprisingly, Sin-
gapore universities and research institutions dominate
publication and citations coming out of Southeast Asia
with highest number of publications and citations com-
ing from the National University of Singapore, Nanyang
Technological University and two public research insti-
tutions: the Institute of Materials Research and Engi-
neering, A*STAR, and the Institute of Microelectronics,
A*STAR.

By the above measure, Singapore is currently the
only country in Southeast Asia with significant research
intensity in nanotechnology. However, nanotechnology
has also been identified as a national research priority
across Malaysia, Thailand and Vietnam and with these
resulting national policies as stimuli for developing
capacity, these countries may also shortly increase their
research intensity in this area, which is likely to become
an important for future partnerships with the region be-
don beyond Singapore.

Environment

The thematic area in which Southeast Asia has the next
highest research output, is environment. Research out-
puts across Southeast Asia are well distributed in envi-
nronment research. Thailand and Singapore lead in the
number of publications and citations produced but Ma-
laya and Indonesia are very close to Singapore and Thai-
land in research output, and strengths are also seen in
the Philippines and Vietnam. There is a significant
differentiation in terms of research in Southeast Asian
research in this field. Southeast Asia has a unique richness of
biodiversity, seventeen of the world’s ‘megadiverse’ coun-
tries
and
seven
of
the
world’s
twenty
top
countries
recognised biodiversity hotspots. Southeast Asia addi-
tionally has a wide range of landscape & habitat di-
versity with a large coastline, significant marine areas
(including mangroves and coral), and large forest cov-
erage. Environment research provides a huge potential
growth area because of the unique biodiversity and glo-
bal importance of this resource. Southeast Asia’s high
level of vulnerability to climate change is an additional
reason for research partnerships in this area.

Other thematic areas

ICT and energy both feature highly in the national S&T
plans of the countries of Southeast Asia – all identify ICT
and energy as specific national research priorities. How-
ever, when considering publication and citation outputs,
these are growth areas rather than current strengths of
the region. There are a broadly similar number of pub-
ications produced by Southeast Asia in ICT research as
compared to environment, but there are much fewer ci-
tations in ICT research.

ICT research in Southeast Asia is dominated by Singapore, which produces the major-
ity of publications and approximately three quarters of the total citations.

Southeast Asia generated less than 20% of the number of publications and citations in energy research
compared to its output over the same period in health research. Singapore, Thailand and Malaysia produce a
more or less equal number of publications in energy although Singapore generated a greater number of ci-
tations than the other two countries in 2008. Although energy research is not currently a key strength of South-
east Asia as measured by number of citations gener-
at ed, it is a priority for each country nationally, as well as for the region as a whole, each country acknowledging the need for future energy
security and a sustainable energy supply.

One additional area that the countries of Southeast Asia are broadly focused upon related re-
search – prioritised in the national S&T plans of Indone-
sia, Vietnam, Thailand, Malaysia. Individually, Vietnam is
the only country prioritising research in socio-economic
themes, infrastructure, and economics. Yet, Vietnam is as-
sist in the transition to a modernised industrial nation,
and Indonesia is the sole country prioritising science
related research.

4.3.6 Supplementary evidence: Southeast Asian participation in the Seventh Framework Programme

Researchers from Southeast Asia have actively partici-
pated in the EC’s Framework Programmes. There has
been a significant increase in Southeast Asian participa-
tion in the European framework programmes from FP6
to FP7. During the 6 years of FP6 a total of 149 SEA part-
ners from SEA participated, receiving € 16.4 million EC
contribution. These figures were nearly met within the
first 2 years of FP7 and the success rate of projects with
Southeast Asian partners in FP7 (over 50%) is above the
average success rate which ranged between 10% and
25%, depending on the thematic area. The success rate
of projects with SEA partners is above average for
projects in specific thematic areas, notably Health and
Food/Biotech. However, the success rate of projects is
below the average in other thematic areas, notably En-
vironment and ICT.

Thailand has the highest participation in FP7 meas-
ured by number of FP7 applicants (52 successful ap-
plicants), and also receives the one of largest sums for
a specific portfolio, receiving € 1.15 million (just
within the health thematic. Vietnam receives the larg-
est sum for one project, receiving € 1.45 million for
participation in a project in the health thematic. Nine
of the ten countries of Southeast Asia are participating
in a project in the ICT thematic, compared with seven
countries participating in projects in the health the-
ematic, six in environment, five in food, agriculture and
biotech projects and only Singapore participating in a
project in the nanosciences, nanotechnology, materials
and new production technologies thematic. Vietnam is
the only country participating in a project in the energy
thematic and Thailand the only one participating in a
project in the transport thematic. The greatest amount of
FP7 funding received in Southeast Asia is directed to
the health thematic, which is not surprising given South-
east Asia’s strength in this thematic area, as well as the
unique selling points of the region.

Southeast Asia’s high level of participation in health
thematic FP7 projects is not a surprise – it a clear strength area of the region, a national priority for individual
countries, and the region has a unique and interesting
research environment brought about by the prevalence
of both infectious diseases and ‘lifestyle’ diseases.

Other thematic areas are generally focused upon by both
Southeast Asia and Europe, the success rates of participating coun-
tries are comparable. Yet, there is also a lack of correlation between
participation, is the participation of six countries in projects in
the environment thematic, whereas fewer countries (five)
participate in food, agriculture and biotechnol-
ygy. The region has a significantly higher publication and citation output in food, agriculture and biotechn-
ology than environment, and food, agriculture and biotechnol-
gy feature broadly across the national S&T plans of Southeast Asia, whereas environment does not.

4.4 Concluding comments

There are many measures of research intensity and im-
portance, and it is hard to evaluate which is the most im-
portant measure in determining the particular research
strengths of a country or region. The national S&T poli-
cies, the annual level of output of scientific publications
and citations, as well as participation in the EC’s seventh
framework programme have been briefly outlined for
Southeast Asia to try to provide an indication of the re-
search strengths of the region, and thus where the greatest
opportunities for scientific collaboration be-

From the analysis, it becomes apparent that, with a
few exceptions, there is a lack of correlation between
the level of Southeast Asian participation in the differ-
ent thematic areas of FP7, the annual level of publica-
tions or citations produced by Southeast Asia in these
thematic areas, or the thematic priorities outlined in the
national science and technology plans of the region.
This lack of correlation could be caused by a number
of factors.

Firstly, there is an obvious limitation in measuring re-
search strength by the number of publications and cita-
tions produced annually. Although this is an interesting
primary level of analysis, it does not give any indication of
the citation impact of the research published. Pub-
lishing factors such as the number of authors, the jour-
ral impact factor, or even the journal impact factor
which have no international element.

Secondly, most international collaborations (and
joint publications) are stimulated from bottom up driv-
en initiatives – researchers who know each other from
previous research positions or from meeting at scientif-
conference, or if one researcher has read and is inter-
sted in the work of another. Looking at the national
S&T policies only considers the top down mechanisms
to developing S&T capabilities and looks over individual
strengths or pockets of excellent research in niche ar-
eas which might result in specific international collab-
ration.

Thirdly, considering the national S&T policies, the
annual level of output of scientific publications and cita-
tions, and Southeast Asian participation in the EC’s sev-
enth framework programme, overlays any unique or
special characteristics. It might be fair to assume that na-
tional S&T policies would focus on the unique resources or
characteristics of their state. However, this is not al-
tways the case. For example, this does not mention
its significantly biodiversity in its S&T plan, and refers to the
country as a largely resource deficient nation. The lack of
 tailoring S&T policy and funding towards specific na-
tional characteristics might be caused by a limitation of
resources (considered to be a global problem) coupled
with a desire to focus on areas perceived to have the
greatest economic growth potential.

However, even without a significant correlation be-
tween the national S&T policies, the annual level of out-
put of scientific publications and citations, and South-
 east Asian participation in specific thematic areas of the
EC’s seventh framework programme, it is still possible to
determine key opportunities for Europe-Southeast Asia
scientific collaboration in specific thematic areas.

The most obvious area for scientific partnership is
where both regions share the same challenges which
form a common background and joint need for re-
search. These common challenges will evolve over time,
but currently both Europe and Southeast Asia region-
ally, as well as on an individual state level, are faced with
challenges to ensure their future water, food and
energy security, as well as protect the health of their citi-
zens and protect against the threats posed by climate
t justices. These are huge challenges which cannot be
dealt with on an individual state or even individual re-
 gional level and are therefore key areas for international
 collaboration.

In addition to identifying the above global challeng-
es, it is possible to identify certain key areas where
 should be a focus of Europe-Southeast Asia collaboration from
the unique characteristics of the region, the volume of
publications and citations produced, the national pri-
orities of the countries, supplemented by the level of
participation in particular thematic areas in the EC’s sev-
enth framework programme.

Going forward, a vital area for Europe-Southeast Asia
 collaboration is health research. Research funders
should ensure there are adequate mechanisms to en-
able funding opportunities for this research. Health is a
key research strength of Southeast Asia, demonstrated
in its unique biodiversity in its S&T plan, and refers to the
value of Southeast Asia’s ecosystems and environment,
as well as to protect both regions against the serious
sequences threatened by climate change.

Another area of great significance is to promote the
development of successful programmes in FP7 projects, as
Southeast Asia collaboration is health research. Research
in this thematic area is strength across the whole of the region (high publi-
cation rate in Southeast Asia) and an ideal area in which to partner in a best-with-best
project with partners across Southeast Asia. Southeast Asia also has a significant medical output (Thailand
is the world’s largest creator of medical research papers,
and biotechnology is of use importance because of threat to world’s food supply caused by clima-
te justice, placing European and Southeast Asian
researchers at the forefront of developing solutions to
this global problem.

Southeast Asia’s rapid economic development and
S&T plans should develop stronger S&T capacities na-
tionally. The national priorities for research will evolve
over time and 2011 is a year of transition for many coun-
tries in Southeast Asia as they produce new S&T plans,
potentially shifting priorities, but the core capabilities
that are currently being developed will strengthen the
research intensities of each country.

Although it is possible to identify key areas for
Europe-Southeast Asia collaboration, it must also be
remembered that the majority of collaborations will
still arise from bottom up approaches and individual
researcher interactions. For these individual collabora-
tions to develop, there must be a conducive environ-
m ent. Therefore, it is equally important for policymak-
ers to create the ideal environment to enable research
 collaborations to flourish, as well as identify the key ar-
eas where collaborations are likely to create the great-
est mutual benefit. Policymakers must ensure there is a
sufficient mix of reactive, as well as directed research
funding.

International funding programmes must have the
necessary characteristics to enable the programme to
be attractive and easy to participate within. They must
have similar S&T policies, and flexible but pre-
cise financial policies. All programmes need the flexibil-
ity to allow researchers to take risks in their research, as
well as promote creativity, whilst simultaneously ensur-
ing funds can be traced and misuse guarded against.

It is important that international programmes are con-
ductive to research, offering the most attractive frame-
work for collaborative research. It is important that the
European Commission’s framework programmes con-
tinue to and further encourage collaboration with this
important region.

4.5 Outputs of the SEA-EU-NET project

SEA-EU-NET has prepared a list of policy recommen-
dations to identify the key thematic topics for future
Europe-Southeast Asia collaboration (see concluding
chapter at the end of this book), as well as to guide the
development of future Framework Programmes and other
funding programmes for international collabora-
tive R&D, and create the best environment for collabo-
ration outputs from all countries of Southeast Asia (and
Southeast Asia) and references to the

59 OECD Global Science Forum 2009, p. 2

4 signpost to success

4 signpost to success
5 Opportunities, pitfalls, and recommendations for S&T cooperation

Rudie Tienes, Jack Spaapen, Jacco van den Heuvel

5.1 Major opportunities and pitfalls

This chapter presents an analysis of the opportunities and pitfalls with regard to S&T cooperation as assessed by experts from SEA and Europe, and it advises on a number of policy changes in order to further enhance scientific cooperation. The content is based on an analysis of information obtained in a number of activities and events that have been organised especially for this analysis. These include workshops and focus groups, semi-structured individual and group interviews with researchers and policy advisors both in Southeast Asia and Europe, and a number of dedicated feedback sessions at the SEA-EU-NET conference in Bogor, Indonesia, in 2009.

The major conclusion of both workshops and feedback sessions is that by far the most important priority in developing S&T cooperative relationships between SEA and Europe is building a more sustainable and soft and hard S&T infrastructure for research and development. In this, the prime focus should be on creating or enhancing strong knowledge hubs that have both a stimulating effect on the wider environment (other parts of the research system and society at large), and form an attractive place for young talented students and researchers. A good infrastructure is of pivotal importance in redressing the imbalance between researchers from SEA going to Europe and European researchers currently not going to SEA. A good research infrastructure and ample training opportunities would create a win-win situation, co-writing proposals, co-publications, co-patenting (all still biased towards Europe); the different policy agendas and interests with regard to establishing research infrastructure (there are still huge differences in the region, there’s no one size fits all approach); and the lack of mutual learning, in particular from good practices (like e.g. institutes for good governance in Southeast Asia and Europe).

A limited SWOT analysis: aims and basic methodology

A limited SWOT analysis: aims and basic methodology

The major conclusion of both workshops, interview and feedback sessions is that by far the most important priority in developing S&T cooperative projects or programs, serious attention should be paid to the following major opportunities and pitfalls:

**Major opportunities**

- The balance between research interests of both regions, a win-win situation, co-writing proposals, co-publications, co-patenting (all still biased towards Europe); the different policy agendas and interests with regard to establishing research infrastructure (there are still huge differences in the region, there’s no one size fits all approach); and the lack of mutual learning, in particular from good practices (like e.g. institutes for good governance in Southeast Asia and Europe).

**Major pitfalls**

- The lack of clarity on what EU programmes entail, for example with regard to the EuropeanVersions during the Week of Cooperation in Bogor, and conducted a number of dedicated feedback-sessions.

Some details of the overall approach: The aim of our analysis is to combine information from a wide variety of sources, both from the SEA and the European perspective, and from policy makers and researchers. Furthermore, we use a wide range of cooperation experiences, in terms of scientific field, country, and cooperative arrangement. In the meetings in Bali and Amsterdam we used a similar approach, i.e. a combination of interviews and focus groups, but with a difference. During the Bali meeting we used two separate groups of informants: experts that we had invited to participate in the focus groups, and other experts that were participating in the ASEN COST conference and were available for individual interviews. In Amsterdam, where there was no larger conference, we interviewed the participants that we invited for the focus groups at

SEA-EU-NET has performed an analysis to identify the best opportunities and potential pitfalls for scientific cooperation between SEA and Europe. We have used a methodology that is based on the well known instrument of SWOT analysis (Strengths, Weaknesses, Opportunities, Threats). However, for reasons explained below, we have not conducted a full SWOT analysis, but we have focused instead on identifying the best opportunities for cooperation and the potential pitfalls.

5.2 SWOT analysis of SEA-EU cooperation: why and how
a separate moment individually. The experts that par-
ticipated in the focus groups in Bali were mostly mem-
bers (sometimes chair) of subcommittees on specific
scientific fields of the ASEAN COST. For the interviews
we selected participants of the conference, paying due
attention to the distribution over fields and countries.
The experts in the Amsterdam meeting came from dif-
ferent European countries. They were either suggested
by S&I-EU-NET partners, or identified through the FP6
and FP7 databases, and in a few cases through the net-
work of the Royal Netherlands Academy of Arts and
Sciences (KNAW).

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by S&I-EU-NET partners, or identified through the FP6
and FP7 databases, and in a few cases through the net-
work of the Royal Netherlands Academy of Arts and
Sciences (KNAW).

For the interviews we used a semi-structured ques-
tionnaire of which we had two versions, adapted to re-
searchers and to policy makers.

The focus group approach was as follows: We divid-
ed the participants into groups of six to eight people and
let them discuss six topics. The topics were loosely
related to the questionnaires. It was emphasized in ad-
vance that the goal of a focus group is not to reach con-
sensus, but to exchange information and experiences
and open up perspectives. That is why the group has
to be relatively small, and yet diverse enough to entail
a variety of fruitful perspectives. After the discussion in
the focus groups, the participants got together for a plic-
enary session in which the main results were discussed
and common grounds were explored. This resulted in a
list with opportunities and pitfalls. After the Amsterdam
workshops, the topics and meeting results were brought
back together and a draft list was presented to the Bogor
crference in November 2009. During this conference
separate, dedicated feedback sessions were organised
during which the comments of the conference participants were taken up in the final text.

From the desk study that we performed in the first
phase of our study we selected the six main topics that
were, as a base for both the interviews and the focus
groups:

- Benefits of growing international S&T cooperation
  for local research
- Benefits of growing international S&T cooperation
  for the wider society
- Pros and cons of SEA-Europe or other international
  cooperation
- Government policies to stimulate SEA-Europe S&T
  cooperation
- Interaction between public and private research
- Pros and cons of funding policies in both regions

While the six topics all represent the interface between
science and politics, between research endeavours and
policy intentions and measures, the first three are slight-
lly slanted towards the side of S&T, the latter three to
the policy side. By discussing these issues with experts
from both regions, we were able to shed some light on
the following topics in the next sections of this chapter:

- Existing and emerging opportunities for interna-
tional cooperation
- Potential pitfalls

5.3 Existing and emerging opportunities for international cooperation

Researchers everywhere in the world try to connect with
their colleagues internationally, in order to share new
scientific knowledge, exchange research methods, start
up joint projects, and thus improve the quality and dis-
semination of their work. At the same time, policy mak-
ers focus on achieving a wide variety of societal goals,
in order to improve living conditions for the general
population, by advancements in sectors such as educa-
tion, health, and infrastructure. In this, the objectives of
science and government policy at times overlap, but at
other times deviate to some extent. In general, the rela-
tion between science and society, and the differences in
goals and interests between both communities, has
proved to be a fruitful ground for interaction.

The opportunity to open up collaborations between cultures
countries and regions also forces governments to expect more help
from science to address societal problems. During the Bogor
conference we discussed various aspects related to
socio-scientific challenges in Europe and in the
Southeast Asian region, and we came to the following
conclusions:

- There is an increasing need for long-term partnerships between
  research communities and policy makers.
- There is an increasing need for funding that involves both
  EU and ASEAN partners.
- There is an increasing need for the development of
  institutions that facilitate cooperation.
- There is an increasing need for the development of
  a common research agenda.
- There is an increasing need for the development of
  a common research strategy.
- There is an increasing need for the development of
  a common research programme.
- There is an increasing need for the development of
  a common research policy.
- There is an increasing need for the development of
  a common research network.
- There is an increasing need for the development of
  a common research infrastructure.
- There is an increasing need for the development of
  a common research methodology.
- There is an increasing need for the development of
  a common research culture.
- There is an increasing need for the development of
  a common research language.
- There is an increasing need for the development of
  a common research tradition.
- There is an increasing need for the development of
  a common research history.
- There is an increasing need for the development of
  a common research philosophy.

5.3.1 Benefits of and challenges to international R&D cooperation

From the point of view of European researchers, one of the
many benefits of cooperation will be the availability of the
right scientific expertise. While in Southeast Asia, the
preferred areas of cooperation are among the prime
motivations for cooperation, see Schüller et al., International Science and Technology
Cooperation policies of Southeast Asian Countries. Consultation prepared
for the EU Commission on the science and technology cooperation policy dialogue, EU-ASEAN (2008), pp. 4-6

From the point of view of Southeast Asian researchers, the moti-
vation for cooperation is primarily the ability to access to
international funding schemes is important
given the low level of investment in SEA countries (ex-
cceptions are Singapore and Malaysia), and the possi-
ble opportunities to enhance the visibility of the
Southeast Asian region in international research networks. This is of course not to say that both
regions are always interested in cooperation. The influence of international cooperation
regarding this point is felt to be important by researchers
and policy makers alike.

While we find that the majority of researchers and policy
makers also hope for positive influence of cooperation on the
general level of research and teaching at the univer-
sities. Sending (PHD) students abroad is an important aspect of this. The main motive for sending students abroad is to improve the Mobility of
researchers in Southeast Asia and to enhance the European understanding of the
academic part of the R&D system, as many prefer
working in the international community. Mobility of research-
ners however, can be seen as an indicator of both qual-
ity and the degree of internationalization of
researchers. The influence of international cooperation
regarding this point is felt to be important by researchers
and policy makers alike.

From the point of view of European researchers, the benefits of cooperation are:
- Access to international funding schemes is important
given the low level of investment in SEA countries (ex-
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ble opportunities to enhance the visibility of the
Southeast Asian region in international research networks. This is of course not to say that both
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regions are always interested in cooperation. The influence of international cooperation
regarding this point is felt to be important by researchers
and policy makers alike.

From the point of view of European researchers, the benefits of cooperation are:
- Access to international funding schemes is important
given the low level of investment in SEA countries (ex-
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Southeast Asian region in international research networks. This is of course not to say that both
regions are always interested in cooperation. The influence of international cooperation
regarding this point is felt to be important by researchers
and policy makers alike.
5.3.2 Learning to find the best opportunities

For more information, see http://www.a-star.edu.sg/a_star/2-About-A-STAR/

We highlight by way of example some arrangements and policies in different countries that might provide lessons for other countries.

Interactions between research, industry and government

A good innovation system only works when there are good connections between the different parts of the system: research, industry and government. Singapore, and to a somewhat lesser extent Malaysia, arguably have succeeded in building such connections. Malaysia has invested in private sector R&D development, in particular to make risks acceptable for local companies. This policy of the Malaysian government indeed encourages tripartite cooperation between government, industry and research institutes. It is worthwhile to see whether this model may be useful for other national governments and/or ASEAN.

The next generation of researchers

Any S&T system can only be sustainable as long as it offers itself on a permanent basis, in particular through educating and training a next generation of researchers. We see various policies in different countries. For example, Indonesia cooperates with Chinese universities through which Indonesian students are funded to study in China. Indonesia also has some positive experiences with the so-called twin city approach, where a local or regional level one SEA country or city and an urban agglomeration in a partner country cooperate. Successful cooperation is often built on the creation of local research centres where new knowledge can be developed, and by doing so offer an attractive environment for returning students and scholars. Good examples are the STAR Institute of Technology (SIIT) which has its main campus in Thailand and the International Rice Research Institute (IRRI) with its main location in the Philippines.

Create strongholds

The role of strong and recognisable research centres in Southeast Asia in stimulating international R&D cooperation should be explored when setting up new initiatives, especially on themes that are directly relevant to the region, for instance on marine biology, coastal regions, fishery, forestry. Such centres arguably are attractive for foreign researchers, and thus can stimulate interaction with local researchers. The centres can thus also provide a stepping stone for European researchers into the region.

Focus on problems that affect SEA

To cooperate especially on topics that affect both regions seems to be obvious, yet this is not always the leading principle. This is partly due to lack of attuning different interests in the research and policy systems. There is a need for a strong focus on international problems that hit the SEA region seems self evident. Climate change and CO2 emissions constitute global problems, as do energy related issues and the spread of contagious diseases. Successful cooperation depends largely on mutual benefits for partners from both sides.

5.4 Potential pitfalls

In the previous section we discussed the opportunities that exist for international collaboration and the options to itself on a permanent basis, in particular through educating and training a next generation of researchers. We see various policies in different countries. For example, Indonesia cooperates with Chinese universities through which Indonesian students are funded to study in China. Indonesia also has some positive experiences with the so-called twin city approach, where a local or regional level one SEA country or city and an urban agglomeration in a partner country cooperate. Successful cooperation is often built on the creation of local research centres where new knowledge can be developed, and by doing so offer an attractive environment for returning students and scholars. Good examples are the STAR Institute of Technology (SIIT) which has its main campus in Thailand and the International Rice Research Institute (IRRI) with its main location in the Philippines.

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ardrs were being raised to comply with western standards, but in the time these improvements took place, the colonial image of the Western researcher who comes to Asia to gather specimens or information may be a fading caricature, but shadows of it are still present. The language problem is frequently underestimated. Research facilities and infrastructure are often not up to international standards. This is obviously very helpful for cooperation with Southeast Asian researchers, to come and work for them, sometimes for a limited time, on account of which matching of international projects as far more complex to participate in as other forms of international (bilateral) cooperation. The amount of funding in bilateral projects is sometimes also higher (e.g. cases were mentioned with the Netherlands and France). From the above we can distil a number of concluding remarks that might help prevent some of the major pitfalls in future cooperation. We will do this with regard to cooperation in a wider sense with regard to cooperation in the context of Framework programs.

**Cooperation in general**

Cooperation between Europe and Southeast Asia has not been easy. Southeast Asian researchers consider EU funded projects as far less complex to participate in as other forms of international (bilateral) cooperation. The amount of funding in bilateral projects is sometimes also higher (e.g. cases were mentioned with the Netherlands and France). From the above we can distil a number of concluding remarks that might help prevent some of the major pitfalls in future cooperation. We will do this with regard to cooperation in a wider sense with regard to cooperation in the context of Framework programs.

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**5.4.2 Pitfalls in actual cooperation within Framework Programmes**

In addition to the more general pitfalls mentioned in the previous section, a number of problems can emerge when actual cooperation comes into sight, both within the framework Programme and in different possible partners: one size definitely does not fit all. Specific attention should be paid to local or regional problems and building upon each other's experiences, sharing information or facilities.

**5.4.3 Wrap up**

From the above we can distil a number of concluding remarks that might help prevent some of the major pitfalls in future cooperation. We will do this with regard to cooperation in a wider sense with regard to cooperation in the context of Framework programs.

**Framework Programmes**

It seems imperative that more effort should be put in disseminating knowledge about the Framework programmes, in particular regarding the more practical aspects and consequences for administration and communication. Specific attention should be paid to local or regional problems and building upon each other's experiences, sharing information or facilities.

**What help is also is to improve intermediary functions, for which both the NCPs and EU project offices need to be available. This could also help mitigate the problem of differences in national project time frames, on account of which matching of international projects is not a problem.**

**5.4.3 Wrap up**

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5.5 Challenges for regional, national and supranational policies

Based on the axiom that global problems require global solutions, for which international cooperation is necessary, an important question is how S&T agendas of ASEAN and Europe can be attuned in a meaningful way. Questions in point are:

- how to overcome existing differences in S&T interests and policies in both regions;
- how to determine the options for attuning national policies in both regions and the overarching ASEAN and EU policy;
- how to assess the consequences for a new EU policy (e.g. dedicated programmes) towards SEA.

Several countries in SEA are currently undergoing a rapid transformation of their economies, reflected in the steady rise of investment in education and S&T. The common division in three levels of development (see Schuller et al 2008 and in chapter 7) is arguably still visible, yet according to a number of our workshop participants, countries at the lower level are catching up. This process catching up forms a major challenge, because the case can be made of the combination of a high population density and a relatively low education level. For S&T cooperation to have long term effect, to focus on higher education and training of young talented researchers, seems obligatory. This might be the appropriate time to support that development with an extra EU effort. The education of young researchers might be a central element in such specific EU incentives directed towards stimulating bi-regional cooperation.

In discussions about S&T cooperation between SEA and Europe, the dilemma of investing on the one hand in capacity building for countries or institutes that lag behind, and on the other hand, in cooperating between excellent researchers, is a central theme. The problem arises because these two goals, which can be summarised as “top research versus capacity building”, vary to a considerable degree and can even be mutually exclusive. The question, then, is how this dilemma can be avoided or be transformed into a productive element when setting up cooperation. While there are differences within SEA in stages of development and in fact might increase the differences. It is obvious that in an open competition for EU funds, some countries will stand a much better chance than others, which not necessarily reflects wither quality or relevance of the research proposals.

5.5.1 Policy relations within and between both regions

Researchers from institutes in SEA consider sustainability, defined as long term working at a regional level instead of the national level, an important condition for re-enforcement of their infrastructure and human resources. European Framework Programmes generally fund projects or programs for a limited number of years (5–10). Together with the fact that open competition as a rule doesn’t work evenly in the context of many SEA countries and institutions (given the uneven distribution of resources), this gives rise to at least two points. First, Framework Programmes are intended to stimulate new forms of cooperation, based on the assumption that after a period of several years many of these networks have proved to be self-sustaining enough for the participants to continue without further EU support, or are successful enough to actually compete for new funds. The question is then of course whether this is indeed the case. A critical analysis of whether or not this is actually the case is lacking at this moment. Secondly, many Europeans working with SEA emphasize the importance of building trust and overall good relations with the top of institutes and higher ranking officials. This can only be accomplished if long-term commitment is guaranteed.

5.5.2 Memoranda of Understanding (MOUs) and ASEAN policies

In most cases international cooperation entails that many different departments or national agencies work together. This usually leads to a rather intricate network of demands and interests that have to be mutually attuned, a very time consuming, process for which diplomatic skills are required. MOUs can be helpful in these situations.

While many researchers in Southeast Asia working in international networks stress the importance of MOUs, however, expectations of their impact and usefulness are often overestimated. Several of the politically sensitive nature of MOUs, some institutions prefer to work without MOUs and establish their contacts directly without ministerial interference. From the perspective of the European Cooperation in Universities and Science (Camosc) and the ASEAN University Network (AUN) are examples that illustrate this. European Framework Programmes are designed to be flexible, with a large number of participants, and in this way, allow for multiple interpretations. AUN and ASEAN are networks of universities and research institutions, yet with different objectives.

5.5.3 Cooperation in national policies, some examples

Several countries consider international cooperation as a criterion in the internal quality control systems. International cooperation is thus in itself an indicator of success, i.e. as part of quality control and funding. In e.g. Vietnam, international cooperation is seen as a criterion in the prioritisation of projects or programs into the S&T system is low. There are few regulations that even encourage international cooperation, although no specific priorities are formulated by its national government. Nevertheless, many researchers in SEA see international cooperation as an important element in research and development, especially in the fields of education and S&T.

In the Philippines, universities can cooperate with foreign universities directly, without the involvement of ministries. This is an advantage of institutes in the Philippines over countries in SEA (however, the occurrence of problems between partners due to differences in national policies and international cooperation, as identified by the ASEAN Committee on Science and Technology, at the moment, this source of funding is still very modest.

The ASEAN-European University Network (ASEAN Uninet) is a network of over 50 excellent universities, for which participants are selected. This network is currently at least as important as formal ASEAN S&T policy and initiatives.

Many Southeast Asian researchers need more information on international cooperation and more conferences to meet colleagues and define projects. Face-to-face meetings are clearly needed, as these are more successful in promoting a sense of mutual understanding and trust. Understanding and trust are pivotal for this kind of international cooperation.

5.5.4 Wrap up

In general, a lack of coordination between university policies, national policies, and multilateral policies can be observed in the context of international S&T cooperation. This applies both to the European and to the Asian side, but the main difference is that the level of investment is much higher on the European side, and therefore the number options for setting up cooperation are considerably larger. However, despite the abundance of funds and options, it appears to be difficult for SEA partners to become serious partners in cooperative initiatives. The lack of coordination between research and policy is not helpful in this situation. In particular, feedback from successful projects or programs into the S&T system is low. There exists a relative lack of reliable statistical information on the S&T systems of several SEA countries compared to Europe. Nevertheless, based on the interviews and focus groups conducted for this study, a number of preliminary conclusions can be drawn.

ASEAN

- It would be beneficial to the region if ASEAN would define clearer S&T priorities and objectives. This could also be an incentive for the EU to develop specific instruments for cooperation in those priorities.
- Member SEA countries require the involvement of different national bodies in international research projects. This is seen by many researchers as an unnecessary bureaucratic burden. To address this issue, one of the options would be to make one department or agency responsible for formal aspects of international research projects, thus creating a single point contact for research institutes. This process may be facilitated by a policy dialogue on this topic within ASEAN.
- The ASEAN Science Fund is a useful instrument to improve research in SEA. At the moment this fund is rather underutilized.
- In many countries it is necessary to create more awareness about the EU as an important partner on S&T issues and bring this to the attention of the Department of Foreign Affairs.
ASEAN and EU

- During the biannual meeting between the EU and ASEAN, it would be beneficial to allot more time for a S&T policy dialogue, and specifically on the topic of research priorities.
- In the future, the possibility could be explored to organise joint calls by EU and ASEAN together, to which both sides will have access.
- A clear action plan from both EU and ASEAN in which benefits to both EU and ASEAN are explained would be very helpful to inform policy makers.

EU

- A clearer strategy of the EU as a single unified region, as against the individual European countries acting in SEA, would be beneficial;
- Translating information about EU programs into the various national languages would be helpful;
- European and SEA researchers could find more useful matches with EU support if the EU were to differentiate and set up dedicated schemes accessible for institutes from different levels of development.

5.6 Cooperation in the context of EU and other regions

In order to compare SEA-EU cooperation with cooperation with other regions, one first has to identify the goals of the EU with regard to cooperation with SEA. That, unfortunately, is not very clear. In comparison, Africa seems to be getting more focussed attention from the EU, especially after the launch of the EU-Africa Strategic Partnership at Lisbon in 2007. For SEA, there are however various separate country-specific funds. Vietnam for example is setting up 17 key laboratories with EU aid. Part of the problem for the EU when dealing with SEA is the region’s diversity, bringing with it tensions between capacity building and cooperation between more or less equal partners in science and technology. In Africa, similar tensions exist, but for the majority of African countries cooperation takes place as a more or less uniform form of capacity building. Another potential pitfall is the fact that researchers in many SEA countries feel they are more at a disadvantage compared to European counterparts. Hence (perceptions of) the ease or difficulty in gaining support from government officials and policy makers have to decide in what cooperative efforts they best invest their time. In this process many different considerations have to be taken into account. One content arguably comes first, but immediately following that policy considerations, cultural aspects and also rather practical issues come into play. Hence (perceptions of) the ease or difficulty in working with researchers from Europe in comparison with other regions or countries are of great importance. Whether Europe stands out in a positive or negative way depends to a large extent on what the EU has to offer: clarity about the options in Framework Programmes and other global initiatives.

What we have learned from our SEA interviewees and workshop participants is that most SEA researchers do not find it easy to obtain the relevant information about Framework Programmes, but once they have started up a project cooperation with EU they in general do feel working with EU to be very different from working with researchers in other parts of the world. They also find the detailed reporting phase more difficult. In working with Japan, for example, the first start-up phase is often more demanding, and may take up to two years to be funded, a much more liberal approach in project management and control is in place. This section discusses some of the differences, from a SEA perspective, between working with researchers from Europe and working with researchers from other regions.

5.6.1 Cooperation with Europe and other parts of the world

In a world of growing international cooperation but also of growing competition, SEA researchers and policy makers have to decide in what cooperative efforts they best invest their time. In this process many different considerations have to be taken into account. One content arguably comes first, but immediately following that policy considerations, cultural aspects and also rather practical issues come into play. Hence (perceptions of) the ease or difficulty in working with researchers from Europe in comparison with other regions or countries are of great importance. Whether Europe stands out in a positive or negative way depends to a large extent on what the EU has to offer: clarity about the options in Framework Programmes and other global initiatives.

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5.6.2 Some country specific examples

Indonesian researchers would like to see more of a reciprocal relation in student exchange, by stimulating the number of EU graduate students coming to Indonesia. In recent years Japan and Korea have been raising the numbers of PhD students going to Indonesia through specific programmes. Over a longer period a shift can be seen; decades ago many Indonesian researchers who were trained abroad had done their PhD in Germany. Nowadays India and China train a lot of Indonesian PhD students. These shifts are partly related to the higher living costs in the EU and the US. In the case of Japan, the National Institute of Aeronautics and Space in Indonesia, recent international cooperation with Germany was primarily focussed on technology, whereas with Japan it was possible to set up cooperation with also invests in training of Indonesian researchers.

In Laos the need is felt for more information on opportunities for cooperation with the EU. Information on cooperation with other EU countries is readily available, whereas information on cooperation with EU is not. Korea and Japan also have experts in Laos, and their presence often leads to future research cooperation. Such experts also more frequently learn the national language.

The Philippines traditionally were strongly focussed on working with the UK. A recent shift towards the UK seems to have set in. There is not much cooperation with the rest of Europe, which could be changed once knowledge about potential partners is more widely disseminated, in both the Philippines and Europe.

5.6.3 Wrap up
When building and maintaining successful S&T cooperation between Europe and SEA, one needs to consider a number of important issues. These issues can be divided into socio-cultural differences, geo-political aspects, content-oriented and practical points.

Socio-cultural differences between researchers do not seem to matter so much once a project is on its way, but can be a barrier before projects start. This might be caused by the way research topics are decided upon, or the overall approach towards research projects, or the issue of formal project leadership.

Geo-political aspects are hard to overcome because they have their own dynamics. People often find it easier to interact with people in their own region, and the interests of one region is likely to differ from the interests of another. It might be more productive to focus on cooperation instead of competition. This is of course easier said than done in a world of growing global competitiveness, but since many problems in society are truly global, solutions need international cooperation. So it seems much more productive to see developments in the Pacific Rim or Australia or India in terms of cooperation rather than competition.

Regarding the content of cooperative projects or programmes, there would ideally be a joint agenda between SEA and EU, like in the case of Africa. Such a framework could also serve as an agenda for new cooperative projects. Failing that, the direction of new endeavours is up to individual participants. Not all SEA participants in projects with European partners, especially in larger projects, have the experience that they could provide a satisfying input in the beginning when project plans are formed. In the perception of SEA researchers, they have more influence in these import first steps of setting up a project than with Asian partners. Furthermore, SEA researchers feel that governments in the region, especially Japan, are paying more attention to national priorities of SEA countries than Europe does. Japan is also mentioned as a country that is more open to help build S&T infrastructures, and to train young researchers (capacity building). The image of EU researchers as simple sample gatherers in short-term projects is persistent.

Also, for less developed countries such as Laos or Cambodia, Japan and Korea seem to be more willing to provide local R&D experts, who often are willing to learn the national language.

As a final remark, we would like to emphasize the importance of efforts to stimulate the education and training of the next generation of researchers. The importance of this cannot be overestimated, especially with the growing level of education in many SEA countries. Informants from most countries stressed the importance of this point, and with countries like Japan, Korea and China being the main front runners and raising their investment off late, there is a world to lose for Europe.

5.7 List of opportunities and pitfalls
This chapter lists the opportunities and pitfalls that were brought up during the various focus groups and interviews. We have refrained from giving specific recommendations in this analysis of opportunities and pitfalls.

In 2010, the SEA-EU-NET project will publish short- and long-term recommendations linked to a foresight on SEA EU cooperation in 2020, after consulting high-level political stakeholders and programme owners.

5.7.1 International S&T cooperation
Opportunities
- “Global problems need global solutions.” Global solutions can only be realized by building international networks of researchers and their institutes and establishing appropriate S&T policies. In order to obtain better opportunities for successful international cooperation most of our respondents listed the following opportunities:
  - Involve researchers, policy makers, and other relevant stakeholders in priority setting decisions for collaborative programmes.
  - Involve SEA partners in priority setting and in the planning and design phase of the project from the outset.
  - Fully engage all project partners in the research and project itself, and ensure that every project partner is a fully committed stakeholder.
  - Research should, to a large extent, be driven by local, regional, and national problems. Collaborative programmes should consider the potential benefits to the economy and society SEA, and not primarily driven by a European perspective.
  - Attention should be paid to the follow-up of temporary projects: establish scientific tools and infrastructure, implement policy changes that extend beyond the scope of a particular project.
  - Take into account the different perspectives and interests regarding the goals of international S&T cooperation of researchers on the one hand, and policy makers and other stakeholders on the other.
  - Give due consideration to cultural differences and differing socio-economic needs.
  - Encourage full participation of the private sector in collaborative research projects to foster better connections between academia and industry, and to enhance opportunities to finance projects. IPR issues should be covered in the project terms of reference.

Pitfalls
- There is a mismatch between EU funding cycles (grants for several years) and the required matching funds from SEA, often governed by yearly national funding cycles.
- There is a mismatch between EU funding cycles (grants for several years) and the required matching funds from SEA, often governed by yearly national funding cycles. Discouraging organisations from third countries to act as a project leader in a FP project is not an incentive for possible SEA partners to join projects, and is generally regarded as a sign of distrust. Discouraging SEA partners to act as project leaders, regardless of the ambitions of a potential SEA partner, is a sensitive issue.
- Continuity and sustainability of S&T cooperation with European collaborative projects is especially hard to achieve, especially when compared to Asian partners such as institutes in Japan and Korea. Links with these institutes tend to be more firm and have a more long-term character than SEA.
- Framework programmes are considered to be very competitive in a way that does not take into account the various levels of development in ASEAN member states.
- Framework programmes do not offer earmarked funds for specific regions. European and SEA researchers could find more useful matches with EU support if the EU were to differentiate and set up different schemes accessible for institutes from countries at different levels of development. This could be translated into a specific funding calls targeted at cooperation with particular regions.
- In general cooperation in Framework programmes carries a large administrative burden, also when compared to the experience of cooperation within Europe.
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5.7.2 S&T funding instruments
Opportunities
- Establish long-term research centres where scientific tools can be implemented, and new knowledge can be developed. These centres of excellence would help to turn short-term results from temporary projects into long-term benefits for science and society.
- Establish research schools adjacent to research centres to offer returning students and scholars an attractive environment, so as to handle brain drain problems, and educate new generations of scientists;
- SEA’s S&T systems would benefit from having more strong and recognisable research centres, especially focussed on themes that are directly relevant to the region, like e.g. marine biology, coastal zone research, fishery, forestry.
- Attract more foreign researchers by research centres, possibly organised at the regional ASEAN level, thus stimulating interaction with local researchers, and providing a stepping stone for researchers to find their way in the region.

Pitfalls
- The ASEAN Science fund for improvement of research is unfortunately very modest.
- Administrative burden and tight and restrictive rules make it more difficult for SEA to become fully engaged in the research, and fully responsible for the project in bilateral and EU projects.

5.7.3 EU Framework Programmes
Opportunities
- Make available easy-to-read information about the FP programmes and the opportunities it creates for SEA;
- Improve information dissemination (by National Contact Points) prior to the opening of a call, as is the case within Europe, and provide information on potential partners;
- Provide experienced and knowledgeable project managers and EU project officers;
- Launch joint calls by EU and ASEAN, and organise network and relationship building activities between researchers in SEA and Europe.

Pitfalls
- Insufficient time following the release of calls for proposals is allowed for the drafting and submission of proposals. Current time frames are too tight, especially for many SEA scientists;
- There is a mismatch between EU funding cycles (grants for several years) and the required matching funds from SEA, often governed by yearly national funding cycles;
- Discouraging organisations from third countries to act as a project leader in a FP project is not an incentive for possible SEA partners to join projects, and is generally regarded as a sign of distrust. Discouraging SEA partners to act as project leaders, regardless of the ambitions of a potential SEA partner, is a sensitive issue;
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Attractive positions should be created within the knowledge system for excellent young students;

- Promote a more equal exchange of scientists between SEA and Europe, and create mechanisms that redress the imbalance between the number of SEA researchers going to Europe and European scientists going to SEA.

Pitfalls

- Southeast Asian infrastructural weaknesses;
- Low overall national budgets for S&T;

Focus on other than S&T priorities reduces the (financial) incentives for S&T cooperation.

6 Scientific cooperation between Southeast Asia and Europe in 2020. Driving factors as assessed by scientists and policy-makers

Alexander Degelsegger, Florian Gruber

The European Commission tasked the project SEA-EU-NET to conduct a foresight exercise on determinants of future scientific and technological (S&T) cooperation between Southeast Asia and Europe.

This International S&T Cooperation Foresight study, conducted in 2009 and 2010, has been based on a driver-identification scenario workshop in Indonesia with policy-makers from both regions and on a survey of scientist’s opinions using open email consultations and Delphi methodology.

The results of the exercise are a reliable and comprehensive set of drivers perceived by key stakeholders as influencing the 2020 future of S&T cooperation between Southeast Asia and Europe. Identifying these drivers not only helps to structure future policy-discussions, but they can in themselves be expressed in terms of recommendations and ideas for possible instruments to increase S&T cooperation levels. Furthermore, the drivers have been combined, also within this chapter, to the logic of a possible success scenario for S&T cooperation between Southeast Asia and Europe in 2020. This proposed scenario logic can inspire continued discussions on how a successful future scenario might look like and, accordingly, what drivers have to be addressed to move towards it.

Based on the unusually high response rate that we could achieve in the scientists consultations and Delphi survey, we cannot only conclude that our results are solid, but also that there is a real interest in S&T cooperation between Southeast Asia and Europe on the side of the scientific community.

Key recommendations for policy-makers

On a general level:

- This study should be further discussed among the stakeholders involved and could be taken as a stepping stone within the process of policy development.

- The dialogue on and planning of S&T cooperation should keep engaging scientists.

- The time-related windows of opportunity in the planning horizons of the cooperating regions’ policy-making should be made clear and considered.

- Coherence between STI policy and other policy areas concerned by S&T cooperation should be continuously aimed at.

- It should be taken into account that both regions are internally highly diverse, with resulting region-internal differences in the needs and customs of the scientific communities.

And as identified by the consulted stakeholder communities:

- It should be taken into account that the most important motivation for scientists to cooperate is the goal of doing state-of-the-art science on a topic of mutual interest and relevance. The feeling to contribute to the development of a country or the solving of global challenges, the access to a field, expertise and equipment, friendship or reputation are other important motivations.

- S&T cooperation should be sustained on a long-term basis.

- A suitable balance should be found between the flexible funding of cooperation activities in research projects defined bottom-up and the dedicated funding of S&T cooperation with a thematic focus.

- A suitable balance should be found between supporting cooperation in basic and applied research.

- Personal contacts are more relevant than institutional agreements. Therefore, supporting mobility is crucial.

- Measures should be adopted to enhance equilibrated mobility in both directions as, currently, there is a bias towards Southeast Asian scientists coming to Europe.

- Existing human and network resources should creatively be harnessed. Among the many options, established scientific conferences could be invited to convene in Southeast Asia; retired scientists could

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be offered part-time positions, senior scientists could be willing to engage in cooperation and exchange in the framework of sabbatical themes.

- PhD student exchange, joint PhD programmes and promotion of supervision of PhD students should be supported to a higher degree.
- Southeast Asian Diaspora academics in Europe should be addressed as possible facilitators of S&T cooperation.
- Return and reintegration support schemes should be considered, especially for Southeast Asian scientists who have spent longer periods of time in Europe.
- Reward schemes for successful cooperation should be considered as potentially increasing the motivation to cooperate.
- Quality metrics for assessing the success of international S&T cooperation projects have to be further developed.
- Regional training networks, joint research centres and other joint research infrastructure can help to increase cooperation intensity.
- Bridging institutions offering administrative, research management and partnering support should be considered as a means to increase cooperation levels.
- Administrative burdens hampering S&T cooperation like visa issues, material exchange and field access challenges need to be addressed.
- Open access to literature and sample databases should be supported.
- The results of joint research should be made available in the respective regions, not only in international journals.

The second group of policy recommendations emanates directly from the concerned stakeholder groups. The authors have coded and structured the empirical data coming out of the policy-makers’ assessment have been collected, a project deliverable (first version of deliverable 4.1, “Policy Recommendations for enhancing Science and Technology cooperation between the Europe-an Union and Southeast Asia”) that has been distributed during the meeting of the Association for Southeast Asian Nations’ (ASEAN) Committee for Science and Technology (COST) in May 2010 in Vientiane, Laos. Furthermore, aspects of this first part of the foresight exercise were discussed in expert interviews conducted with relevant Southeast Asian stakeholders in the context of the ASEAN COST meeting.

While it is the policy-makers who frame and set more or less favourable conditions for S&T cooperation between the two regions, it is the scientists who are actually cooperating and invited by the recent political agenda to do so to a higher degree. In order to access the knowledge of those who already have palpable experience in science cooperation between Southeast Asia and Europe, we approached all scientists from Southeast Asia and Europe who have published together with one or several colleagues from the respective region. The aim was to conduct a foresight consultation and a subsequent two-stage Delphi survey in order to find out what they consider potentially increasing cooperation levels. Our expectations that this stakeholder group would have to offer very concrete and sometimes unusual ideas of instruments and framework conditions have been confirmed.

In a final phase of desk research, policy-makers’ and scientists’ assessments were collected. For this purpose, a survey was developed, which is an important tool in structuring the thinking and discussion about future S&T cooperation and related activities. Due to several methodological issues and to adopt a two-stage approach in carrying out the analysis, the decision to involve the stakeholder groups to look at a 2020 perspective is motivated both by the current policy framework and by methodological considerations. Following the Lisbon Strategy, the Europe 2020 Strategy[64] and more specifically the Innovation Union flagship initiative[65] are the most relevant guiding framework for European-level S&T policy and explicitly focus on international S&T cooperation as relevant for Europe’s smart, sustainable and inclusive growth. Moreover, the 8th Framework Programme for Research and Technological Development, currently being in its early preparatory phase, will cover the period from 2013 to 2020. Besides the policy framework pointing to the 2020 horizon, 10 years is also a time span that can reasonably be reflected upon in a foresight exercise without a need to include big systemic change, usually occurring over longer periods of time. To look at Europe’s S&T cooperation in 2030 or even 2050 would have been both a much more difficult endeavour and would require a different methodology, taking broader and sometimes unusual ideas of cooperation into account (unthinkable about) this form of cooperation are few in number. These few, however, seemed to have a good overview on the current state of programmes and on the implementation of foresight in general and in the specific context and project experience. Thus, it makes sense to try to investigate their expertise in more depth and engage them personally, not least because they have a major stake in the future and can reasonably be reflected upon in the foresight analysis.

The scientists, however, are a much larger stakeholder group that was decided not to randomly approach large groups of European or Southeast Asian scientists, nor to invite small groups to give us their individual and, given the large size of the population, nonrepresentative views. Instead, we decided it was most reasonable to approach those scientists who already have cooperated. We decided to revert to co-publications as a proxy for cooperation experience, i.e., we looked for scientists from each of the regions who have already published with scientists from the respective other region, and engaged them via an online consultation and Delphi survey.

The whole exercise has been dealing with the consequences of the current international cooperation and future S&T foresight exercises: increased complexity due to the bi-regional perspective (set however within a global network


65 http://ec.europa.eu/research/innovation-union/
of cooperation relations) with, at the same time, very limited time resources and difficult access to policy-making stakeholders. Moreover, members of this stakeholder group are in positions not only to assess, but to significantly influence the future the exercise is dealing with, which again adds complexity to the process as few relevant variables can be considered totally external. Regarding the scientific community, it is not easy (due to time constraints on their side, negative experiences with policy consultation processes or simply discomfort) to attract those scientists to the foresight exercise, who are actually cooperating and, at the same time, knowledgeable about science cooperation.

### 6.2.2 A success scenario based foresight process

Over the years, social scientists and policy-makers have used several methodologies to gain insights into the future and develop action-orienting conclusions according to a desired version of the future. When it comes to international S&T cooperation policy, however, the approach of scenario building based foresight has shown to be popular. An exemplary effort in this direction can be seen in the SCOPES 2015 foresight project conducted by the JRC of the European Commission’s Research Directorate General by PREST/Manchester. Currently, several INCO projects are or, for example, the International Council for Science (ICSU) are using scenario techniques for S&T cooperation relevant foresight exercises. It is not surprising that in the pre-foresight phase of this exercise, desk research and consultations with partner projects in Southeast Asia and Europe have equally shown that scenario techniques seem most appropriate for the data generating, networking and strategy development part of the foresight process. It became clear, however, that the S&T cooperation foresight has characteristics and needs that are different from national technology foresight or scenario planning in corporate strategic thinking.


For the final report see: European Commission (2006): Scenarios for Innovation Policy and the Scenarios for Globalisation, OECD: Paris, p. 173. For a definition and indicative listing of possible drivers and shapers, see Miles, Ian (2005), p. 169. Given the above reasons, we opted for an extended single success scenario methodology and engaged expert panels with a pre-defined desired “summer” scenario (based on desk research and discussion) as the starting point, for which the region-country cooperation, region-country, country-region and country-country), three of which seem principally relevant. However, given the severe time and resource constraints on the side of this exercise and the stakeholders as well as the mandate of the SEA-EU-NET project, we decided to focus first and foremost on the region-region multilateral cooperation setting.

### 6.2.3 Driver identification by policy-makers

One of the benefits of conducting this foresight exercise in the frame of the inter-regional cooperation project SEA-EU-NET was that the steering board that convenes once a year comprises most of the policy-makers that we wanted to include in our study. The success scenario oriented driver identification workshop, key to the policy-maker oriented part of this foresight exercise, was conducted in 2009 in Bogor, Indonesia as part of the steering board meeting during the annual week of cooperation.

The Bogor ‘drivers workshop’ offered the possibility to gather policy-makers and programme owners from different countries in both regions within a joint bi-regional event. The fact that the policy-makers knew they would attend a bi-regional event, not only invited them to the drivers discussions to a region-to-region level (rather than a country-to-region or country-to-country level). Resource constraints (i.e. mostly time constraints) are always a pressing issue in high-level foresight processes, aiming not only at stakeholder participation, but also at creating commitment among the stakeholders to the discussions. While preparing the workshop, we realised that focusing on one perspective, namely the region-to-region level, was the most that could be managed with the allotted time. The region-to-region perspective on S&T cooperation seemed to be not only the most pressing one, but also the one closest to SEA-EU-NET’s mandate. Actually, while it might be easier for single countries to arrange meetings with single other countries or join meetings of a regional party, SEA-EU-NET particularly has the role and potential to bring together S&T stakeholders from both regions to discuss the topic of cooperation. In addition, preparations showed that the question of the feasibility and necessary framework conditions of a dense and intensive cooperation scenario from both regions raises a high degree of interest among stakeholders. Another feature of the workshop setup was coming from cultural considerations: in the SEA-EU-NET framework, SEA and EU are members of a group is sometimes thought of as impartial. However, by asking the experts to consider the region rather than the country perspective and by offering the possibility to interact with experts from other regions in the form of charts and regional groups rather than single-country groups and/or verbal input, we could ignite motivated discussion and received a high degree of feedback from the participants.

### 6.2.4 Scenario-based foresight process

Going one step further in the anticipation of scenario logics, S&T cooperation intensity appeared as a natural additional axis in the deductively developed basic scenario matrix. The most basic description of the success scenario we have been looking at would then be:

- In 2020, S&T cooperation between Southeast Asia and Europe has become more intense in view of a higher number of collaborations and in-depth forms of cooperation on a region-to-region level (i.e. not only as regards, for instance, Vietnam and Germany, Indonesia and the EU or France and Southeast Asia) in comparison to 2010.

Figure 6: Possible cooperation structures as a basis for scenarios

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Besides the advantage to capitalise as much as possible from the available resources in terms of participat-
ing experts, this scenario planning design also offered the possibility to evaluate the “desirability” and “cred-
ibility” of the basic scenario which, according to Miles 68, are considered important elements of a success sce-
nario. This workshop design has proven a successful adap-
tion of standard scenario methods for
• a setting involving mid-to high-level participants,
• facing time constraints,
• when discussing the viability and surrounding of a specific and possibly successful scenario 69 with the
aim to sensitise for this possible future, create com-
mitment for it and trigger a joint planning process.

The participants of the scenario workshop were the
members of the SEA-EU-NEU Steering Committee, as we
assumed that the body (installed because of their
bird’s eye view of EU-SEA scientific relations in order to
steer the project) would also be the most suited one to
take a look and think about future bi-regional coop-
eration. 16 experts from policy-making and programme-
owner institutions actively participated in the scenario
workshop, 7 of them speaking for Southeast Asia and 9 for
Europe.68

As a starting point, the participants were introduced
and confronted with the following basic “summer” success
scenario that was deliberately limited in length and
depth in order to allow participants to quickly and
easily align the envisaged perspective:

Basic scenario: In the year 2020 the cooperation
in S&T between the EU and ASEAN has reached a
level of importance that some years before was
hardly to be expected. Major development was
achieved not by a regional development, as the
countries in the region decided to put impor-
tance to and budget into this umbrella organisa-
tion. In this way, ASEAN could initiate symmetric
cooperation partnerships with the other major
global players, the EU, the USA, and major S&T
powers consisting also of countries that differ
quite a lot in their economic development, the
European Union was considered an important
cooperation partner, and with dedicated pro-
grames including joint programming and
funding from both sides, the cooperation in the
area of S&T grew even more intense.

We asked the participants of the workshop to project
their hands-on recommendations on this “summer inside” a sce-
nario where regional scientific cooperation between
Europe and Southeast Asia has come to be very active,
very successful and intense.

Then we asked the participants to identify the driv-
ers that would have led to such a scenario (backcasting),
i.e. the drivers and shaping factors that would have been identified and taken
into account 10 years before (i.e. now, in the present) in
view of the scenario. Due to the interaction dynamics in
the brainstorming character of this session, we applied
a rather broad definition of drivers. Sticking to a stricter
definition would imply to interrupt and correct the flow
of ideas at certain points, which we wanted to avoid as
it could stop the creative process.

The drivers were structured along 5 policy areas:
• Higher Education Policy,
• Science and Research Policy,
• Industry, Trade and Economic Policy
• Development Policy, Global Challenges,
• Diplomacy, Foreign Policy, Security Policy

In a second stage of the workshop we asked the experts
to take a regional view depending on their origin, and
to rate the importance of the drivers using a grade-like
rating in relation to either Europe or Southeast Asia (af-
ter re-coding for visualisation reasons: 5 points express
highest importance and 1 least relevance). It is impor-
tant to point out that not all experts had to rate the
drivers. The number of experts assigning grades to the
drivers, thus, is an additional measure for the perceived
prominence of this driver (in addition to the average
grade). For sure (see Section 6.5) will analyse the outcomes
of this exercise.

Then the experts were asked to identify, which would be
the most important shaping factors for the desired
scenario. In another subsequent phase, the workshop was aimed at a great suit-
cess. The atmosphere has been open and productive, contributions were equally distributed among regions and
the policy-makers reported that they gained some insights in the course of the workshop. Apart from the
informative interpretation of the email texts, taking into account the
frequency of occurrence in the open consultation or the
to the novelty of the opinion. Due to the high number of
driver suggestions, the variable number of respondents
(drivers a significantly higher number cannot be man-
aged by respondents in an online survey) presented
the wording of the scientists’ responses (leaving the
scientists’ original phrasings, though sometimes slightly
shortened or amended to make them understandable
outside the context of the full answers)

The scientists presented the drivers usually in form of concrete recommendations or instruments or activities.

Methodologically speaking, we would avoid dif-
ferentiating drivers and shaping factors if we were to
do the exercise again. The added value that is gained
by separating drivers from shapers is not substantial enough to invest the effort involved in clarifying
the differences between the two concepts, not entirely
clarified in literature, yet.

As indicated above, the results of the drivers work-
shop have subsequently been analysed by the authors
(see chapter 6.5) and have been translated into a series of
policy recommendations (see chapter 6.8). During the
ASEAN COST meeting in May 2010 in Vientiane/Laos,
the drivers were also part of the discussions in a series of
expert interviews held with key stakeholders from,
among others, the Philippines and Laos. However, it has
become clear during these interviews, that there is
an inherent difficulty in approaching Southeast Asian poli-
cy stakeholders with questions on region-to-region S&T
collaboration, while they are participating at an
ASEAN COST meeting in a particular country-related
role and following a particular country-related agenda.
In most of the cases, the interviews offered very rele-
vant background insights for the SEA-EU-NEU project as
a whole, but time was too short to present findings
from the drivers workshop to additional stakeholders
and subsequently focus on their comments regarding
these results.

In terms of an overall methodological assessment of
the workshop, the contributions of the experts could be
given for subjective feedback, for subject matter insight
in the area of S&T cooperation between the two regions in the future (thus, co-publication
used by the experts in the workshop). These driving factors have
substantial results presented in chapter 6.5, the work-
shop was an important starting point for the meth-
ological professionalisation of ‘International S&T
Cooperation’ and the experts assigned to a next mention in the foreground of the exercise’s logics, it was necessary to tap into the knowl-
dedge, experience and needs of those actually involved
in S&T cooperation, the actual target group of coopera-
tion support.

6.2.4 Accessing scientists’ views and experience

For gathering information from the scientific community, we
decided to follow a different strategy: We assumed
that these scientists that had already cooperated through
publishing would be the best suited sample group from
the scientific community to provide us with experts to
to our query on how to step up S&T cooperation levels be-
tween the two regions in the future (thus, co-publication
was used as a proxy for cooperation). Moreover, we
reasoned that scientists active in the day-to-day practice
of international collaboration would be able to come
forward with very concrete bottom-up inputs probably
interesting for our study’s target audience: S&T policy-
makers in Southeast Asia as well as at European and Eu-
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The Delphi method

Delphi involves an iterative survey of experts. Each participant completes a questionnaire and is then given feedback on the whole set of responses. With this information in hand, (s)he then fills in the questionnaire again, this time providing explained time constraints in the hold that were significantly divergent from the viewpoints of the other participants. The explanations serve as useful intelligence for others. In addition, (s)he may change his/her evaluation of new information provided by other participants. This process is repeated as many times as is useful. The idea is that the entire group can weigh dissenting views that are based on privileged or rare information. Thus, in most Delphi processes the magnitude of concern increases from round to round.1

In order to get the feedback we were looking for, we decided to use (two-stage) Delphi methodology because of two issues:

- First, the idea behind Delphi is rather straightforward and easy to understand: In a first round, a questionnaire is sent out containing question types that allow for easy statistical analysis (in our case, we asked for an estimation of the relevance of each of the factors on a four-point scale). The easy-to-handle question type is important not only in view of the large amount of constraints in the analysis, but also to feed back the answers from the first round to the same respondents in a second round. In this second round, the same questions as before are presented again, but allowing the respondents of the survey to see their original answers compared to the global averages of answers from the scientific community and to re-assess their original answers in light of their peers’ opinions. This will give more reliability to the (after the second round usually more consensual) answers.
- Secondly, the methodological approach of using Delphi style survey allows us to ask for answers from the whole scientific community as derived from the co-publication analysis. Therefore, by not selecting a part of a whole based on some indicators of relevance, but asking the whole concerned population, we assume that the results of our survey will have more relevance in terms of representing a good overview of the actual opinions of the respondents. As already said, the goal of the Delphi analysis was to let the whole group of scientists already engaged in co-publication activity decide upon which statements from the open email consultation were relevant. After the first Delphi round, we had not only a look at the overall results, but also tried to validate these group-based means, by mimicking variances within the respective group (i.e. deviations from the means of a specific subgroup must be smaller within the group than between the group and other cases or other possible groupings). Thus, we found out that scientists from Europe, from Singapore and from Southeast Asia excluding Singapore were the three most suitable groupings (we did not want to have more than three groupings). To give an example: The difference in relevance ratings (of all drivers) between Indonesian scientists and Thai scientists was smaller than between Indonesian and Singaporean or Southeast Asian and European scientists.

The motivation for using an inductive grouping for the respondent’s group in the second stage of the process, which is not utilized in “normal” Delphi queries, was that we assumed that scientists from Europe and Southeast Asia would not necessarily share the same motivations (drivers) for starting and continuing the cooperation.

Given the difference between the regions and the fact that Singapore is materially the wealthiest country in the ASEAN region, the groupings seem quite natural. This being true, as we shall see in chapter 6.5, the grouping still gives interesting and in some cases unexpected insights.

We have already seen that the first stage of the scientist consultation by email has gathered significant feedback. The response rate (for the second stage, i.e. the Delphi, have also been very impressive: Out of the 12,000 email addresses initially gathered, slightly less than 10,000 were actually active and functioning. Among these, 1,200 scientists have filled in the online survey in the first Delphi round. The second Delphi round, presenting the average relevancies assigned to the identified instruments in the first round and offering the respondents the possibility of the scenario drafts, answers or comment upon them, has been completed by 48% of the respondents from the first round. The overall response rate throughout the whole Delphi process is around 5.7% (very high according to independent experts; similar exercises normally attract answers from about 2-5% of the persons contacted), which turns the set of concrete instruments identified into a reliable source of bottom-up recommendations. Moreover, answers were equally distributed among the two target regions (for the second round: 254 complete answers from Southeast Asia and 301 from Europe).

The goal of using the open email scientist consultation process before starting the Delphi was to ensure that the driving factors that we would later ask the scientists to evaluate in order of relevance would come directly from the concerned scientific community and would not be “invented” by us. A nice side-effect was that we got very positive feedback from scientists that mention explicitly their approval of this approach, and that the incoming completed surveys were more numerous than usual in comparable exercises. Moreover, the results gained display both the scientists’ ideas regarding relevant drivers of future S&T cooperation between Southeast Asia and Europe and concrete recommendations on how to achieve an increased cooperation intensity. Critical remarks within the consultation process concerned mainly the transparency of the follow-up process (which we will tackle by sending this report to all contacted scientists) and the question of science policy to take and implement advice derived in the process. In this regard, the authors of this study can only recommend strengthening the link between science policy and science by acknowledging the importance of scientists’ advice in the development of science policy. Taken together, the respondents for our queries have invested a huge amount of time working and they would probably appreciate if this contribution could be made explicit in the further development of science policy.

6.2.5 Towards a success scenario of 2020 EU-ASEAN S&T cooperation

As explained above, after the drivers identification, scenario method typically starts defining the scenario type, logistics, followed by a fleshing out of the draft scenario, before this is put up for discussion. The SEA-EU-NET Foresight team used the results of the driver identification and assessment process for the desk research and assessment process for the desk research to generate a research-based core scenario logic and a draft success scenario. We followed the single success scenario method introduced above. Given the resource constraints we had to deal with, we took this as the most promising method for the goals of triggering debate and creating a jointly owned vision of the future. The success scenario drafted in the narrative form of a fictive news clippings, was put up for discussion (in a Knowledge Café format94) during a SEA-EU-NET event in Chiang Mai / Thailand. A high-level policy-maker and research funder audience (around 50 people from EU and ASEAN countries) discussed the future of EU-ASEAN S&T Cooperation in the light of the necessary future paradigm shifts defined in the Krabi Initiative 95.

After this detailed account of the methodology forming the basis of this foresight study, we can now focus on the results, starting with the policy-makers and then moving on to the scientists’ point of view. Contrasting and combining both with the goal to generating a set of fruitful insights on how to go for a 2020 S&T cooperation success scenario for Southeast Asia and Europe.

6.3 Policy-makers’ views

As said before, at the beginning of the foresight process in November 2009, policy-makers from Southeast Asia and Europe were invited to consider driving forces for an increased S&T cooperation between the two regions in five policy areas. For each of these areas, we will highlight the major driving forces that were identified in the workshop. Subsequently, we will point out interesting differences between the regions before, finally, moving on to the results of the identification of environmental factors that are considered relevant for the future of S&T cooperation, but cannot or hardly be influenced (“shapers”).

6.3.1 Higher education policy

In the field of higher education policy, facilitation of mobility and achieving science excellence in a globalised world were identified by experts from both regions as the most important driving forces for achieving a high level of region-based research cooperation between Southeast Asia and Southeast Asia. The far-ranging driver favourable policy background was slightly more important for the SEA experts, whereas internationalization of education was highlighted mainly by Europeans. SEA experts take very different stances towards this issue among them.

Discrepancies between the two regions are most prominent, however, in the rating of the importance of drivers like funding and donor availability more important for SEA experts), research management (more important for European experts) and, most notably, humanities and letters, with good support from the European side and none from Southeast Asia. The following diagram shows a selection of drivers that were estimated as highly important by both regions (right part of the diagram) and where views differed significantly (left part of the diagram).
6.3.2 Science and research policy

One additional driver should be highlighted as it contributes to science excellence in a globalised world, while SEA experts complement the last-mentioned support for research infrastructure: Schemes for joint usage of infrastructure, fulfilling bi-regional high intensity S&T cooperation scenario. While not all SEA experts considered these views as quite relevant by the whole group of experts, as can be seen in the following diagram, less consensus prevailed regarding a set of five other drivers: European experts emphasized Achieving science excellence as a crucial driver. In the field of Higher Education Policy, experts from Southeast Asia and Europe agreed in assigning outstanding importance to maintaining a competitive edge in global innovation and, to a lesser extent (less experts giving a grade, however with a similarly high average grade) to the free movement of people and capital between regions.

Regarding a set of other drivers that were proposed for considerations or that popped up during the discussion, considerably discrepant views prevailed, most notably when it comes to trade and economic factors. Getting more SMEs into RTD cooperation, supply chain integration/efficiency (average of 5 points from SEA against 3.5 points from Europe in both cases) and reducing/removing trade barriers (4.75 against 3.53 points average) were all regarded as much more important by SEA experts than by Europeans.

An additional fact can be seen as enclosing the aforementioned list at a superordinate level: A favourable policy background in this policy area was considered absolutely crucial (average of 5 out of 5 points) by the SEA experts participating (with 5 out of 7 giving grades). Two thirds of the European experts considered the issue an important, but no crucial driver (3.83 points out of 5). One third of the European experts did not vote on this aspect. While not all SEA experts considered these issues worth expressing their opinion on, those who did (between 2/7 and 5/7) underlined the importance of the trade and economic policy background drivers.

Apart from these, as mentioned already, science excellence, here, is seen as a most important driver by European participants, while a “pro poor” approach and questions of funding and donor availability are considered important drivers by Southeast Asian experts rather than by Europeans.
6.3.6 Diverging views within regions

Besides examining consensus and diverging views on the importance of certain drivers, a series of driving forces was considered by some as crucially important and by others as rather irrelevant. This is shown in the following table using each of the experts' grades given to the specific driver as well as the variance and average of the given points: (answers with a variance of more than 1 are highlighted).

<table>
<thead>
<tr>
<th>Policy area</th>
<th>Driver ※</th>
<th>Estimated relevance</th>
<th>Estimated relevance for SEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher education policy</td>
<td>Support for co-authored papers (co-funding schemes)</td>
<td>4.4</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Internationalisation of education</td>
<td>5.5</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Science and research policy</td>
<td>Diversification of partners</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Industry, trade and economic policy</td>
<td>Achieving economic excellence in a globalised world</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Development policy/global challenges</td>
<td>Lift DEV Programmes stronger with S&amp;T programmes</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Diplomacy, foreign policy, security policy</td>
<td>Supporting less developed countries</td>
<td>5.5</td>
</tr>
</tbody>
</table>

※Most important = 5; least important = 1

Southeast Asian experts, for example, had no corresponding views among themselves to the question whether the support for co-authored papers would be relevant as a driving force for S&T cooperation between Southeast Asia and Europe.

In the area of Higher Education Policy they disagreed even more about the possible role of an internationalisation of education for boosting bi-regional S&T cooperation. EU policy-makers decided to address the goal of an intense bi-regional science and technology cooperation through enhanced higher education internationalisation. This aspect, for instance, might need clarification and further consultation with the Southeast Asian partners.

In Science and Research Policy, there was no consensus among Southeast Asian experts regarding the question whether a diversification of partners drives bi-regional S&T cooperation between Southeast Asia and the EU forward or not. As seen above, this point is in average considered less important by the Southeast Asian attendees. The opinion of the participants regarding the possible driver science excellence also varies strongly within the group of Southeast Asian participants and among the regions. By contrast, as regards the role of support to less developed countries, the rating was moderately positive on both sides, while answers vary significantly within each group of attendees.

These aspects exemplify the diversity of the Southeast Asian region, which will have to be taken into account in any effort to strengthen bi-regional S&T cooperation. This was also expressed by workshop participants from both sides in the final discussion round.

In addition, views on the significance of integration processes within Southeast Asia for S&T cooperation with Europe also differed, although not as strongly as other issues. It might be appropriate to keep these different estimations of the role of SEA integration in mind when approaching the goal of a strengthened bi-regional S&T cooperation at the political level. When there is no consensus among Southeast Asian stakeholders that can be interpreted in this account, it might be difficult to get substantial political support at regional Southeast Asian level.

The issue of the driver supporting national industries was already discussed above. Southeast Asian experts offered different opinions and valued this driver less than other economy-related issues. This might be explained by either a trust of Southeast Asian stakeholders in their economic landscape, the experience that national industries are not important for S&T endeavours or the perception that national industries are central for competitiveness and thus too critical to be subsumed under shared regional responsibilities.

In the case of the European group of experts, there was diversity with regard to a greater number of possible drivers (answers with a variance of more than 1 are highlighted).

Table 12: Diverging driver relevance assessments – high variance in European answers

<table>
<thead>
<tr>
<th>Policy area</th>
<th>Driver※</th>
<th>Estimated relevance</th>
<th>Estimated relevance for SEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher education policy</td>
<td>Competition for scarce (human) resources</td>
<td>5.5</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Diplomacy, foreign policy, security policy</td>
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<td>5.5</td>
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We do not want to pick out each single item here, but extract some of the most interesting findings relevant for policy recommendations.

As can be seen, the competition for scarce (human) resources as a possible driver for bi-regional S&T cooperation provoked strongly different reactions among European experts in all three policy areas in which this driver was indicatively raised for discussion. European workshop participants disagreed about possible brain gain as a driver in the scenario.

Whether or not the organisation of bi-regional science days can advance S&T cooperation, was also an ambiguously evaluated issue. Accordingly, if such events should take place in the future, policy-makers, programme-owners and organisations cannot expect unanimous support from stakeholders.

Supporting less developed countries, supporting research infrastructures and adopting a "pro poor" approach are possible drivers that are very diversely reflected upon by the European participants. Likewise, European experts did not agree upon the importance of mobility with the explicit hint to possibly banning visas for scientists. Further research in form of follow-up and additional interviews is needed in order to give valid interpretations of these findings.

6.3.7 Shapers and additional drivers for SEA-EU S&T cooperation 2020

In this section, we shortly highlight the most important shapers of the future of bi-regional S&T cooperation between Southeast Asia and Europe that were identified by the scenario workshop participants.

In methodological terms, as described above, participants were asked to consider a list of indicative shapers and add new ones. Subsequently, every expert could both vote the relevance of each of the shapers by distributing to relevance points over the whole set of shapers and add qualitative comments and further explanations.

As will be seen, while in theory and definition it might be possible to draw a line between driving and shaping forces as directly influencing and indirectly conditioning factors, in a dynamic workshop setting, it might not always be easy to maintain this separation proposed by the UNIDO foresight manual. Several of the shapers that will be presented below, can or even must actually be interpreted as drivers.

The shaper that by far raised the biggest interest among experts in both regions was focusing common R&D areas on so-called "Food Security". Southeast Asian experts also be understood as a driver, here it is also to be interpreted in terms of the general relevance of food, energy and water issues in the region in the not-so-near future. A corresponding commentary of an expert justifying the impact of this shaper on Southeast Asia: "F, E, W are the main issues in ASEAN countries. Although there have been a lot of approaches and achievements [...] still in the upcoming years (up to 2020), people in ASEAN [...] are very concerned on these three issues". Similarly another expert: "It is important for ASEAN countries to have a regional food product or a regional proven technology for ensuring energy resources".

Another expert addressing the impact of this shaper on the EU recurrs to a different reading: "Common R&D programmes will have an effect on the future EU scientificentific programme". He means that, as more money will be allocated to research activities focusing on these issues, this will shape the bi-regional S&T cooperation.


78 Which was slightly bigger – 9 participants compared to the 7 SEA participants
It becomes clear that the differentiation between drivers and shapers is not intuitive and not easy to maintain in our scenario workshop setting with policy-makers and programme-owners. The potential for further cooperation is evident, but the drivers for such an interaction are not always intuitive and not easy to discern. By focusing on the drivers, it becomes easier to understand the motivation behind the cooperation and to develop strategies to enhance it.

The drivers for regional cooperation can be divided into three main categories:

1. **Economic and Business Drivers**
   - There is a common concern for global challenges and for the future of Southeast Asia and Europe.
   - Southeast Asian experts assign the responsibility for R&D to the government and consider national strategies to be the key drivers of regional cooperation.

2. **Political Drivers**
   - There is a common interest in regional cooperation and a recognition of the need for strengthened relations.
   - Southeast Asian experts assign the responsibility for R&D to the government and consider national strategies to be the key drivers of regional cooperation.

3. **Social and Cultural Drivers**
   - There is a common concern for global challenges and for the future of Southeast Asia and Europe.
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Preparatory Work

To facilitate the workshop, a preparatory work is conducted to identify the potential for further cooperation. This involves analyzing the drivers for regional cooperation and developing strategies to enhance it.

Methodology

The methodology involves conducting a literature review, analyzing the drivers for regional cooperation, and developing strategies to enhance it.

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to possibly rewarding scientists willing to engage with their community through international peer reviews. While this debate sounds slightly misplaced at first sight, in view of the fact that a number of co-publications and submissions originate from authors’ including their reviewers as co-authors, it is reasonable to discuss reward structures for high-quality reviewing supporting international cooperation.

The financial and reward aspects bring us to one of the specific driving factors of international cooperation that are related to, but not only determined by the availability of financial resources (the empirical material gathered throughout our email consultation pinpoints a rich range of modalities, going far beyond simply stating that money is needed); the question who decides in which thematic areas S&T cooperation takes place, i.e. is supported and rewarded. Respondents identified a combination of bottom-up and limited joint top-down priority setting as necessary in the context of international cooperation. While most of the respondents highlighted that it is indispensable to have thematically open support for international S&T cooperation in order to make it function (the argument being that scientists just will not search for partners as long as they do not feel that the topic of their research), a few respondents also opined that top-down priority setting would in general help to drive cooperation levels. For them, top-down themes indicate political backing for this kind of cooperation (which has been mentioned several times by Southeast Asian scientists as a pre-requisite for successful cooperation. Assessments have not been universal in this regard. However, a solution to possible resistance that can be mentioned by the scientists is to support cooperation in jointly defined subject areas relating to global cooperation. While most of the respondents mentioned that the classical fora for scientific exchange, namely the disciplinary and interdisciplinary conferences, are highly relevant drivers for international S&T cooperation, at least for those scientists that are not already connected extensively on a global scale. In addition to scientific conferences, other types of meetings like dedicated matchmaking events or smaller problem-centred seminars could in general be greatly helpful to generate cooperation possibilities.

Several respondents agreed that, in addition to scientific conferences, other types of meetings like dedicated matchmaking events or smaller problem-centred seminars could in general be greatly helpful to generate cooperation possibilities. The following more specific, but very relevant innovation-related tools and driving forces for S&T cooperation have also been identified by the scientists:

- **Support for exchange and subsequent cooperation is beneficial merely for political reasons, long-term economic prospects or for the sake of cooperation itself. In this regard, exchange and co-supervision can prove very helpful, as well, as people are brought together over longer periods of time, thus enabling them to identify and develop joint research interests.**

Notwithstanding the possibilities of long-term exchange of junior scientists, most respondents also mentioned that the classical fora for scientific exchange, namely the disciplinary and interdisciplinary conferences, are highly relevant drivers for international S&T cooperation, at least for those scientists that are not already connected extensively on a global scale. In addition to scientific conferences, other types of meetings like dedicated matchmaking events or smaller problem-centred seminars could in general be greatly helpful to generate cooperation possibilities.

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- **Not only in order to maintain contacts, but also in view of the goal of establishing new contacts and future cooperation, Southeast Asian diaspora communities in Europe (or Southeast Asian scientists with European PhDs) might be helpful. A lot of especially second generation migrants in European countries have studied, and are thus familiar with the languages and cultures of both regions.**

Most of these exchange-related aspects focus on personal contacts. However, they can receive significant support from institutional cooperation. The key is international S&T cooperation agreements involving joint university campuses, third country campuses, exchange schemes or joint events. Several respondents indicated institutional cooperation agreements being particularly relevant for international cooperation. However, the majority rather underlined single personal contacts as relevant. Given the variety of answers, we conclude that the scientific community should identify both personal and institutional contacts as supportive for S&T cooperation.

**Institutional contacts might be relevant for another driver identified by the respondents: partner identification.** Not only international cooperation agreements involving joint university campuses, third country campuses, exchange schemes or joint events. Several respondents indicated institutional cooperation agreements being particularly relevant for international cooperation. However, the majority rather underlined single personal contacts as relevant. Given the variety of answers, we conclude that the scientific community should identify both personal and institutional contacts as supportive for S&T cooperation.

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The facilitation of S&T cooperation between Southeast Asia and Europe. Regarding the personal or institutional motivations that drive international S&T cooperation, respondents mentioned the following drivers (no ranking of importance):

- the goal of doing good state-of-the-art science
- reputation
- the feeling to be able to contribute (to the development of a country or a scientific discipline)
- the ideal of helping to solve global challenges; while this appears first and foremost to be a personal or institutional motivation, if one considers that cooperation in the fight against global challenges produce cooperation patterns, it also is a tool
- getting field access; here, some kind of international cooperation is quickly established given the interest and needs of one partner. The relevant question, then, is not so much how to establish S&T cooperation, but how to establish it on an equal footing.
- exchanging empirical data and materials
- getting access to expertise and knowledge pools
- getting access to human resources (e.g. motivated PhD students)
- getting access to an economically important or increasingly important region
- tapping into potential for joint development of technological and/or marketable qualities. For sure, the relevant material appears as more or less relevant according to the research subject area and mode of investigation
- love for the culture(s)
- tourist experience
- keeping friendship alive

As international cooperation activity is increasingly becoming an important performance indicator for individual scientists and scientific institutions, the quest for international projects and publications will have to be added to the above list as an increasingly relevant institutional motivation for S&T cooperation.

Some respondents pointed to industry involvement and technology transfer from (applied) science to the private sector as “cementing” cooperation. In order to make that happen, another factor has to be taken into account: intellectual property rights (IPR). Clear IPR guidance was mentioned by some participating scientists as helping S&T cooperation to grow into concrete results with local impact.

Finally, soft factors like mutual respect, openness to differences among cultures, a non-arrogant attitude, but also language skills, communication skills (e.g. in order to clarify what reasonably can be expected from the cooperation), etc. have been considered as relevant for the motivation of S&T cooperation. But also financial considerations are important:

- The motive for cooperation is a shared interest.
- The motive for cooperation is to get access to expertise and knowledge pools.
- The motive for cooperation is to get access to an economically important or increasingly important region.
- The motive for cooperation is to produce cooperation patterns, it also is a tool.
- The motive for cooperation is to tap into potential for joint development of technological and/or marketable qualities.
- The motive for cooperation is to love the culture(s).
- The motive for cooperation is to keep friendship alive.
- The motive for cooperation is to tourism.
- The motive for cooperation is to support exchange between scientists [...].

The cost of this is difficult to compensate, especially when one partner has to stop working for that period. For the own work and career planning such a stay might be good but financially it can be a disaster.

Conditions might also not be that favourable at all.

“I have looked into coming to Europe but the labor market conditions in research and academia are too bad for me to do so, relative to the US market.”

Naturally, scientists will have potential trade-offs in mind when considering to engage in international cooperation.

These personal and institutional motivations are inherently driving international cooperation to a certain extent, whatever the framework conditions are. However, as mentioned at the beginning of this overview of participants’ responses, motivations can (to a higher or lower degree) be transformed into action by the availability of tools driving international S&T cooperation between Southeast Asia and Europe. As to policy-makers’ scope of action, personal and institutional motivations can and should be addressed, but can hardly be changed. Policy-making can make sure, however, that the tools for transforming motivation into action are suitably available.

Specifically with regard to the tools that might drive international S&T cooperation, we wanted to make sure that we did not only gather individuals’ opinions, which would be worthwhile but not representative. This is why we received feedback on the qualitative material of the open email consultation to the entire target respondent group of approximately 10,500 scientists with Southeast Asia-Europe co-publishing experience in form of a two-stage Delphi survey.

6.5 Global assessment of important driving factors – Delphi survey results

In order to let the entire target group evaluate the individual assessments of driving forces of international S&T cooperation between Southeast Asia and Europe, the set of “drivers” [tools and personal motivations] was presented to the group of 10,500 scientists in the form of the following 59 statements:

**Motivations – general**

- From an academic viewpoint, the possibility of interacting with people coming from a culture so different, yet sharing the same scientific interest and working in similar topics is stimulating.
- If we do not act immediately, we will be soon lagging behind. Strong and early partner- ships might help Europe keep up with the su- multuous growth of the S&T potential of the SEA countries.

**Driving factors for cooperation** are mainly:

- Driving factors for cooperation are mainly to share our knowledge with a developing country.
- In order to engage in S&T cooperation, a love for Southeast Asia/Europe and its people and cultures is necessary.

**Motivations – scientific**

- The motive for cooperation is a shared interest and expected mutual benefits among all partners.
- The motive for cooperation is the global and scholarly reputation of the institutions within which cooperative activities are housed.
- The motive for cooperation is to get access to high-tech labs.
- I cooperate because I think my partners can benefit from my institutions’ excellence.
- Working together promotes not only scientific results, but friendship that is likely to lead to further joint studies.

**Information**

- Scientists in each region must be familiar with the other region’s scientific institutions, science policies, and scientists.
- A permanent bridging institution should be established to facilitate the exchange between the two regions (e.g. by helping with partner search, managing administrative burdens, helping with proposal writing).
- Networking events should be available (separate from or in addition to thematic academic conferences) where scientists from both regions can meet, discuss and build networks.

**Policy framework**

- It is breaking through the political barriers that is most important.
- Thematic priorities for cooperation should be clearly pre-defined by policy-makers and funding assigned accordingly.
- Research grants should be awarded independent of governments’ thematic priorities.
- The EU should reach out to facilitate the inclu- sion of Southeast Asian scientists in FP7.
- Joint programs should be set up, where each party can leverage funding from their own country to address an issue of direct concern to both.
• Thematic priorities and joint programs should be established with a long-term perspective.

Programme setup

• At the end of each project cycle, separate funding should be allocated for publications and dissemination work.

It would be good if EU encouraged the Southeast Asian countries to be the coordinators, and not just members of FP7-consortia.

• Industry and leading companies should be involved across various disciplines to work with and sponsor academic institutions in both EU and SEA.

• S&T activities should be supported by training the persons involved in “soft skills”, mediating cultural differences (on top of the usual funding schemes).

The main driver is PhD scholarships awarded to graduates already employed for several years in scientific institutions, not to people who have just completed a degree.

Training grants should be provided to young investigators – going in both directions, while travel grants should be offered to other investigators.

Support should be given to post-docs to re-visit foreign host institutions to keep contacts alive.

In the first round of the Delphi survey, around 1,050 scientists have estimated the relevancies of each of the statements (scale: strongly agree – agree – disagree – strongly disagree – not applicable) and shared half of them have accepted the offer of having a second half of them have accepted the offer of having a second round within each of these regions were more similar than answers from my institutions’ excellence. 6.5.1 Overall assessment

6.5.2 Regional differences

Regarding the following group of driving factors, there has been extremely high agreement (high agreement: more than 290 percentage points), regional and hierarchical differences in the answers present more interesting than going into more detail at the level of overall averages.

While agreement levels with regard to the inclusion of Southeast Asian scientists in FP7 are very high in both regions, less Europeans (62% compared to 87% Southeast Asians) tended to agree that Southeast Asian part...

Networking events should be available (separate from or in addition to thematic academic conferences) where scientists from both regions can meet, discuss and build networks.

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lished with a long-term perspective.

Practically all (95%) Southeast Asian respondents agree not allowing this is an important issue. In the case of the Europeans, agreement was lower, but still considerably high (87%). At the end of each project cycle, separate funding should be allocated for publications and dissemina-
tion work.

Industry and leading companies should be involved across various disciplines to work with and sponsor academic institutions in both EU and SEA. Scientists from Southeast Asia agree at a significantly higher degree to the involvement of industry. Between 90 and 100% of the responding scientists in Southeast Asia agreed to this statement, whereas in Europe “only” 75% did so.

One of the keys of success is technology transfer to our hosts. • S&T activities should be supported by training the persons involved in “soft skills”, mediating cultural differences (on top of the usual funding schemes).

Some incentives could be offered to scientists who work for the whole community (e.g. offer support to conferences organised by scientists who review papers for international peer reviewed scientific journals).

Most of the SEA Countries are ‘developing’ ones with few (if any!) facilities to do scientific research. Therefore, in this kind of cooperation human re-

sources are the key factor.

Training grants should be provided to young investi-
gators – going in both directions, while travel grants should be offered to other investigators.

I would advise to offer professors still active in re-

search sabbatical-like periods and subsidies in ex-

change for this additional work as they are already overwhelmed with all kinds of duties so that very few can accept.

PhDs returning to developing countries should be given funds to set up their own lab in order to be able to continue their work.

Regarding the funds for returning PhDs, 75% of European respondents agreed, while in the case of Southeast Asian respondents, the overall average agreement rate was more than 90%.

European scientists did not agree to these state-

ments that have nevertheless been agreed upon among Southeast Asian scientists:

• It is breaking through the political barriers that is most important.107

• Breaking through the political barriers is not allowed to receive FP7 funds.107

Interestingly, the only driver where Southeast Asian sci-

entists agree to a significantly smaller degree (they still agree, however) is reflected in the statement that “the financial and auditing aspects of the EU grants are ex-

trremely confusing”. It might be that there is a bias be-

cause Southeast Asian respondents wanted to be polite in front of us (and we are and have been perceived as a European project). Otherwise, Southeast Asian scien-
tists could simply be happier with FP7 also in terms of accounting and auditing or they are not so familiar with FP7 yet, as to have a critical opinion. In-depth qualita-

tive analysis would be needed to present a definite an-

swer, here.

6.3.5 Developed countries – developing countries?

As we hear, interestingly, respondents answering from a Southeast Asian perspective are more concerned about supporting developing countries than their European counterparts. What are the differences, now, within the extremely diverse ASEAN region, and between this group of countries that could be considered (more or less) consisting of developing countries and Europe or countries like Singapore?

Thematic priorities and joint programs should be es-


tablished with a long-term perspective. Agreement rates in Singapore are 15% less than in the other Southeast Asian countries. The majority (56%) of people answering from a Singapore perspective disagree that this is of any relevance.

Most of the SEA Countries are ‘developing’ ones with few (if any!) facilities to do scientific research. Therefore, in this kind of cooperation human re-

sources are the key factor.

Interestingly, around 40% of Singaporeans disagree with that statement and 15% consider it not applicable to their situation. Regarding the other Southeast Asian countries, 88% of the respondents agree to this state-

ment.

One of the keys of success is technology transfer to our hosts.

Agreement rates in Singapore are 15% less than in the other Southeast Asian countries (70% agreement vs 85% agreement). Support should be given to post-docs to re-visit for-

eign host institutions to keep contacts alive. PhDs returning to developing countries should be given funds to set up their own lab in order to be able to continue their work.

Regarding one driver, agreement in Singapore has been similar to agreement in Southeast Asia excl. Sin-
gapore. Cooperation for future FP7 calls only for significantly higher in Southeast Asia excl. Singapore than in Sina-
pore (however, most Singaporeans still agree): • Driving factors for cooperation are mainly to share our knowledge with a developing country.

While only 58% of respondents answering from a Singa-

dorean perspective agree to this statement, 84% from the other Southeast Asian countries do so. • In order to engage in S&T cooperation, a love for Southeast Asia/Europe and its people and cultures is necessary.

The motive for cooperation is to get access to high-

tech labs.

Working together promotes not only scientific re-

sults, but friendship that is likely to lead to further joint activities.

It is breaking through the political barriers that is most important.

Singapore does not seem to suffer from any political barriers impeding cooperation: a majority of Singapo-

rean respondents disagrees with the statement or con-

siders it not applicable to their situation. In the other Southeast Asian countries, 70% of the respondents agree with the statement.

At the end of each project cycle, separate funding should be allocated for publications and dissemina-
tion work.

• Thematic priorities for cooperation should be clearly pre-defined by policy-makers and funding assigned accordingly.

Testing samples based on different sets of Southeast Asian countries (e.g. ASEAN excl. Singapore, excluding Malaysia and Thailand) have shown that the results are very similar: The differences in agreement occur in rela-
tion to precisely the group of drivers where differences in agreement also occur when comparing Southeast Asia as a whole or with Singapore and Europe or Southeast Asia excl. Singapore and Singapore.106

6 Driving factors

– Separate funding for dissemina-
tion
– Bridging institution
– Networking events
– FP7 outreach
– SEA coordination or FP
– Separate funding for dissemination
– Involvement in technology transfer
– Soft skills training
– Incentives for working for the scientific community
– SEA countries are developing countries
– Human resources important
– Training grants
– Sabbaticals
– Funds for returning PhDs to set up labs
– Breaking through political barriers
– Policy-makers could pre-define thematic priorities
– Act, otherwise Europe will lag behind

Highly agree-

able drivers

– Access to high tech labs
– Partners benefit from my institution’s excellence
– Bridging institution
– Networking events
– FP7 outreach
– SEA coordination or FP
– Separate funding for dissemination
– Involvement in technology transfer
– Soft skills training
– Incentives for working for the scientific community
– SEA countries are developing countries
– Human resources important
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– Sabbaticals
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– Breaking through political barriers
– Policy-makers could pre-define thematic priorities
– Act, otherwise Europe will lag behind

Table 6: Regional specificities in driver relevance assessments

Agreement / region
Southeast Asia (excl. Singapore) Singapore Europe

Strong agree-

ment (all re-

gions) regarding the following drivers:

– Interaction is stimulating
– Shared interest and mutual benefits as motive
– Friendship
– Long-term exchange for PhDs, short-term for seniors
– Joint programs based on national funds
– Long-term perspective
– Personal contacts of supervisors
– Support to post-docs for resigning

Southeast Asia (excl. Singapore) Europe

Higher agree-

ment rates in...:

– Personal contacts of supervisors
– Involve industries
– Technology transfer
– soft skills training
– Incentives for working for the scientific community
– SEA countries are developing countries
– Human resources important
– Training grants
– Sabbaticals
– Funds for returning PhDs to set up labs
– Breaking through political barriers
– Policy-makers could pre-define thematic priorities
– Act, otherwise Europe will lag behind

Confusing FP7 financial audit-

ing aspects

– Access to high tech labs
– Partners benefit from my institution’s excellence
– Bridging institution
– Networking events
– FP7 outreach
– SEA coordination or FP
– Separate funding for dissemination
– Involvement in technology transfer
– Soft skills training
– Incentives for working for the scientific community
– SEA countries are developing countries
– Human resources important
– Training grants
– Sabbaticals
– Funds for returning PhDs to set up labs
– Breaking through political barriers
– Policy-makers could pre-define thematic priorities
– Act, otherwise Europe will lag behind

107 Which is, strictly speaking, not true. It has only to be justified why the inclusion of a partner from Singapore is necessary for the success of the project.
6.6 The different views from hierarchy

In the Delphi survey, we have also asked the respondents to specify at which hierarchical/career level they currently are (PhD, Post-Doc, Senior Scientist, Emeritus or Other). The complete answers in the first Delphi round came from 50 PhDs, 96 Post-Docs, 674 senior scientists and 42 Emeritus. As can be seen, the overall answers in our survey can be interpreted as reflecting the opinion of senior scientists.

In order to find out whether scientists of different career levels assess driving forces for S&T cooperation differently, we have compared the means of the most relevant subsamples. The results have been as follows:

There have been no significant differences (neither at 0.01 nor at 0.05 level) between the agreement rates of PhDs and Post-Docs. Regarding differences between the answers of senior scientists and emerits, only one driver was agreed upon by significantly more emerits than senior scientists:

- Retired scientists should get a better funding to go to developing countries for mentoring their former students. It seems quite understandable that retired scientists have an interest in the availability of such funds. Nevertheless, it is also a good sign that senior scientists would be interested in seeing younger scientists.

Significant differences can be recorded, thus, only between the younger and more senior cohorts of the scientific community. We have compared the answers of PhDs and Post-Docs together with those from senior scientists.

Regarding the following statements, agreement among senior scientists is significantly (at 0.01 level) higher among their younger peers:

- From an academic viewpoint, the possibility of internationalising the young generation of scientists argues in favour of such networking events.
- Interaction with people coming from a culture so different, yet sharing the same scientific interest and ways of working in science is stimulating.
- Agreement rates among researchers in administrative positions have in addition been significantly (at 0.01 level) higher with regard to the following three additional drivers:
  - Networking events should be available (separate from or in addition to thematic academic conferences) where scientists from both regions can meet, discuss and build networks.
  - PhDs returning to developing countries should be given funds to set up their own lab in order to be able to continue their work.
  - S&T activities should be supported by training the persons involved in "soft skills", mediating cultural differences (on top of the usual funding schemes).

The financial and auditing aspects of the EU grants are extremely confusing.

In the case of the following drivers, it is the opposite case, i.e. younger scientists consider them more relevant:

- A permanent bridging institution should be established to accelerate knowledge exchange between the two regions (e.g. by helping with partner search, mastering administrative burdens, helping with proposal writing,...)
- The motive for cooperation is to get access to high-level laboratories.
- I cooperate because I think my partners can benefit from my institutions’ excellence.
- Working together promotes not only scientific results, but friendship that is likely to lead to further joint studies.
- Cooperation can be very successful if you place motivated and highly trained foreign scientists in a country’s laboratories for long term stays.
- I would advise to offer professors still active in research sabbatical-like periods and subsidies in exchange for this additional work as they are already overwhelmed with all kinds of duties so that very few can accept.

Agreement rates among researchers in administrative positions in addition have in addition been significantly (at 0.05 level) higher with regard to the following three additional drivers:

- Having in mind these and related contextualisations of the data presented here, in view of trying to shape the 2020 future of S&T cooperation between Southeast Asia and Europe, it is sensible to take into account the specific needs and thought patterns of younger generations of scientists, even as these might change with increasing seniority.

Besides the career level, we have also asked the respondents to specify whether they currently are in an even position or not. 458 first-round respondents answered with “yes”, 590 with “no”, which allows us, again, to look at significant differences in the agreement rates between two groups.

Agreement rates among researchers in administrative positions has been significantly (at 0.01 level) higher than among other researchers regarding the following six drivers:

- Networking events should be available (separate from or in addition to thematic academic conferences) where scientists from both regions can meet, discuss and build networks.
- Thematic priorities for cooperation should be clearly pre-defined by policy-makers and funding assigned accordingly.
- Agreement rates among researchers in administrative positions in addition have in addition been significantly (at 0.05 level) higher with regard to the following three additional drivers:
  - Networking events should be available (separate from or in addition to thematic academic conferences) where scientists from both regions can meet, discuss and build networks.
  - PhDs returning to developing countries should be given funds to set up their own lab in order to be able to continue their work.
  - S&T activities should be supported by training the persons involved in "soft skills", mediating cultural differences (on top of the usual funding schemes).

For most of these bullet points the (necessary) managerial activity of people active in science management and science administration positions helps to interpret the differences in agreement levels. The group of senior scientists in administrative positions is most far away from their undergraduate past and given that the last driver proposes direct benefits for this group.

Having in mind these and related contextualisations of the data presented here, in view of trying to shape the 2020 future of S&T cooperation between Southeast Asia and Europe, it is sensible to take into account the specific needs and thought patterns of younger generations of scientists, even as these might change with increasing seniority.

Considering the relationships between senior scientists and emerits, only one driver was agreed upon by significantly more emerits than senior scientists:

- PhDs returning to developing countries should be given funds to set up their own lab in order to be able to continue their work.

6.7 The views from the scientific community contrasted by views from policy-makers

In the preceding chapters, we have first presented the results of a scenario-based drivers workshop where policy-makers and programme owners from Southeast Asia and Europe have identified and discussed driving forces for the future of bi-regional S&T cooperation. Then, the results of an open email consultation and Delphi survey with a relevant part of the scientific community (namely one that has recently engaged in joint publication activity) have been presented. In the consultation and Delphi survey, scientists have also identified a series of driving forces for the 2020 future of S&T cooperation between Southeast Asia and Europe.

We will now compare the results of both exercises in order to see where policy-makers’ and scientists’ opinions were similar, where they could complement and where they contradict each other.

Several supposed driving forces for S&T cooperation between Southeast Asia and Europe have been identified in both the policy-maker scenario workshop and the scientist consultation. However, the scientists’ assessments tend to go into more detail as to what concrete operationalisation of the driver could actually support cooperation. This could be expected, given that in the policy-maker workshop we aimed at a broader discussion (stirred by listing five different policy areas) making use of the audience’s wider expertise, while the scientist consultation was trimmed towards expressing into the experiences of those that are actually doing science cooperation.

To illustrate the difference of breadth and depth to which we here refer to: Funding and donor availability, for instance, were overarching research funding, two drivers identified by the policy-makers, clearly refer to the scientists’ conviction that dedicated funds for cooperation activities have to be available (either as part of international cooperation programmes or as add-ons to usual funding schemes). Policy-makers voice another driver that the free movement of capital has to be guaranteed. They do not specify, however, whether funding of cooperation should be linked to dedicated international cooperation programmes or whether specific mobilisation, cooperation/workshop outgoing, return, sabbatical or retirement schemes should be financed. Regarding the question whether funds should be thematically focussed or bottom-up, the drivers of joint agendas for common challenges, bottom-up initiatives, project teams, common convictions and policy initiatives might be found. Policy makers propose a cooperation that is likely to lead to further joint studies.

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Similarly, where the policy-makers rather vaguely pointed to facilitation of mobility as a relevant driver, scientists underlined the importance of the availability of exchange support schemes (with tailor-made time frames, quality, national, etc.) or support for international conference visits and organisation. The driver of facilitated visa procedures and conditions identified by scientists can also be grouped under this heading (or under the policy-makers’ driver of the favourable policy background). Policy-makers have additionally considered the free movement of people and capital a moderately important driving force.

However, policy-makers did not share the concern of scientists in view of bureaucratic obstacles impending mobility, the exchange of empirical material (biomaterials, etc.) and field access. Instead, trade liberation and free movement of capital have been identified by them (policy-makers from both regions) as facilitating S&T cooperation. This is a driver that has not been present in the opinions of the scientists.

The driver of internationalisation of education, identified by policy-makers, can be referred to scientists’ hints to the relevance of joint PhD programmes, PhD and undergraduate mobility and exchange as well as regional trends to enhance the quality of education and the comparability of degrees.

The driver of schemes for joint usage of infrastructure, such as Centres of Excellence appears in the scientists’ opinions in different occasions: once where they propose support to research infrastructure; for instance, the possibilities of recurring to mobility and capital a moderately important driving force. Furthermore, a driver: namely a motivation of those trying to motivate an innovation performance might thus be an indirect or second-level driver, since the scientists did not consider topics like human rights and human trafficking as a relevant driver for the future of S&T cooperation.

However, policy-makers did not share the concern of scientists. A firm’s or a country’s competitiveness is not seen as a relevant driver on a case-by-case basis regarding the topics of joint databases and computing are raising.

One of the “soft” factors identified by the scientists as relevant drivers also has been highlighted by policy-makers. This factor is a communicative, open and non-discriminatory attitude towards the other region, on which they have not been considered by policy-makers. Apart from these corresponding drivers (or possible core structure issues like a communicative, open and non-discriminatory attitude towards the other region) the possibilities of co-supervision of PhDs discussed above have not been considered by the policy-makers. Similarly, the involvement of scientific diasporas has not been discussed in the workshop, nor have favourable or unfavourable labour market conditions (co-determining, but related drivers), a series of factors brought forward has not been mentioned by scientists. In addition, the inclusion of SMEs is rather relevant as a driver in that it can harness scientific results, link it back to a field of application and not let the impact stop at the end of an international journal. Moreover, the policy-makers did not consider topics like human rights and the fight against human trafficking as a relevant driver for the future of S&T cooperation.

Regarding the question of personal and institutional motivation: So far, we have compared the sort of drivers of S&T cooperation that present themselves as supportive tools rather than motivations. In terms of personal and institutional motivation as well as political motivations, we have identified drivers of international S&T cooperation, policy-makers’ assessments are again less detailed than scientists’ accounts and reflect the scientists’ national economic perception and general and more specific, but related drivers, a series of factors brought forward by the scientists do not at all or not prominently appear in the policy-maker workshop material. The possibilities of co-supervision of PhDs discussed above have not been considered by the policy-makers. Similarly, the involvement of scientific diasporas has not been discussed in the workshop, nor have favourable or unfavourable labour market conditions (co-determining, for instance, the possibilities of recurring to mobility schemes) been mentioned. Policy-makers from neither region insisted upon the relevance of long-term commitments, the possibility of assigning the driver of connecting the research work with the local contexts. They did not come forward with an estimate whether personal or institutional contacts are more relevant. Moreover, there is a role assign regional and supranational research and bridging bodies and the policy-makers want scientists to engage more intensely in innovation practices, some specific funding programmes would probably be necessary. However, we might also have a small bias towards public research orientated scientists, as scientists related to or engaged with industry might not appear in databases of scientific publications.

The preceding pages have shown that the SEA-EU-NET Foresight exercise has created extensive strategic intelligence on the question which variables influence the future of S&T cooperation between Southeast Asia and Europe and what are the key driving forces influencing the future S&T cooperation. As we have seen in this chapter, we can summarise that a series of drivers identified by the policy-makers can reasonably be further specified with the data from the scientists consultation and Delphi. Both sets of drivers can be combined and, thus, result in a broader and, regarding the proper science cooperation activity (as done by scientists), more in-depth account of relevant variables or drivers influencing the future S&T cooperation between Southeast Asia and Europe.

6.8 Conclusions and recommendations

In order to concretely step up S&T cooperation levels between Southeast Asia and Europe, providing resources for some or all of the subsequent instruments is recommended by a majority of the group of scientists we have approached and/or by the group of policy-makers and programme owners that have joined the process: efforts towards S&T cooperation should be sustained over a longer-term horizon. Cooperative research needs time to grow (the scientists estimated
between 3 and 5 years) until it can bring quantifiable results. S&T cooperation support must, thus, be sta-
able (in order to be trusted and to “survive” financial crises) and flexible (in order to react to new subject areas and their complexities) at the same time.

- In terms of thematic areas of joint research, define a suitable balance between flexible funding of inter-
national cooperation components of bottom-up de-
dined research and dedicated calls and programmes for international cooperation in areas of joint inter-
est. It would have to be discussed in a separate oc-
cassion with the scientists to what extent the open-
ness of the entire FTO to third country participation meets the need for bottom-up priority setting.

- Define a suitable balance between basic blue-sky research and applied research, possibly even with industry participation. The outstanding prominence assigned by the policy-making stakeholders to the goal of maintaining a competitive edge in global innovation as a driver for bi-regional S&T coopera-
tion (in view of Science and Research Policy, Industry, Trade and Economic Policy) might advise to the-
ationally focus S&T cooperation efforts, at least in a short-term perspective, to innovation-relevant areas.

- However, the scientific community gave ambiguous answers: Some would like to see the early and tight cooperation with in-
dustry and SMEs, that possibly makes cooperation suitable for setting up and research collaboration in the form of blue-sky projects.

- Regarding international cooperation calls and joint calls, make sure that the priority-setting is ordered and discriminative process with scientist involvement. Joint calls and joint pro-
gramming have been highlighted as relevant drivers especially by policy-makers. They could be dedicat-
ed to address in order to suitably complement rather than counteract thematically open bottom-up support for cooperation. Through-
out the scenario workshop, European experts have pointed to the need for more formalised and harmonised planning, monitoring, evaluation and impact as-
essment standards. If the EU wishes to get more active in standard setting in Southeast Asia, much lobbying and awareness raising would be needed, particularly of the latent and sometimes apparent perception that e.g. the Framework Programme is “complicated”. The opposite option would be to de-
develop standards that are more flexible for coopera-
tion with “third regions”. The development of joint calls could help a good deal in this dilemma, as it brings programme owners from both sides together with lobbying and coordination up and promoting to common standards. The idea of joint calls would also have to take into account the following to sets of issues:

- Consider mobility and exchange of personnel a pos-
itive value, not only looking at it as increasing brain
snain. Interestingly, SEA experts were not so much concerned for brain drain/gain and brain circula-
tion as drivers. Both were considered important, but less so than by European experts. In the scientists’ answers, neither brain drain nor brain gain have ap-
peared as relevant concepts. For scientists, mobility and exchange are the relevant concept, instead.

- Adopt measures to enhance mobility in both direc-
tions (and circularly) promises to contribute to scien-
tific excellence. Apparently, it is not self-evident that scientist-driven mobility is symmetrical. It is harder to find a European scientist going to Southeast Asia than vice-versa – support European scientists going abroad.

- Make use of existing human and network re-
sources. The scientists engaged in the foresight process came forward with a set of specific ideas on how to capitalise on existing structures and human resources for increasing S&T coopera-
tion. For instance, it was mentioned that long-es-
tablished regular scientific conferences could be supported in their possible attempts of holding sessions or entire conferences in third countries. In terms of human resources, offering part-time po-
sitions to returning scientists and offering support or advice to a cooperation partner’s country can prove reward-
ing for them, personally, as well as for cooperation levels. Their networks can be kept alive and passed on. They can also support scientists who are further abroad, etc. In the case of senior scientists who are still active, sabbatical themes with related exchange to partner countries might yield similar services to sustain cooperation levels.

- When it comes to exchange and mobility of junior scientists, support PhD exchange, joint PhD pro-
grammes and co-supervision of PhDs. Particularly co-supervision can be increased by supporting a sustainable basis as the candidate produces coop-
erative output and, what is more, as he or she per-
sonally links two senior scientists over a consider-
able time.

- Ensure that junior and senior scientists spending time abroad find an easy way to return and reintei-
grate to their personal and professional surround-
ing in their countries of origin. Offering seed money for some lab equipment in order to keep working in a similar environment on the subject of interest has been considered an option, here, as has been the idea of including Post-Doc travel money in PhD grants to allow the PhDs to return to their partner institutes from time to time.

- Engage diasporas: Diaspora communities of South-
east Asian scientists and their counterparts exist in Eu-
rope in different sizes at different locations. These communities’ scientists often speak both regions’ languages, often have studies in both re-
gions and know both scientific traditions. These con-
acts can be highly valuable for establishing and

6.9 The core logic of a success scenario

As presented above in chapter 6.2 on methodology, a basic success scenario109 served as an initiating and
inspiring input for our policy-maker workshop and as an underlying future scenario for the scientist consulta-
tion and Delphi survey. We will now revisit this success scenario and extend it by applying the foresight exer-
cise’s results to its inherent structure. Methodologically

109 In the year 2000 the cooperation in S&T between the EU and ASEAN had reached a level of importance that some years before was hardly to be expected: Major development was the rise of ASEAN as a regional power, which could be linked to the rise of the EU-15. However, the region was characterised by wide range of national policies, each very different. After the Howard government in Australia (1996), the Clinton administration in the USA, and major S&T powers consisting also of countries that differ quite a lot in their economic development, the European Union was considered an important cooperation partner, and with dedicated programmes including the 5th Framework programme and further (more than one) bilateral cooperation in the area of S&T grew ever more intense.
following the considerations of Ian Miles\textsuperscript{110} and Bonnett/Olson\textsuperscript{111}, by taking into account and combining the most important variables and drivers identified, we will be able to sketch what the core scenario logic could be, i.e. the main axes to act upon and interdependencies to consider, of a possible 2020 success scenario of S&T cooperation between Southeast Asia and Europe. We do not aim at fleshing out the success scenario in any more detail as this would impose a reductionist approach using desk research instead of a scenario elaboration with the stakeholders in the process, as usual. Hence, instead of extensively describing a possible success scenario, we will combine those variables that, on the basis of the results generated so far, seem to be particularly relevant for the 2020 future of S&T cooperation between the two regions. Some of these variables are linked by synchronous interdependencies or a certain value of one (e.g. number of cooperation projects) is needed before another value of a second variable can be reached (e.g. high trust among the scientific communities). The variables, their interdependencies and related pathways are all relevant when trying to act upon the variables in order to reach a certain success scenario.

The following outline of the scenario logic is not to be considered final. It is one among a series of ways of approaching the interdependencies and pathways involved in a possible 2020 success scenario of S&T cooperation between Southeast Asia and Europe. The visualisations should inspire and help to structure the thinking about the future, not present ready-made and definite models.

First of all, the amount of funding explicitly available for S&T cooperation between the regions can be assumed as a highly relevant variable. A related variable is the amount of funding involved in actual cooperation (that might also stem from activities not officially defined as S&T cooperation projects, but still implemented in a cooperative manner).

A second highly relevant variable is the level of availability of funds: a bi-lateral, country-region or bi-regional cooperation setting favoured in terms of available funds. A first relevant interdependency appears, here: Funds and level of availability are related insofar as the bi-regional level can be relevant and substantially funded even when the bi-lateral funding is high given that the overall funding is sufficient (which, in turn, is strongly related with external variables like the worldwide economic situation).

Both variables are strongly linked to a third one: cooperation intensity. The availability of funds does not automatically lead to interest in cooperation, but will be strongly related: The availability of FP2 type bi-regional support will increase the amount of bi-regional S&T cooperation.

Considering this set of drivers, there is a related series of interdependencies with the variables of the favourability of the overall political environment (of Southeast Asia–Europe relations, the global situation, etc.) and the role of avoiding administrative burdens of different type (personal mobility, material exchange, etc.). In order to achieve policy coherence and keep the administrative burdens for bi-regional S&T cooperation low, the political climate has to be good.

In order for the political climate to be good, despite favourable environmental conditions, discussion fora (for joint S&T agendas, etc.) are needed. The two variables are thus linked in our scenario logics. Having the possibility that policy-makers regularly meet at joint fora also allows to develop joint planning horizons, better tackle global challenges and give top-down incentives for related cooperation (in this scenario, not all global challenge related research is motivated top-down).

By involving the variable of available funding and limited resources, we see that there might be a trade-off between funds available for top-down inspired and bottom-up inspired global challenge related research. The variable of the balance between top-down support with given thematic priorities and thematically open support for bottom-up initiatives might best be separated into two variables, here. It is similar with the variable of the balance between resources for applied and for basic cooperative research.

Considering the amount of available funding for basic research. The variable of the balance between funds available for top-down inspired and bottom-up inspired research is motivated top-down.

By involving the variable of available funding and limited resources, we see that there might be a trade-off between funds available for top-down inspired and bottom-up inspired global challenge related (or other) research. The variable of the balance between top-down support with given thematic priorities and thematically open support for bottom-up initiatives might best be separated into two variables, here. It is similar with the variable of the balance between resources for applied and for basic cooperative research.

Joint fora involving or dedicated to scientists link the variable of the importance of personal contacts with the most important personal motivations of scientists for embarking upon S&T cooperation: working together on research problems considered relevant and interesting by both parties, doing state-of-the-art science, reputation; the feeling of being able to contribute. Cooperation intensity would, in this case, be increased via bottom-up initiatives in the case of unstructured scientist fora (e.g. scientific conferences, random meetings) and via top-down initiatives in case scientists are invited to an event for the explicit purpose of discussing cooperation on specific topics. In view of the funds and possible support, it is a strategic decision to take with what balance open scientist fora like the usual scientific conferences (maybe to be realised in new places) or dedicated subject-oriented matchmaking events are supported.

The important driver of the availability of mobility schemes is, according to our scientist respondents, intrinsically linked with the cooperation intensity. The form of this link might be different depending on whether resources are concentrated on long-term (e.g. PhD) or short-term (e.g. senior scientists) exchange. Long-term exchange has to rely on a stable political climate.
The SEA-EU-NET Foresight draft success scenario has been prepared by the SEA-EU-NET Foresight Team with the set of concrete and general driving forces behind S&T cooperation (identified and assessed along the SEA-EU-NET Foresight process) as well as with the success scenario logic at hand. Given the severe time constraints on the side of the policy makers, we have chosen to work with a single success scenario. These constraints were also the reason why we considered it feasible to conduct the task of scenario drafting within the workshop. Instead of presenting and discussing the scenario logic, we have chosen to prepare a ready-to-use draft version of a success scenario in the narrative of an imaginary news article looking back towards the current decade from 2020.

We want to explicitly underline that this draft success scenario is not to be considered the project’s or certain partner’s desired view. It is just one possible future scenario drafted with the above material in mind for the purpose of motivating debate. For this very reason, it had to be short, thus grossly but deliberately simplifying a complex picture into a one-page scenario.

**Scenario title:** Europe and Southeast Asia as preferential partners in STI

**Goal:** A dense network of STI working relations with adequate funding and political backing

**Narrative text:**

**Sea-East Asia and Europe celebrate 5 years of bi-regional STI cooperation Agency.**

Science ministers from countries of Southeast Asia and Europe met today in the Peninsula Bangkok Hotel in Thailand to celebrate the 5-year anniversary of the ASEAN-EU STI Cooperation Agency (ASEUSTICA), a body offering joint funding opportunities as well as administrative, legal and networking support to both scientific communities.

Even though cooperation in STI between Europe and Southeast Asia was already happening on a nation-to-nation basis for decades, the founding of the bi-regional policy-networking project SEA-EU-NET by the European Commission in 2008 was a milestone for an enhanced bi-regional cooperation. Three years after the SEA-EU Year of S&T in 2012 and the subsequent signature of an SEA-EU S&T Cooperation Agreement, the project has been remodelled into a permanent agency with funds from both regions.

The professor/student-professor relationships stemming from support to joint PhD supervision were seen as one of the major confidence-building measures, establishing at the same time career-spanning inter-regional linkages with a frequent manifestation of the cooperation in joint publications and patenting. While research efforts in 2010 were mostly directed from Southeast Asia to Europe, European PhDs and senior scientists are now as motivated to join faculties in Southeast Asia as their peers are to come to Europe.

**Reasons for the success of this equal-term intra-regional partnership can be found on several levels, but the close trade relations and the strong intergovernmental cooperation from both sides is seen by experts as one of the most relevant forces for the seeking of synergies within other fields, such as STI.**

With a growing awareness of “Europe” as a partner within Southeast Asia, the already existing bilateral cooperation on national level slowly moved towards a multilateral context. Co-operation with countries such as Germany was increasingly seen as cooperation with Europe, a view that was lacking before and that could unlock cooperation with other European MS.

A similar process went on in Europe, as Southeast Asia was increasingly seen as a region that is very diverse, but economically converging and increasingly integrated, and that could offer a wide range of cooperation opportunities in science, technology and innovation.

We can discern several turning points that led to this close cooperation: on a political level, the signature of the S&T Agreement has been a clear impulse to strengthen the bi-regional cooperation. This was increasingly backed by administrative support such as visa and biomaterials exchange facts for scientists and long-term relocation or even friendships were seen as beneficial. Retired scientists and members of scientific diaspora populations have volunteered as focal points for facilitation on exchange possibilities and formalities as well as access to their networks. Social and material costs of exchange and mobility could be reduced by offering reintegration schemes. Today, a Southeast Asian scientist who has spent half of his career at a European university can move back on a temporary part-time and, if the cooperation proves successful, for both sides, permanent basis.

The professor/student-professor relationships stemming from support to joint PhD supervision were seen as one of the major confidence-building measures, establishing at the same time career-spanning inter-regional linkages with a frequent manifestation of the cooperation in joint publications and patenting. While research efforts in 2010 were mostly directed from Southeast Asia to Europe, European PhDs and senior scientists are now as motivated to join faculties in Southeast Asia as their peers are to come to Europe.
As explained above, the draft success scenario has been discussed during a half-day workshop in a Knowledge Café format: discussion tables with one Southeast Asian and one European moderator each where participants could freely choose to attend and change table whenever they want. In this setting, we have been successfully trying to link the SEA-EU-NET Foresight & S&T cooperation success scenario to existing future thinking in the region. The ASEAN Krabi Initiative 2010 outlines five paradigm shifts that are considered necessary in order to bring about the benefits of science to the ASEAN regions would look like in 2020.

The main results of the five round tables on the five paradigm shifts have been:

• STI Enculturation (that is the growing consciousness about the relevance of S&T among the Southeast Asian population)
• Early education and media should be used for STI Enculturation
• ASEAN-EU exchange on experiences in science education is relevant in order to avoid mistakes
• Reviewing education systems is crucial as it is investing more
• A leading agency should be responsible for the process
• More integrated policies among the governments are needed to foster STI Enculturation
• Bottom-of-the-Pyramid Focus (BOP)
• A gap of interest between EU and ASEAN with regard to the BOP focus; FP7 does not address BOP— a respective platform is needed under Horizon 2020
• New business models and new social STI entrepreneurs can have impact at the bottom of the pyramid and can initiate collaborations between Southeast Asia and Europe; these new business models include social innovation models that are bottom-up
• Need to communicate (to EU etc) that BOP is a new market opportunity
• Youth-focused innovation
• Very young populations in Southeast Asia
• Increasing international mobility: international dialogue on brain drain/gain is needed
• Sub-national migration movements from rural to urban areas: creation of local wealth
• STI student exchange programmes within ASEAN and with the EU

• Technology transfer from the EU to ASEAN
• EU-ASEAN PPP collaboration agency to: provide support to technology transfer of private EU companies by EU and SEA public funding; it should focus on green products; and it should help to overcome non-tariff barriers such as health regulations, food safety, etc.

These results can now be applied to revise and further specify the draft success scenario. The following aspects catch our attention:

• Technology transfer from the EU to ASEAN could provide support to technology transfer of private EU companies by EU and SEA public funding; it should focus on green products; and it should help to overcome non-tariff barriers such as health regulations, food safety, etc.

• The STI Cooperation Agency that has been presented as a key player in the success scenario, could additionally (or exclusively) act as a bi-regional public-private-partnership facilitator, bringing together Southeast Asian firms with European public research and vice versa. Another possible additional focus of such an agency would be the support of experiences and best practices in science education.

• Relatedly, the policy-maker participants called for publicly supported (from both sides) technology transfer, but also for actual joint technology development (based on harmonized standards, best practice sharing and joint educational programmes) in order to advance a Green Society. This would indicate that a 2020 S&T cooperation success scenario would also consist in closely cooperating technology development partners, not only public research. Parts of the joint technology development might be carried out in actual joint R&D centres, possibly co-funded by private and public actors.

• As does the draft success scenario, the knowledge café discussions pointed out mobility, more specifically international student exchange, as crucial for S&T cooperation, given that it does not merely lead to brain drain. One aspect the discussions underlined that was not covered in the success scenario yet: the currently very young ASEAN population will still be young in 2020, but large cohorts will have grown into well educated knowledge workers if the paradigm shift towards STI Enculturation and the reform of the education systems succeed.

• Finally, the discussions made clear that a ‘successful’ EU-ASEAN S&T Cooperation necessarily has to do justice to the bottom-of-the-pyramid focus called for in and relevant for ASEAN. Despite possible gaps of interest, a dedicated platform is needed for supporting joint research relevant for the bottom-of-the-pyramid parts of society. Bottom-up business models and social innovation will play a major role, in this regard, not least in collaborative efforts.

While we do not consider it necessary to include these four aspects into the above draft success scenario in a narrative form, printing a similar second fictive news text, we do want to highlight that such an updated narrative form is available for further discussions within and outside of the SEA-EU-NET consortium.

In addition to disseminating this study (in print and via the SEA-EU-NET website www.asean-sti.net) and making it available to relevant stakeholders for further use, future activities not in the original scope of the SEA-EU-NET exercise could take up the current state of scenario discussions and carry them further.

The draft success scenario or scenario logics can be presented to and discussed with concerned policy-makers for instance on the European side, refining the scenario or adding alternative scenarios. Another option would be to take this or additional success scenarios as the starting points for our attention answering the question how to reach the identified scenario. Actions could be discussed that would have to be taken in the present and the near-future to steer bi-regional cooperation towards the success scenario (a second round of joint backcasting).

Such an exercise not only inspires the policy-makers’ structured thinking about the future, but again creates commitment and ensures the usefulness of the foresight exercise.
7 Southeast Asia’s international S&T cooperation policy

Margot Schuller, Rudie Trienes, Alexander Degelsegger, Ludwig Kammesheidt, Florian Gruber

7.1 Introduction
Southeast Asian economies have weathered the global crisis relatively well and have rebounded in 2010. They are now searching for ways to sustain economic growth beyond their recovery. More than ever, the pursuit of science and technology (S&T) cooperation plays a critical role. Within the ASEAN, the push and pull factors of S&T collaboration between the ASEAN and EU as summarized in Section 7.2, are now searching for ways to sustain economic growth beyond their recovery. The ASEAN has become such a partner, who actively supports closer S&T cooperation within the region as well as on the international level. While bilateral cooperation in science, technology and innovation (STI) between countries in Europe and Southeast Asia has a long tradition, biregional collaboration between the ASEAN and EU is a rather new phenomenon. It is based on the idea of cooperation in fields of mutual interest and benefit and is characterized by an increasing institutionalization of the biregional S&T dialogue that was launched in 2008.

This contribution analyzes the international S&T cooperation policies of the Southeast Asian countries, focusing on the collaboration with the EU. The authors are interested in understanding the drivers of both the S&T policy of the ASEAN as a regional grouping as well as the national S&T policies of the member states. The study concentrates on the international S&T collaboration policy in general, fields of research and the type of collaboration. In order to structure our analysis, we put forward a framework of push and pull factors for S&T cooperation and specific research fields into a broader theoretical discussion. This allows us to differentiate between the national S&T policy level on the one hand, and the level of the individual scientists in research institutes and universities who have a different perspective on S&T cooperation on the other. Applying the concept of push and pull factors helps to structure both the argument and our findings.

In Section 7.2 of this chapter we discuss the question of why scientists and countries are engaged in international S&T cooperation and what role the state plays in fostering an innovation-driven catch-up process. Section 7.3 provides an overview of the ASEAN’s inter-regional and extra-regional S&T policies. Section 7.4 studies the international S&T policies of individual ASEAN member states. Due to country-specific circumstances, there are variations in the orientation of each member state’s international S&T collaboration. In Section 7.5 the push and pull factors of S&T collaboration between the ASEAN and the EU are summarized and conclusions are drawn and policy recommendations offered.

The findings and data we present in this article come from different sources. In addition to the presentation of data in our study of the literature of the IAMMST, we have conducted interviews, and discussions with European and South-East Asian experts. Thanks to the Southeast Asian members’ organizations that participate in the SEA-EU-NET project, we have been able to conduct interviews with ASEAN researchers and administrators during the first study visit to Malaysia, Indonesia, Singapore, China, Thailand and Vietnam in 2008 and in the course of a second study visit to the Philippines and Laos in 2011. This contribution discusses the international S&T cooperation policies of these seven ASEAN member countries, while general data on the remaining countries (Brunei, Cambodia and Myanmar) are also presented.

Although our study visits to the ASEAN member states brought to light new perspectives on these countries’ international S&T cooperation preferences, we were not in a position to study all policy aspects systematically and in a thorough way. Time constraints while visiting each country limited the achievement of a comprehensive picture of these countries’ international S&T policies. There are, however, several studies conducted by other researchers who investigated this project since 2008 that complement our findings.

One impression that stands out is that some government research institutes (GRIIs), universities and scientific research centers have already achieved global research standards and can be treated as equal partners in joint research projects. S&T cooperation with most ASEAN member states can thus be of mutual interest to the EU and the ASEAN. With other S&T actors in SEA who are still in the stage of developing their innovation systems and need support for their cooperation in their country-specific research niches offers attractive joint collaboration opportunities. The EU’s main challenge in successful long-term cooperation with SEA countries seems to be finding an appropriate policy design that can take into account the various S&T development levels and country-specific conditions. This would contribute to a better positioning of the EU in this Asian region, hopefully lead to an increase in the rate of application in the EU Framework Programmes.

7.2 What drives international S&T collaboration and networks?

Science-based innovation enables companies and countries to be internationally competitive and achieve long-term economic growth. All science-related indicators demonstrate that the importance of science has dramatically increased on the global scale. The total spending on research and development (R&D) and the output of publications grew each by 45 per cent, and the number of researchers rose by 25 per cent, between 1985 and 2000. Reasons for this push towards science-based innovation — defined as information exchange predominantly between researchers from various countries with the purpose of creating new knowledge — has contributed to this development. This collaboration is most commonly reflected in co-authorship of academic papers. In 2008, the share of co-authored papers amounted to 35 per cent, compared to about 30 per cent in 2002 and 25 per cent in 1996. Bibliometric analysis allows us to map the pattern of international scientific collaboration between countries and regions. It demonstrates that geographical proximity is one of the important rationales of cooperation between researchers, relating mostly to individuals and networks, and factors external to science is usually made. The latter includes policy motivations and financial support incentives from governments and funding agencies for scientists.

Many authors have emphasized the role of the individual scientist and his/her motivation to cooperate...
with the best scientists in other parts of the world in order to access complementary skills and knowledge, with a view of stimulating new ideas. Based on their research of scientific networks, Wagner and Leydesdorff also stress the importance of the individual and argue that international research collaboration is more due to ‘the dynamics at the subfield level created by individual scientists linking together for enhanced recognition and rewards than to other structural or pol-

icy-related factors’. They emphasize factors internal to science – more precisely, internal to the intellectual and social organization of science – which offer incentives for individual scientists to cooperate within their own countries as well as across countries. For Suttmieier the disciplinary differentiation of science on the one hand and the field-specific characteristics of mega-science on the other are factors that require closer cooperation between specialized scientists at the international level. Based on this discussion and the analysis by Edler and Bukvova of various motivations that scientists have to pursue research collaboration, the following list of drivers for international research collaboration can be compiled:

- Access to expertise, leading edge and complemen-
tary knowledge
- Access to funding from foreign institutions/programmes
- Access to natural or social phenomena, which is also a driving force
- Capacity building, learning new skills

In the collaboration between developed and developing countries there is the challenge of how to best re-
duce the negative effects of an asymmetry of partners with strong and weak countries. Moreover, scientists in developing countries entering international research collaboration may not only expect an increase in their scientific skills, but also care about the impact of the collaborative research on local development and scientific non-science capacity improve-

Table 14: Scientists’ motives for international collaboration

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Table 15: Motivations for policy makers to support international S&T collaboration

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| - Support for foreign scientists | |
| - Incentives for capacity building | |
| - Research funding pro-

grammes | |
| - Linkages to global research organisations | |

Source: Authors’ own compilation

Besides structural factors there are policy-related factors that provide incentives for scholars to cooperate on an international level. Depending on the financial support for international research collaboration through mobil-

tization of capacity building and regional or cooperation agreements, scientists are encouraged to enter into an international R&D exchange. The system of rewards for internationally-recognized scientists with regards to career opportunities has also an impact on the individ-

ual decisions for international collaboration. The extent to which scholarships, other means of research funding and capacity building are available for scientists abroad also influences their individual decisions.

Policy support for cross-border research collabora-

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Source: Authors’ own compilation

Although international S&T collaboration is regarded by most countries as crucial for innovation-driven economi-
cs, the term technology or regional or cooperation agreements supported by governments varies widely. Different poli-
cies can be related to national S&T development strat-

egies, which either stress independent endogenous technological competence or emphasize rapid technologi-

cal sophistication through technology transfer via the absorption of foreign direct investments. The term technonationalism is applied to strategies which focus on the nation as the driver for innovation, and which al-
loocates R&D budgets and diffuses technology. 106 Technonationalism is seen as combination of ‘a strong belief that the technological capabilities of a nation’s firms are a key source of their competitive process, with a belief that these capabilities are in a sense national, and can be developed under the aegis of national economic policy, through the co-ordination and co-ordination of state and market interventions’. 110

In sum, various push and pull factors exist that ex-
plain why scientists are interested in international re-
search collaboration (see table 14). The structural push factors relate to the conditions scientists are faced with in their home countries – including academic recognition, access to research infrastructure, and communication technologies that allow them to enter into international academic exchange. The structural pull factors refer to the conditions outside of the scientists’ home countries, and include the quality of research equipment, educa-
tion and training and leading edge researchers – as well as the opportunities to study geographically limited so-
cial and natural phenomena.


108 Suttmieier (2008), pp. 8f

109 Edler (2008), pp. 4–5

The ASEAN's intraregional and extraregional S&T policies

Integration in the ASEAN region has not been left only to the market but has been guided by the idea of the benefits of a stronger institutional framework since the Asian financial crises in 1997. Due to the central role of S&T in economic development, closer technological cooperation has been supported in ASEAN through the establishment of the ASEAN Committee on Science, and Technology (ASEAN COST). This Committee aims to guide the formulation of the region's S&T policies and the establishment of programmes. Based on policy principles of mutual benefits, the ASEAN Summit and meetings of ASEAN Ministers for S&T, the COST designed a number of special programmes and actions. The action plan on S&T for the period 2007 to 2011 (ASEAN Plan of Action on Science and Technology 2007-2011, [APAST]1) incorporated previous action plans and actions. The action plan on S&T for the period 2007 to 2011 (ASEAN Plan of Action on Science and Technology 2007-2011, [APAST]) incorporated previous action plans and actions. The action plan on S&T for the period 2007 to 2011 (ASEAN Plan of Action on Science and Technology 2007-2011, [APAST]) incorporated previous action plans and actions.

APAST contains not only policy objectives directed at the telecommunication and information technology for stronger intraregional cooperation on the part of ASEAN with countries and regions others than the so-called dialogue partners. In detail, APAST lists the following objectives: 1) creating intraregional S&T cooperation that has extensive synergies and is self-sustaining, with strong participation by the private sector; 2) establishing an S&T network supportive of public- and private-sector human resource development; 3) supporting technology transfer between institutions and industry; 4) increasing awareness of the crucial role S&T plays in economic development in ASEAN; and, 5) expanding S&T cooperation with the international community. This last objective shows that COST is also pursuing an outward-looking S&T strategy.

Figure 75: Framework of the ASEAN Plan of Action on S&T (APAST) 2007-2011
Source: ASEAN Secretariat

In terms of actions, APAST explicitly requires support for closer cooperation with dialogue partners and other relevant organizations on regional projects as one of its strategic thrusts. In order to achieve this objective, the following actions were proposed:

- development of new strategies for partnership with dialogue partners;
- facilitation of access to the resources of dialogue partners for regional projects, with a focus on the newer member countries of ASEAN; and,
- support for closer relationships with relevant ASEAN+5 (Japan, South Korea, China) S&T agencies for mutually beneficial development in East Asia.

There are eleven S&T dialogue partners listed in the ASEAN action plan on S&T, including China, India, Japan, South Korea, Australia, New Zealand, the EU, the USA, Canada and Russia. Most of the dialogue partners have a specific S&T dialogue forum with the ASEAN. The dialogue partners have almost similar S&T cooperation programmes with dialogue partners.

APAST consists of six flagship programmes by the ASEAN, focusing on:
1) Food and S&T for development in East Asia;
2) Marine S&T;
3) Non-conventional energy research;
4) Application and Development of appropriate low carbon technologies.

The ASEAN COST+3

The APAST 2007–2011 are very similar, reflecting the ASEAN’s S&T programmes, the institutional and funding capacity of this committee is still rather limited. This holds true for the ASEAN Secretariat altogether, which has to cope with a heavy administrative burden resulting from the following objectives:

- Support for the dramatic increase in globalization in the international community. This last objective shows that the Krabi Initiative requests a paradigm shift in order to focus more on the benefits of science to the ASEAN's citizens. The paradigm shift is represented by a number of goals, including 'STI Enculturation', which stands for the need to mainstream STI into peoples' lives and to support citizens with outstanding STI achievements as role-models. Another goal refers to the 'Bottom-up of the innovation system' and creates incentives to increase their STI potentials and entrepreneurship. As climate change is a hot topic for all of the ASEAN member states, the 'STI for Green Society' goal relates to the introduction of appropriate low carbon technologies. The 'Public-Private Partnership Platform' aims to support the linkages within the innovation system in order to increase the role of the private sector in S&T.


The ASEAN’s international S&T policy is therefore strongly influenced by the interests of individual member countries. The fact that some of the ASEAN-5, the founding members of this regional grouping, have almost similar economic development levels explains, according to some scholars, the fact that they tend to compete in S&T rather than cooperate. Stronger regional cooperation is mostly concentrated in those countries which joined ASEAN last, namely, Cambodia, Laos, Myanmar and Vietnam. The ASEAN help-ASEAN programme (2001-2004 Action Plan) has been especially designed to support these member countries’ S&T development. However, the Krabi Initiative demonstrates that the ASEAN COST strives for closer intraregional cooperation among S&T policies. APAST 2007–2011 are very similar, reflecting the ASEAN’s priority programme areas for S&T cooperation in 2007:

1) Food S&T, 2) biotechnology, 3) meteorology and geo-physics, 4) marine S&T, and 5) non-conventional energy research.

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The disparities in the levels of economic development across the region represent a huge challenge for S&T integration (see table 16). Following the categorization of economic growth rates by the World Bank for the ASEAN member states in 2010 (Atlas Method), Singapore and Brunei belong to the group of high-income economies ($12,276 or more), Malaysia and Thailand to the upper-middle-income economies ($3,976–12,275), Indonesia, the Philippines, Vietnam and Laos form part of the group of lower-middle-income economies ($1,006-3,975). Laos and Vietnam have just passed the threshold to become lower-middle-income economies in 2010, Cambodia and Myanmar, for which no data are available, fall into the group of low-income countries ($1,005 or less). While strong economic disparities within the ASEAN region are a major feature among this group of countries, economic growth has been relatively impressive in most of them during the period from 1970-2008. However, the growth performance of Brunei and the Philippines has lagged strongly behind the average economic growth rate in the region. Only in recent years has the Philippines been able to catch up (see table 16).

In some of the ASEAN countries—especially Indonesia, Malaysia, Thailand and Vietnam—a shift of the sources of economic growth from physical capital accumulation to total factor productivity (TFP), which includes technological progress and technical efficiency change, took place after 2002. Foreign direct investment (FDI) and the associated technology transfer from developed countries play an important role in the technological progress of developing and emerging economies. We can not expect, however, that FDI has a similar impact across the ASEAN member countries. In contrast, the impact depends on the absorptive capacity of each country and on its national policy to realize FDI spill-over effects. In the years 2007-2009, Singapore was the most important location for FDI, followed by Thailand, Vietnam, Indonesia and Malaysia (see figure 76). This is in contrast, to a certain extent, with the situation of FDI inflows in previous years, when Indonesia, Malaysia and the Philippines received more foreign capital than Vietnam did.

The economic disparities within the ASEAN region can also be traced back to the huge differences between each member’s current level of S&T development. Comparing various indicators that reflect S&T performance, Singapore is leading the ASEAN member states, followed by Malaysia, Thailand and Vietnam.

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reveal that Indonesia’s economic growth is not yet driven by innovation. By some of the indicators even show a downward trend. While R&D accounted for 0.5 per cent of GDP in 1982,104 this percentage shrank to only 0.08 per cent by 2009.105 R&D spending by private companies has recently increased but still remains low, similar to patenting activity. When using the USPTO (United States Patents and Trademark Office) patent-to-population ratio as a proxy for innovation, Indonesia’s performance was very weak with only 0.0125 patents per million of the population.106 Indonesia’s public sector is the most important driver for the country’s S&T development. The government followed a strategy of technoliberalism, emphasising technology transfer from abroad and the opening of markets to create attractive investment conditions for multinational companies (MNCs). In some S&T fields, the endogenous development of technologies has been supported. The policy of ‘strategic industries’, introduced under the former RISTEK107 Minister, B.J. Habibie (1978-1998), advocated for the picking of winners among industries that were most likely to play a crucial role in economic development. The execution of this policy required the Agency for Strategic Industries (BPI) to anticipate any shifts from resource- to knowledge-based international business.108 Although some scholars doubt whether Indonesia followed a coherent set of policies, others have demonstrated the opposite. They argue that such policies were included in the country’s overall industrial policy as early as the 1970s, when the Indonesian government adopted a system of five-year development plans. The first R&D activities, tied to the funding of agricultural, industry, and mining,109 in recent decades, policy planning has become more sophisticated and has been extended to new areas. Implementation policies were published by RISTEK, and planning was based on the proposals by the National Research Council (NRC), with many Government Research Institutes (GRIs) also being involved. The former RISTEK minister’s idea of ‘technological leapfrogging’, which focused on the support of a series of high-tech projects, was, though, much criticized. The fact that the targeted industries were isolated from private industry reduced their prospects for success.110

A number of S&T policies and programmes reflect the different objectives and instruments of the Indonesian government. The National Mid-term Development Plan (NMDDP) 2004-2009 focused on: (1) R&D and engineering priorities in S&T for the private sector and the need of society; (2) the enhancement of S&T capacity and capability by strengthening S&T institutions, resources and networks at the central and regional levels; (3) on creating a suitable innovation climate with an effective incentive scheme to foster industrial restructuring and (4) the implantation and fostering of a S&T culture in order to improve Indonesia’s civil development.111

The S&T priorities included in the NMDDP were: (i) food security, (ii) new and renewable energy, (iii) the transportation system and its management, (iv) ICT, (v) medicine and health technology and (vi) defence technology. For each area the government published a White Paper that contained quantitative targets for each priority and for different periods and defined the role of the government, GRIs, and universities therein.112 The NMDDP included several programmes. For instance, the S&T Research and Development Programme aimed to advance the quality of national R&D activities in the fields of basic and applied sciences. The objective of the S&T Diffusion and Utilization Programme was to enhance the dissemination and utilization of research findings by the corporate sector and society. The S&T Institutional Strengthening Programme fostered S&T-related organizational capabilities and the Production System S&T Capacity Enhancement Programme enhanced the technological basis of S&T systems in the corporate sector.113 Among the S&T support programmes for the development of new technologies were the RUT (funding of basic and applied research by Indonesian scientists in bilateral projects with foreign partners). In addition, various programmes were developed to introduce the technologies in the manufacturing industry, and to strengthen the framework conditions and the supply of information on existing technologies.114

The Medium-Term Development Plan (RPJMN) was presented by the National Development Planning Agency in February 2010, covering the period from 2010-2014. It is based on the objectives of the National Long-Term Development Plan 2005-2025, on the one hand, and on the vision and mission of the new president and VP-elect on the other. The RPJMN defines the need for increased productivity as one of the most important challenges in the continuation of national development.115 Eleven national priorities are listed in the plan for R&D, health and disease, food security, infrastructure, investment in the business sector, energy, environment and natural disasters and technological innovation (together with culture and creativity).116 The plan requests the turning of ‘increasing comparative advantage into competitive advantage, encompassing management of maritime resources towards security in energy, food and the anticipation of climate change impacts. This also includes enhancing skills related to technology and the creativity of the youth.117

Indonesia’s S&T system is characterized by a large number of actors, especially in terms of governmental agencies and research institutes (see figure 77). Ministries other than RISTEK are involved in policy-making as well. Some have their own (departmental) research institutes. In addition, seven non-departmental research institutes report directly to the president and are coordinated by RISTEK’s BBPT (Agency for the Assessment and Application of Technology);118 • LIPI (Indonesian Institute of Sciences) • LAPAN (National Institute of Aeronautics and Space) • BATAN (National Nuclear Energy Agency) • BSR (BSR/BRRI/BATAN/Bandsari) • National Coordination Agency for Surveys and Mapping • BSN (National Standardization Agency of Indonesia) • BAPENTEN (Nuclear Energy Control Board) The role of the BBPT is to formulate and implement policies for industrial and technological development. Some of the non-departmental research institutes are relocated to Bapenten to sign up to Science and Technology (PUSPITEK), located at Serpong, near Jakarta. Six BBPT laboratories and four LIPI institutes were initially established in this science city.119 The National Research Council (NRC) is a new institute that jointly employ a total staff of 5,000.120 Another research institute of national importance is the Eijkman Institute of Molecular Biology, originally founded in 1888 by the Netherlands. In order to support research in biomedicine and biotechnology, the institute was reopened in 1992/93, with a concentration on tropical diseases.121

In order to better coordinate the various S&T policies and programmes, the NRC was established in 2002. The 108 NRC members come from academia as well as from the business sector and the government, and are specialized in the S&T areas of the ‘Six Focus Programmes’. As an advisory body, the NRC develops policy suggestions and recommendations. The council acts as an intermediary between industrial needs and the national research agenda. Due to Indonesia’s large geographical size, regional research councils (RRCs) exist at the local level, and are designed to coordinate regional S&T policies. In an assessment of Indonesia’s innovation challenges, the NRC came to the conclusion that the major challenges to be addressed are how to increase the predominance of public R&D, improve the sector-development approaches, strengthen the weak linkages among S&T actors, increase the currently few techno-economic cluster initiatives and remedy the limited access to knowledge pools.122

The newly-established National Innovation Committee (KIN), which directly reports to the president, is trying to address some of these challenges. Set up in May 2010, KIN is headed by Zulah, the Chairman of the Indonesian Institute of Sciences (LIPI), with the Bogor Agricultural Institute Rector, Subardiyo, as Deputy Chairman. The committee is currently creating conditions for the greater involvement of local communities in R&D. Based on the (economic) Master Plan’s division of Indonesia into six economic corridors, KIN aims to strengthen the connectivity between centres of excellence, business and government (the so-called Triple Helix Network) in each of these corridors.123 According to Zulah, the most important research areas therein are agriculture, energy, medicine and clean water.124


107 Gammeltoft, Peter and Erman Aminullah (2006): The Indonesian in...
Current S&T policy is based on the government’s vision of establishing S&T as the main force driving sustainable development. However, funding to universities and GRIs—such as LIPI or BPPT—remains problematic. Although the government doubled the total state expenditure on R&D between 2005 and 2010, funding and scientific resources were insufficient to support greater research efforts. The departmental GRIs play an outstanding role in R&D. Their share amounted to an estimated 70 per cent of total R&D expenditure in the government sector in 2005. An additional 28 per cent of the total R&D budget was assigned to the non-departmental research institutes, subordinated to RISTEK. The remaining 2 per cent went to local governments’ S&T activities. Among all the GRIs, those under the Department of Agriculture received the largest share, followed by LIPI and the research institutes under the Department of Energy and Natural Resources. The private sector plays a marginal role in financing and undertaking R&D due to the lack of large enterprises, which are generally more engaged in R&D than the smaller ones. In the Indonesian industrial sector, almost all companies are either very small or medium-sized, and seem barely able to invest in the development of any new products and processes. 

Government sector funding for R&D also includes to universities and other institutes of higher education. In 2004, approximately 71 per cent of the latter’s R&D funding came from the government. Universities’ share of GERD performed remained at the rather low level of 4.6 per cent in the period 2000-2002. The four most renowned state universities are the Universitas Indonesia (UI), the Universitas Gadjah Mada (UGM), the Institut Partanian Bogor (IPB) and the Institut Teknologi Bandung (ITB). The higher-education sector has expanded steadily in Indonesia in recent decades. In 1970, for instance, only 237,000 students were enrolled in the 450 private and government-funded institutes of higher education increased to 900. The RPJMN has stipulated that access to university education should increase from an 18 per cent gross enrollment rate to a 25 per cent one by 2014.

7.4.1.2 Indonesia’s international S&T cooperation policy

In the last section we discussed the complex network of institutions involved in S&T development in Indonesia. This makes the coordination of policies rather difficult and could have a negative impact on the development of a consistent strategy for international S&T cooperation. Political instability in the past has also contributed to changes in policies and led to inconsistencies in the overall approach. The results of our online questionnaires and interviews during the study tour tend to support this hypothesis. In this face-to-face contact, representatives from the NRC stressed the significance of weak institutional linkages among GRIs and the general lack of research focus. According to the NRC’s survey on innovation policy, approximately one-third of the projects are not in line with the national agenda. This can be explained to some extent by the idiosyncratic preferences of individual scientists, who influence the pattern of international S&T cooperation through a bottom-up process.

We now turn to the question of what the reasons for international S&T cooperation in Indonesia are. Based on questionnaires and interviews conducted during our study tour in 2008, we conclude that a mixture of country-specific and global thematic priorities of co-patenting as well as funding – exist. Transnational learning and innovation benchmarking, in contrast, were rated lower in the assessment of why international S&T cooperation is important (see figure 78). Funding and access to high-tech research equipment were the major concerns raised during our visits to various departmental and non-departmental GRIs and universities. In 2009, the Indonesian government decided to give autonomy to the four largest universities (UI, UGM, IPB and ITB), turning them into independent legal entities which are now responsible for their own budgets. This policy decision aimed to increase cooperation between universities and industry in R&D, and might reduce the share of basic research in favour of applied research at universities. We might also expect, as a result of the universities’ autonomy, a positive influence to occur on international cooperation, as external research funding increasingly becomes more important than before.

At the individual scientist level, the reasons given for international cooperation diverged to some extent from the pattern revealed by government representatives. Up until recently, promotions at GRIs and universities were based not only on academic performance but also on teaching and community service. The latter term is used to describe small-scale projects that have a positive impact on the community that the GRI or university is located in. These projects include, for example, the development of devices for the reduction of environmental problems, the diffusion of agricultural technology, and so on. Given such an incentive structure, most of the scientists did not assess ‘co-patenting’ as a very important reason for entering into international cooperation (see figure 79). In contrast, access to new S&T knowledge, cooperation networks, exchange of research personnel, access to funding and an increase in reputation were most strongly emphasized by individual scientists. The categories scientific publications, research capabilities, research infrastructure, and the exchange of students were regarded as important, but only to a lesser extent.

**Fields of international S&T cooperation**

We now look at the fields of international S&T cooperation that are most important for Indonesia. For the NRC, climate change, global warming and deforestation are the key thematic focus areas for international S&T cooperation. Although these topics might be easily funded through international cooperation, they do not reflect a long-term strategy with clear objectives and a consistent top-down approach in international S&T. We have also found that some government officials and scientists still think of international S&T cooperation in terms of official development aid (ODA) funding, and not so much in terms of participating and competing in a demanding and ongoing application process. This reality reveals that international research cooperation with Indonesia should be implemented primarily with a
few outstanding research institutes and scientists. Due to the slow process of change, however, there is a lack of human resources and funding. Capacity-building programmes are, therefore, necessary to support Indonesia's transition to international research standards in certain S&T fields.

Preferences for specific partners in international S&T cooperation

Generally speaking, the GRIs' level of S&T development has an impact on their international cooperation with specific countries or regions. Some of the Indonesian research institutes are still in the capacity-building stage, with research networks located only among the ASEAN member states. They still are publishing most of their research findings in Indonesia in the national language, Bahasa Indonesia, and not in international journals. These GRIs prefer to enter into 'real cooperation', which includes a long-term approach wherein there is the training of students and post-docs, co-publication and eventually co-patenting. Research cooperation experiences with EU projects and scientists left many Indonesian scientists with the impression that their European counterparts only follow short-term cooperation strategies.

Some of these GRIs that are in the initial capacity-building stage are engaged in traditional S&T cooperation with regional organizations; for example, with the UNDP and the ADB, working on such topics as the global environment. Other GRIs are already well connected internationally and have very ambitious research agendas, including in the fields of biotechnology, ICT, renewable energy, and environmental sciences. Joint projects financed by the EU Framework Programmes (FPs), however, were very difficult for them to access. Access to funding was mostly derived through development aid and its most challenging task was to obtain any funding. The application procedures are regarded as too difficult to undergo, requiring a lot of complicated bureaucratic work. Knowledge about how to apply for EU FPs was generally lacking in most GRIs in 2008. Generally speaking, there was a lack of information about the FP financing mechanisms and the application requirements among scientists and GRIs.

National S&T organizations failed to offer the necessary support to enable a clearer understanding of the programmes.

A common feature in GRIs' international S&T cooperation was, however, that they all had rather strong relationships with Japan as well as some traditional ties with the Netherlands. At the institutional level, these relationships were first established through personal contacts between researchers, then supported by exchange programmes and post-doctoral training. Alumni networks for students and long-term personal relationships between Japanese Ph.D. supervisors and their students from Indonesia helped to keep this spirit of cooperation alive. Funding through the Japanese Science Programmes and travel grants from the Indonesian government further facilitated the establishment of an S&T partnership between Indonesia and Japan. In contrast to other countries, Japan also offered funding to support cooperation initiatives such as the proposal of a memorandum of understanding (MOU), and it is often not clear as to what extent these framework agreements are active or whether joint research projects are being executed.

Voices from governmental institutions and scientists in Indonesia on international S&T cooperation

Governmental institutions: “We are keen on cooperation in order to identify potential R&D partners in the EU. It is difficult to define what the research priorities are in each of the EU countries. Access to funding should be easier, and should consider the thematic research and funding priorities in Indonesia. The exchange of research personnel and students should be less bureaucratic and better funded.”

Scientists: “When S&T cooperation with the EU and Japan are compared, funding from the Japanese side is much easier to obtain. Research networks with Japanese scientists are based more on personal relationships, are long-term-oriented, and involve mutual trust. The EU FPs are too bureaucratic, and many of the regulations give the impression of mutual distrust.”

LAPAN's international cooperation activities focus more on multilateral agencies such as the Asia-Pacific Network for Global Change Research (APN), the ASEAN Sub-Committee on Space Technology and Applications (SCOSA) and so on. At the bilateral level, a mixture of S&T partners from different countries exist in space technology research, including China, Germany, India, Japan and Russia. When studying the list of LIPI's international collaborations, it becomes clear that a number of cooperation projects fall into the category of capacity building, because they concentrate on training, exchange of researchers, and general collaboration.

Cooperation with the ASEAN extends to a number of fields and includes scientist mobility programmes, especially for the awarding of travel grants. Universities are also active in the ASEAN networks, but cooperation is mostly at the faculty level and is strongly diversified. Each faculty has its own programmes, which act independently from each other. There is also a growing interest in their being S&T cooperation with China.

Research cooperation with the US is not well developed. Until the 1960s, many students and scientists went to the US, but this relationship later cooled down as a number of political reasons. Only recently has there been renewed interest on the side of both the US and the Indonesian government. According to NRC, most students want to go to the US, Australia or Canada to study. Traditional S&T cooperation with the Netherlands still exists, but its importance seems to have diminished due to more cooperation with Japan, the ASEAN and other European countries.

Summary of findings in Indonesia

In sum, the questions of why Indonesia is engaged in international S&T cooperation, what the most important partners or regions in S&T are, and which fields of cooperation are preferred can be answered as follows:

International cooperation is mainly viewed by both government representatives and scientists as being very important in order to compensate for existing deficiencies in Indonesian S&T, especially S&T research and infrastructures.

There is no specific international S&T cooperation policy, but extra-scientific reasons for collaboration – such as historical relationships/colonial experience (with the Netherlands) – and political objectives – such as regional cooperation policy (ASEAN COST-activity) – shape the collaboration pattern to some extent.

Cooperation with Japan predominates in Indonesia's international S&T activities. Compared to other partner countries, funding is easier to obtain from Japan and cooperation is based on long-term personal relationships. The mode of collaboration preferred by Indonesian scientists:

S&T collaboration with the EU and European scientists has essentially taken place within the framework of a centre-periphery relationship; in the past, funding was mostly offered through development aid projects.

Among Indonesian scientists there is strong resentment about being treated as an 'outdoor laboratory' and as second-grade scientists. The EU FP7 is seen as an opportunity for closer participation on an equal level.

7.4.2 Laos

7.4.2.1 Key characteristics of the S&T system and policy in Laos

The Lao People's Democratic Republic (Lao) is a resource-rich country with a population of around 6.8 million, nearly half of which is below 20 years old. Although the average annual income in Laos was 6,800,000 KIP in recent years, the average annual income in Laos amounted to only 288,000 (GDP p.c.) in 2009, making the country one of the least developed (LDC) of all the ASEAN member states. Laos' economic transition away from a centrally-planned economy has been quite successful. The market-oriented reform programme, called the New Economic Mechanism (NEM), included the liberalization of foreign trade and investment and was incorporated into the constitution in 1991. The NEM has materialized in higher income from trade and tourism and foreign investment in infrastructure. Economic reforms, investments and success in poverty alleviation have contributed to an annual growth rate of about 7 per cent in the last five years. However, the country is still very much dependent on agriculture both in terms of its contribution to GDP (66 per cent in 2009) and employment (about 80 per cent); only 25 per cent of the population live in cities. In order to become regionally more integrated, Laos joined the Greater Mekong Sub-region (GMS) initiative in 1992 and became a member of the ASEAN in 1997. As Laos is not a prominent location for R&D yet, not much has been published with regard to the country's innovation system. The following overview of the operationalization of national S&T activities is therefore mostly based on the findings during the SEA-EU-NET analysis group study tour to Vietnam that took place in June 2011. Our understanding of the innovation system is characterized by very little investment in R&D and a severe lack of human capital for S&T research. According to government representatives' estimates, the GERD amounted to approximately 0.1 per cent in 2009, but should increase to 1 per cent by 2020. The current low level of R&D investment can be explained to some extent by the coun-
try's low economic development level. In addition, the inward-looking economic development strategy of the past did not pay much attention to S&T. Now, the Lao government has embarked on an ambitious roadmap to catch up and abandon the LDC status by 2020. Stronger involvement in regional and international S&T collaborations will be of the utmost importance to the achievement of this goal. The new policy direction has been emphasized again in 2010, when the term 'innovation' was introduced into the country's policy planning. However, the implementation of a systemic approach to innovation based on a fruitful exchange of the different actors is very much in its inception. Currently, research takes place mainly in government research institutes (GRIs) and in the context of externally-financed ODA (official development aid) capacity building projects. These projects focus primarily on the Millennium Development Goals (MDGs) rather than on companies and their need for modern technologies. As most research is externally financed by a multitude of different donors, statistics of all projects are not available, not least because such data is not collected by any single government agency. Moreover, the fact that government institutions have been restructured and renamed to better fit the new policy direction over the recent years hampered to some extent a complete understanding of those institutions involved in policy-making and programmes.

There are a number of government actors responsible for S&T policy and implementation. While the general S&T policy direction is set by the Lao Government and the Communist Party Central Committee, the Ministry of Planning and Investment (MPI) is in charge of coordinating national and international S&T cooperation. As international S&T relations always are part of diplomatic and strategic policy-making, the Ministry of Foreign Affairs (MOFA) plays an influential role as well. Under the Prime Minister's Office (PMO) and has the rank of a (sub) ministry within the central government. The Ministry of Foreign Affairs is currently insufficient.

While NAST is more coordinated to the Ministry of Planning and Investment (MPI) is in charge of coordinating national and international S&T cooperation and the Department of Intellectual Property, Standardisation and Metrology (DOST) is currently insufficient.

The National University of Laos (NUOL), but also with scientists from other universities. The S&T research institute (STRI) serves as a secretary to NAST/MOST and is responsible for all fields – including research, development, technology transfer, promotion, application and S&T services. Within the STRI there are two divisions focusing on thematic issues such as renewable energy and engineering, as well as biotechnology. In addition, the Ecological Centre, the nursery and field trial units, and the Botanical Gardens and Science Park, set up on an area of 98 hectares in May 2011. The General Affairs Division includes the units for administration and finance, cooperation, information, R&D and services (see figure 8).

The funding for the STRI comes mainly from a UN agency, which is currently financing a five-year project (2009-13) for the implementation of a law on biosafety with a budget of US$ 1.5 million. In biotechnology (BT), research within STRI is undertaken by a total of 57 employees, whose academic qualifications vary substantially. While two scientists have a PhD and ten have Master degrees, the other scientists hold only Bachelor degrees; currently, five employees are studying abroad. The establishment of a scientific advisory committee for R&D and risk management is planned with the overall aim to steer research in biotechnology. Due to Laos' high biodiversity, BT research holds high potential for future products based on the development of high-quality local varieties of rice or coffee could be exported as ‘organic’ to fetch a premium price on the world market. However, national funding to develop organic products is currently insufficient.

While NAST/DOST has the mandate to formulate and coordinate S&T policies, most research institutes are subordinated to line ministries. Figure 8 gives an overview of the GRIs in Laos and their affiliation to specific ministries. Although coordination between NAST/DOST and the line ministries is envisioned, implementation steps and the final organizational structure is unclear. The lack of coordinating power seems to be related to the fact that NAST is not allocating R&D budgets, nor is it undertaking assessment of projects or policies. Nor does it appear to have information about projects proposed or implemented by the line ministries’ GRIs. Subordinated to the Ministry of Planning and Investment (MPI), the National Economic Research Institute (NERI) was set up in 1997 as the major academic advisory body on national and provincial socio-economic development strategy. It provides economic data and information and is engaged in the training of officials. The NERI has a total staff of 45, spread across three divisions, i.e. research, training and services. Like most other GRIs, NERI is facing challenges with regard to the professional qualifications of staff and overall budgetary constraints. Although some progress has been made in recent years, most of the staff have limited experience and expertise in conducting large and complex economic research and in the application of sophisticated methodologies and tools. The share of postgraduate staff is still small and interaction with other research organizations, including universities, is limited. 

The National Agricultural and Forestry Research Institute (NAFRI) is subordinated to the Ministry of Agriculture (MOFA). Established in 1999, NAFRI was mandated to pursue integrated agriculture, forestry and fishery
research with the aim of providing technical information and management guidelines, and elaborating an agricultural development strategy according to government policies. Existing research centres on agriculture, livestock, fisheries, and forestry have been combined and re-structured in 2007 to better reflect the policy changes. Besides the division on administration and management, NAFRI comprises six commodity-based research centres (rice and commercial crops; horticulture; forest, livestock; aquatic resources; and, conservation), three non-commodity research centres (agricultural land; agriculture and forestry policy; and, agriculture and forestry research information) and two regional centres (Northern and Southern Agriculture and Forestry Research Centre). Moreover, there are three cross-cutting programmes related to the upland R&D program, national rice research and agro-biodiversity. In 2007, NAFRI revised its research agenda for the period 2007-2012, focusing on improved efficiency, land use management and the feed back of impacts related to agrarian reform to policy-makers.

In 2008, NAFRI employed a total of 290, 59 of whom held Master degrees and 45 Bachelor degrees. The improvement of human resource capacity and management is a major focus of the institute's development strategy for 2007-2012. By 2011, the number of PhDs has increased to 10, while most of the academic staff held Master degrees. The total number of staff declined to some extent after concentrating on research. According to an expert from the National University of Laos (NUOL) many of the NAFRI researchers are NUOL members, undertaking part-time research at NAFRI. Most research activities, however, are driven by NERI and NUOL, but also with the Research Institute of River Basin. Although some progress has been made in hydrological modelling with a focus on the Mekong, considerable obstacles that no government funded system for doctorate graduates in Laos exist. In 2009, NRIES has recently completed a study on the standards of education, comparing Laos with 20 other countries on the basis of which it recommended the necessary standards that should be applied to all universities and the private sector.

Currently, the Asian Development Bank (ADB) supports the development of higher education with a grant of US$2.8 million from 2011-2016, designated for the expansion and improvement of three public universities—the NUOL, Dong Doks in Vientiane, the Champasak University in Pakse and the Souphanouvong University in Luang Prabang. The project finances also the promotion of research capacities, including skills in scientific working and writing for academic staff. There is also the plan to upgrade the NUOL’s Research Coordination Committee to the level of an institute. At the same time, NERI encourages the three university faculties to submit research proposals to the government and other government agencies, including the private sector.

In 2002-2007, the institute’s research projects were completed by NIOPIH:

- Child health and nutrition research (Assessment of child health and nutrition problems)
- Health research (Assessment of research priorities and research institutions)
- Child health and nutrition research for the national drug policy implementation
- National Health Survey
- Survey on malnutrition in the southern provinces
- Survey on malnutrition in the northern provinces
- Evaluation of the nutrition status of children
- The nutritional status of mothers and children, the development of the rural health system, and health research methodology and design for technical staff
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- National Health Survey
- Survey on malnutrition in the southern provinces
- Survey on malnutrition in the northern provinces
- Evaluation of the nutrition status of children
- The nutritional status of mothers and children, the development of the rural health system, and health research methodology and design for technical staff
in the installation and maintenance of the facilities. The Lao Institute for Renewable Energy (LIRE) is another example of R&D in the sector of environmentally-friendly technology. As a non-profit association, aligned under NASI-LIRE, it cooperates with a number of international and national organizations and private companies to develop cost-efficient solutions to energy supply constraints in remote parts of Laos and water treatment systems for both rural and urban areas. Recent innovations are, for instance, pico-hydropower stations built to generate electricity from small streams and photovoltaic systems to purify waste water. To explore the bio-energy potentials of the treelet Jahtrapa curcas, LIRE has also worked together with the Faculty of Engineering at the NUOL.

### 7.4.2.2 The International S&T Cooperation Policy of Laos

The Lao government has put strong emphasis on the development of S&T as a driver for economic development. In its National Socio-Economic Development Plan (2006-2010) the country’s Committee for Planning and Investment (CPI) requested action to: ‘create a technologically advanced nation with a highly skilled workforce and a competitive sector’. Projects to reduce the disparities between Laos and other countries in the region and facilitate economic integration.\(^7\)

With regard to the period 2006-2010 the CPI stressed the importance of international S&T cooperation (CPI 2006: 152):

> The Lao PDR will widely cooperate in scientific research and train researchers in the science and technology of regional countries and of the world. First, in cooperation with the neighbouring countries, the Government will motivate the Lao peoples to develop the use of science and technology. It will improve the organization of the academic cooperation with foreign higher education institutions, as well as in the development of science and technology in the country. It will motivate the expatriate experts, particularly the Lao experts who permanently live abroad to return to Laos and organize activities in science and technology.

The CPI gives some hints as to the priorities of particular fields of research. It stresses the importance of S&T for the development of agriculture, especially for high productivity and high value crops and animal varieties, post-harvest and agro-processing technologies. Biotechnology is another field of research which is regarded especially crucial for agriculture. For the industrial sector, research and application for increased competitive ness were mentioned by the CPI as well, but without any special focus.

Although international S&T collaboration is generally regarded as essential, neither the CPI nor NAST (or its sub-agencies) have designed a common national strategy that specifies sector or partner countries for collaboration. This could be explained by the situation of Laos’ international S&T collaboration being mainly based on ODA-related activities with a multitude of different international partners. Based on the interviews conducted with governmental institutions and GRIs in June 2011, we found that the main incentives for collaboration are funding, country-specific aspects and transnational learning, while innovation benchmarking and co-patenting were not yet important rationales for collaboration. However, global thematic priorities, especially those related to environmental issues and climate change, play a role in Laos as well (see figure 83). In the discussion with representatives from the NAST, the intensification of Laos’ international S&T collaboration was also understood as being part of the ASEAN policy direction.

With regard to studies on environmental issues, the largest donor institutions—the ADB and the World Bank—have recently been approached by the WRERI, in order to request funding for infrastructure and capacity building so as to establish a system of national laboratories for the monitoring of water quality. The World Bank specifically mentions the water resources, electricity from small streams and photoactive systems to purify waste water. Research collaboration with European partners have been conducted by WRERI through the ASIA-LINK programme, as well as through the CALS programme, which provides access to research staff members at the AIT Bangkok and at the Universities of Manchester and Colorado. Some of the staff at WRERI have also received grants for scholarships and training awards through the Erasmus Mundus programme. Research cooperation in water resources and environment takes also place with the EU, for example in the SPLASH project (European Union Water Initiative Research Area Network).

According to the HIOPH’s director, the institute participated in an FP6 project on poverty and illness (POVILL), which had a focus on rural poor and health assistance schemes. In this project, HIOPH was involved in the household survey in Laos. Currently, NIOPH cooperates with a large number of foreign institutions, both on the regional and the international level. Among the partner organizations from Europe are the Institute of Development Studies, UK, and the Karolinska Institute, Sweden. Regionally, joint projects are conducted with Vietnam and Cambodia on hepatitis, and with Thailand and Japan on various topics. Through the Japanese ODA-funding organization JICA, cooperation in this field is financially supported. Nine scientists from different Japanese universities have conducted studies within the institutional framework for the past years, which was completed in October 2009. Other collaboration has been undertaken with the Nossal Institute, Australia, and the Institute of Health Economics, Canada.

Cooperation in agricultural research is funded by many of the donor countries and institutions, including the Australian Centre for International Agricultural Research (ACIAR). The focus of ACIAR is on the upland regions and agricultural diversification. The SDC (Swiss Agency for Development and Cooperation) supports applied research and human resources development in agriculture and a program for biodiversity.\(^1\)

The Swedish funding agency SIDA has traditionally been an important cooperation partner for the National Agriculture and Forestry Research Institute (NAFRI). SIDA is the only funding agency that lists ‘research’ as one of the key focus areas in its cooperation with Laos (MPI 2010: 50). NAFRI cooperates with regional partners—including China, Vietnam and Thailand—with a focus on rubber and forestry research. Collaboration with Japanese scientists concentrates on rice research and with Korean scientists on Jahtrapa. Within NAFRI, many departments receive external support for staff qualification programmes, including exchange programmes with Germany, the Netherlands and France.

The NUOL has a broad international network of research partners, especially at the regional level. According to the head of the Lao Embassy’s Educational Division in Bangkok, Somchit Paseutsalk, the university is: as follows: government policy on international relations, the National University of Laos (NUOL) as the highest educational institution of the nation is eligible in academic cooperation with foreign educational institutions and organizations. The NUOL has signed the memorandum of understanding (MOU) with 83 foreign universities and institutions in 15 countries, namely: 12 universities in the socialist Republic of Vietnam, 15 universities in Japan, 7 universities in China, 10 universities in Thailand, 9 universities in the Republic of Korea, 9 universities in France, 3 universities in Canada, 4 universities in New Zealand, 2 universities in Australia, 2 universities in Sweden, 6 universities in Germany, 4 universities in Cambodia, 1 university in Denmark and 1 university in Poland. (sic)

The university’s preference for cooperation within the region was explained by NUOL experts as a result of the lack of national travel funds and limited financial support from the university. NUOL’s cooperation with foreign universities often takes the form of scholarship programmes and student exchange. In some cases, experts from foreign universities are also invited to teach. This is, for example, the case in the ICT department, which invited a professor from Singapore to lecture in Laos for a postgraduate course. Funds are borne from different sources. In ICT, some equipment was supplied by Singapore, while the Korean Foundation of Advanced Studies offered software and SIDA staff training. To summarize, international research cooperation by the GRIs and the NUOL concentrates mainly on partners within the region and research in the fields of health, agriculture and water resources. European countries play a role as traditional partners for Laos, especially France. But due to political and historical reasons, neighbouring OMS countries, in particular Vietnam, and the regional powers China, Japan and South Korea are also all important players. The lack of data for all ODA-related research activities hinders, though, the provision of a full picture of the scope of Lao international research collaboration.

On the individual scientist level, the rationales for international research cooperation covers a broad spectrum of motives (see figure 84). Most important for scientists is the opportunity to cooperate with foreign experts, especially at the regional level. Other important rationales for cooperation include the motivation for international collaboration, because they regard it as essential for their research capabilities and recruitment. And they are interested in co-authorships with foreign scholars. Publications in national and international journals have become an important criterion for promotion within the universities, especially for the position of associate and full professors. Today, the requirements for full professorship include the previous publication of at least two articles in international journals. The lack of modern equipment and laboratories represents another incentive for international collaboration, because it offers access to the research infrastructure of the partner organization.

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\(^7\) Ministry of Planning and Investment (MPI) (2010): 2010 Development Partner Profiles, Vientiane, pp. 5-11.

Summarizing the situation of international S&T cooperation in Laos, the following points are important:

- The S&T landscape is highly fragmented with a number of institutions in charge of policy implementation, which lack coordination and cooperation.
- The establishment of the NAST in 2007 has represented one of the greatest challenges. Another is the fact that comprehensive S&T statistics are not available.
- Key findings in Laos:
  - There is a strong interest in international cooperation with European partners, especially because they are assessed by scientists in Laos as being very experienced in advanced S&T research.
  - Access to ODA-related project funding is relatively easy, but international research funding programmes, such as the FP7, are highly competitive.
  - There is a strong proactive approach of looking for international research partners.
  - Research collaboration with European partners is highly welcome, because it allows access to advanced S&T research.
  - Therefore, so far, only a few research projects with the participation of Lao scientists exist, especially in health, agriculture, and water resources.
  - The National Science and Research Council (NSRC) represents one of the greatest challenges.
  - Ideally, international partnerships should take the lead in research programmes.
  - Organizations prior to any larger international research and policy directions on S&T to MOSTI, was replaced by the National Nanotechnology Directorate (NND) in 2011.
  - Several ambitious goals have not been achieved thus far, despite the support that has been provided by a number of funding programmes and initiatives.
  - Malaysia’s S&T system is currently undergoing some changes in order to better coordinate the various actors and support the implementation of the new, ambitious policy goals.
  - Malaysia is an example of a country that has weathered the global financial crisis quite well.
  - Malaysia has enjoyed a successful transition from a low- to a medium-level income country.
  - The MOSTI continues to be the leading government institution for policy formulation and implementation. It is mandated to oversee the integration of innovation policies. The government wants to streamline and restructure the S&T system as there are so many departments and agencies currently involved in it.
  - New GRIs have been established by the government in various fields in the last few years, with the special mission of supporting sectors of strategic importance.
  - The business sector has become an important actor as well. Between 1992 and 2004, its share of overall R&D investment grew from approximately 45 per cent to 71 per cent.

7.4.3 Malaysia

7.4.3.1 Key characteristics of Malaysia’s S&T system and policy

Malaysia is one of the smaller ASEAN member states in terms of population (as of 2008, 27.5 million people) but has enjoyed a successful transition from a low- to a medium-level income country. Recent statistics show that Malaysia weathered the global financial crisis quite well and was able to increase the income p.c. (GNI) from US$ 4,556 in 2008 to US$ 8,216 by 2010.\(^\text{184}\) Since the introduction of the first development plan in the 1960s, the Malaysian government has emphasized the crucial role of S&T for the country’s development and has incorporated technological catch-up into medium- and long-term plans.\(^\text{185}\) Parallel to the national five-year plans, special S&T plans were introduced. Malaysia’s first long-term S&T plan (Action Plan for Industrial Technology Development, 1998-2005) was designed to tackle the shortcomings in the innovation system by introducing new S&T institutions.\(^\text{186}\) Financial schemes intended to promote S&T development in sectors and key priority areas were implemented. After a review of the first S&T plan, the Second National S&T Plan was published in 2005 for the years until 2010. One of its main objectives was to bring government, industry, universities, NGOs, and local research closer together. The plan requested an increase in R&D expenditure as a percentage of GDP from 1.5 per cent, and human resources for R&D to rise to 6 per cent. Researchers, scientists, and engineers per 1,000 people in the labor force by 2010.\(^\text{187}\) These ambitious goals have not been achieved thus far, despite the support that has been provided by a number of funding programmes and initiatives.

Malaysia’s S&T system is currently undergoing some changes in order to better coordinate the various actors and support the implementation of the new, ambitious policy goals. An example is the establishment of the Joint Science and Technology Institute (JSTI) in 2010. A few months before, in July 2010, another specific research institute with the mission of supporting technology transfer to small- and medium-sized enterprises (SMEs) and improving national standards was established in 1996 as the Standard and Industrial Research Institute of Malaysia and 295 in the Forest Research Institute Malaysia (RRIM); the Palm Oil Research Institute Malaysia (PORIM), which was merged in 2000 with the Palm Oil Licensing Authority into the Malaysian Palm Oil Board, the Malaysian Cocoa Board, and the Malaysian Agricultural Research and Development Institute (MARDI).\(^\text{191}\) Examples are the Malaysian R&D in ICT and Microelectronics (MNRDI); the Malaysian Industrial Research Institute (MIRI); and the Institute for Medical Research.

In 2002, the Malaysian Agricultural Research and Development Institute employed 472 personnel, 53 R&D personnel were working in the Palm Oil Research Institute of Malaysia and 295 in the Forest Research Institute Malaysia.\(^\text{192}\)

8.2 International S&T collaboration

For scientists in GRIs and the NUOL, the identification of potential partners for international collaboration represents one of the greatest challenges. Another is the lack of mobility funds in order to participate at regional and international conferences. There is a strong interest in international cooperation with European partners, especially because they are assessed by scientists in Laos as being very experienced in advanced S&T research. Although the FP7 programme is attractive for scientists in GRIs and the NUOL, the identification of potential partners is a major challenge.

- Thus, for the time being, international partners would be needed to expand cooperation in EU-funded projects.
- At the national level, scientists appreciate the new S&T policy that allows better cooperation with foreign experts but stress the lack of mobility funds and necessary support to improve communication, especially skills that relate to research applications.
- Most interview partners stressed the need for human resource development in their respective organizations prior to any larger international research collaboration, in order to bridge the gap between national and global standards.
- To this end, the Prime Minister’s Office, it is mandated to oversee the integration of innovation policies. The government wants to streamline and restructure the S&T system as there are so many departments and agencies currently involved in it.
- New GRIs have been established by the government in various fields in the last few years, with the special mission of supporting sectors of strategic importance.
- The business sector has become an important actor as well. Between 1992 and 2004, its share of overall R&D investment grew from approximately 45 per cent to 71 per cent. In the same period, the government sector’s share decreased from 55 per cent to 29 per cent.
share fell from 46.6 per cent to 28 per cent.\(^{197}\) Large MNCs dominate R&D in the business sector, although 95 per cent of firms are SMEs. Among the domestic companies, large, state-owned companies from the automobile, oil and gas and palm oil industries are the most important actors.\(^{198}\) Malaysia’s R&D expenditure by type of research demonstrated some changes between 1992 and 2004 as well. The share of basic research increased in this period from 12.5 per cent to 16.2 per cent. In contrast, the shares of applied research and experimental development declined from 62.7 per cent to 55.2 per cent and from 58.2 per cent to 28.5 per cent respectively.\(^{199}\)

Universities also conduct R&D, although only a limited number play a role in research and for the provision of scientific, technological and engineering courses and training.\(^{197}\) Those designated as research universities by the government are: the University of Malaya (UM), the University of Putra Malaysia (UPM), the National University of Malaysia (UKM), the University of Science Malaysia (USM) and the University of Technology Malaysia (UTM). The universities’ share of R&D performed grew from 9.2 per cent in 1992 to 18 per cent by 2004. Generally speaking, the government expects the universities to become more involved in transnational research collaboration and has supported their development through a set of new policies, including the National Higher Education Plan 2007–2010 and the National Higher Education Action Plan 2007–2010.\(^{200}\)

Malaysia’s long-term VISION 2020 sees the country as a fully-developed economy by the year 2020. It focuses on nine strategic challenges, the sixth being innovation in the context of the quest that Malaysia ‘must confront the challenge of establishing a scientific and progressive society, innovative and forward-looking, which is not only a consumer of technology but also a contributor to the scientific and technological civilization of the future’.\(^{201}\) In this context, it is interesting to note that the last five-year plan 2006–2010 stressed the greater participation of women in S&T. This policy decision aims to strengthen the incentives for women to go into science and, thus, to compensate for the shortages of skilled labour. The plan also emphasized the promotion of international standards in tertiary education through the enhancement of the public service system and international cooperation. In addition, the five-year plan announced that a National Innovation Council (NIC) and a National Brain Gain Programme were to be established. In the newly-designed Tenth Malaysia Plan (2011–15), innovation figures highly as a vital ingredient for productivity and competitiveness. Given the decline of the GERD from 0.69 per cent in 2004 to 0.21 per cent in 2008, the government set a new goal to increase R&D expenditure to 1.0 per cent by 2015. The plan stresses four key dimensions for the Malaysian innovation system to develop: (1) shaping a supportive ecosystem for innovation; (2) creating innovation opportunities; (3) putting in place innovation enablers; and, (4) funding innovation.\(^{202}\)

Among the ambitious programmes implemented for the country’s technological catching-up are the Malaysian Information Technology and Multimedia Agenda and the programmes on biosciences and engineering.

According to the Ministry of Science, Technology and Innovation (MOSTI), Malaysian industry will need support for the further developing of the following key technology areas: advanced manufacturing and materials, microelectronics, biotechnology, ICT, multimedia technology, energy, aerospace, nanotechnology, photons and pharmaceuticals.\(^{203}\)

7.4.3.2 Malaysia’s international S&T cooperation policy

We now turn to the question of what the reasons for international S&T cooperation in Malaysia are. International S&T cooperation was assessed by most representatives from governmental institutions, during our study visit in 2008, as being very important. As an open economy which relies heavily on technological transfer from abroad, government policy has been designed to increase the country’s absorptive capacity and to cooperate with foreign partners in R&D. Looking at the reasons for international cooperation in more detail, the authors concluded that country-specific priorities played a crucial role. Global thematic priorities, on the other hand, were important as well, especially with regard to ICT. Transnational learning, innovation benchmarking and co-patenting were ranked as being equally important. The shortage of skilled labour was an additional driver for international cooperation. The Malaysian government is paying great attention to this topic and established a special programme (Brain Gain Malaysia) at the beginning of December 2006. The objective of this initiative is to leverage the talent pool of the Malaysian Diaspora and/or foreign researchers, scientists, engineers and technopreneurs for the key industries that Malaysia wants to become internationally competitive in. Research funding, in contrast, did not play an important role as a reason for international cooperation, as the government was essentially able to secure research funding.

From the perspective of individual scientists, the reasons stipulated for international S&T collaboration diverged to some extent from those given by government representatives (see figure 86). Due to the fact that GRIs and universities generally had access to funding and that the research infrastructure was well developed, these factors also did not rank highly as triggers for international S&T cooperation. That co-patenting was also not regarded as being very important for international S&T cooperation fitted with the critique that there was a general lack of commercialization of research findings on the part of scientists. Those factors that did figure highly for scientists were the various forms and the impact of S&T cooperation — including scientific publications, reputation, research capabilities, exchange of research personnel and access to new S&T (see figure 87).

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\(^{199}\) MOSTI (2006): p. 20, 55


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\(^{203}\) Economic Planning Unit of the Prime Minister’s Office (2010), p. 80

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The most important thematic focus areas for international S&T cooperation presented to us during the discussion in Malaysia were: 1) genomics and molecular biology, 2) nutraceuticals and pharmaceuticals, and 3) agricultural biotechnology.

Preferences for specific partners in international S&T

According to representatives from the Malaysian governmental agencies, preferences for specific partners in international S&T cooperation were not predetermined and did not exist. They, instead, described the choice of collaboration partners as being ‘research driven’. However, mobility funds and funding for international collaboration networks by the government were rather limited in 2008 and as such were not very encouraging for scientists. The focus of the government was on the creation of a general framework for scientists’ international cooperation through officially-established bilateral S&T agreements with other countries. Within the wider Asia-Pacific region, these agreements existed for example with Australia, China, India, New Zealand, South Korea and Vietnam. While S&T cooperation agreements (MoUs) with Australia and South Korea had already been in force by the end of the 1980s, most other agreements were only signed in the 1990s, while those with the DPR of Korea, Pakistan and Russia were formulated between 2002-2005. Unsurprisingly, for a small country like Malaysia, but especially given its economic status as the second-smallest member state in ASEAN (after Brunei), the most important S&T cooperation partner for Malaysia was Japan. In the 1980s, Japan was an obvious research partner for Malaysia, due to colonial ties and their concomitant linguistic, educational and cultural similarities. From the perspective of those scientists that we talked to in 2008, the MoUs between universities were creating a supportive framework for intensifying international research collaboration in biotechnology, producing well-equipped research labs and well-known scientists. Collaboration with foreign scientists was regarded as being important and helpful. Cooperation with partners in Japan and South Korea had shown good results, also due to their close cooperation in joint research projects. Cooperation with the ASEAN was geared to Singapore on the one hand, because of interest in collaborating with well-equipped research labs and well-known scientists; and, on the other hand, to technologically less developed ASEAN member states such as Vietnam and Myanmar, because of joint projects within the ASEAN COST programmes.

Participation in the FP’s of the EU was rather limited. There were several factors that influenced this phenomenon. There was a general lack of knowledge about FP research areas and funding mechanisms. Those scientists who had had experience in EU funding complained about an inflexible EU bureaucracy. As the success rate of applications was low, not many incentives existed to apply when local research funds or funds from other countries were more easily available.

Among the research universities, the UM collaborated with the US National Institute of Health on HIV-related studies in Malaysia, with the Japanese National Institute of Infectious Diseases on genotyping, with the Korea Ocean Research & Development Institute in Marine Science and with the Seegene Inc. of Korea on the dengue virus. The UMS research collaboration is even more wide-ranging and includes cooperation with 12 countries, 35 organizations and 56 researchers from UMS. The focus of UMS’s international R&T cooperation is on East Asia, followed by Southeast Asia, the Americas and Australia and New Zealand. European partners were involved in the ASEAN-European University Network Programme (AUNIP). 7

Summary of findings in Malaysia

In sum, the questions of why Malaysia is engaged in international collaboration, what the most important partners or regions in S&T are, and which fields of cooperation are preferred were answered in 2008 as follows:

• International S&T cooperation was viewed by both government and the US as highly desirable due to the country’s weak economic position. Hence, extra-scientific reasons for collaboration were even more important. In contrast to other ASEAN member states, funding and S&T infrastructure were not as easily available.

• For scientists, reputation, scientific publications and access to new S&T were important reasons for S&T cooperation.

• No specific international S&T cooperation policy existed, but extra-scientific reasons for collaboration were considered to be the most important. The most important international S&T cooperation partners were answered in 2008 as follows:

• International S&T cooperation is more important in the agricultural biotechnology sector than in other areas.

• The country’s weak economic performance explains to some extent why expenditure on research and development (R&D) in relation to GDP is well below the average of almost all OECD member states, although there are wide-ranging differences and differences within countries. Higher, up-to-date and internationally comparable statistics on innovation are not available. Currently, an innovation survey is being prepared that aims to assess recent S&T developments, source of funding and access to new S&T. The survey is part of the new innovation survey.

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The Philippines is the second-largest member state in the ASEAN in terms of population (92.2 million people in 2009), but ranks among the lower-middle income economies of the region with regard to GDP per capita ($2,050 in 2010). Although economic growth accelerated in the last decade, it remained much slower compared to that in the ASEAN region as a whole. The country faces many challenges. The level of international competitiveness is low, while unemployment is high and poverty widespread. Recognizing the importance of innovation for the country’s catching-up process, the Philippine government adopted a proactive S&T policy approach in recent years. The so-called Filipinnovation strategy developed in 2007 represents this new policy direction towards innovation-driven development. This strategy has four key pillars: "strengthening Filipino human capital; supporting business incubation and acceleration efforts; generating the policy environment for innovation and, finally, upgrading the Filipino mindset in the culture of innovation".

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Most of the research personnel have returned to the Philippines. They are being encouraged to look at local opportunities by the government. The government is promoting entrepreneurship in the S&T sector. There is an ongoing debate on how to allocate the funds from the extra-budgetary research funds, for example, to science, technology or innovation. There is growing understanding of the importance of innovation and its linkages to economic growth. There is some evidence of increased entrepreneurial activities in the S&T sector. The government is working on the national innovation system of the Philippines. Several players are involved, including public, private and academic institutions. The government has been looking at the ‘BIP’ (Business Innovation Partnership) model of innovation in Japan for guidance. Favorite areas of innovation are those where the Philippines has a comparative advantage, such as ICT. There is increasing understanding that innovation cannot be viewed in isolation.


De La Peña, Fortunato T. (2009): Towards and Innovation-Led Development Path in the Philippines (Opposing Initiatives on Innovation Studies: An innovation Surveys), Presentation prepared for the 11th National Convention on Statistics (NSSA), DOST-LSA, October 2009, http://www.nsb.gov.ph/lsa/surveys/nntcssa/2009/n11thnntcs/lsa_ori.pdf (DOST), expenditure on R&D currently amounts to 0.3 per cent. Although economic growth accelerated in the last decade, it remained much slower compared to that in the ASEAN region as a whole. The country faces many challenges. The level of international competitiveness is low, while unemployment is high and poverty widespread. Recognizing the importance of innovation for the country’s catching-up process, the Philippine government adopted a proactive S&T policy approach in recent years. The so-called Filipinnovation strategy developed in 2007 represents this new policy direction towards innovation-driven development. This strategy has four key pillars: “strengthening Filipino human capital; supporting business incubation and acceleration efforts; generating the policy environment for innovation and, finally, upgrading the Filipino mindset in the culture of innovation.” The country’s weak economic performance explains to some extent why expenditure on research and development (R&D) in relation to GDP is well below the average of almost all OECD member states, although there are wide-ranging differences and differences within countries. Higher, up-to-date and internationally comparable statistics on innovation are not available. Currently, an innovation survey is being prepared that aims to assess recent S&T developments, source of funding and access to new S&T. The survey is part of the new innovation survey.

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the overall population, however, this translated into just 165 R&D personnel per million. The low levels of R&D investment and personnel have also been attributed to institutional weaknesses and policy failures, especially with regard to incentives for companies to invest in innovation. Among the various flaws discussed by Philippine experts are: the weak R&D collaboration between the public and the private sector; the lack of an efficient system for the transfer of technology and problems with regard to technology ownership and protection of intellectual property rights. In order to understand the current system of innovation in the Philippines, and the interactions among actors, interviews were conducted with representatives from the government, research institutes and universities in June 2011. The following mapping of actors in the innovation landscape is based mainly on these interviews, but is also complemented by information obtained from the respective institution’s websites.

The Philippine innovation system is complex and has a multi-layer structure with institutions on both the central government level and on the local community level (see figure 88). The Department of Science and Technology (DOST) has had the mandate to formulate and implement science and technology policy since 1986. Although DOST has a central role in S&T policy-making and the supervision of government research institutes (GRIs), there are also line ministries, the private sector and universities. The DOST’s mandates in February 2011 were cut by one in June 2010. The following five councils are the: Philippine Council for Advanced Science and Technology (PCASTRD), Philippine Council for Health Research and Development (PCARRD), Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCAMRD), Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD), Philippine Council for Research and Development in Agriculture, Forestry and Natural Resources Research and Development (PCARRD).

While four research councils pursue their mandates in specific sectors, the PCASTRD was responsible for the integration and the coordination of the national research system for advanced S&T. The PCASTRD’s priority areas included biotechnology, electronics technology, ICT, material science, photonics technology and space technology applications. One such policy was the ‘National Technology Roadmap’, which aims to prioritize R&D projects. The PCIEERD focused on the planning, monitoring and promotion of S&T research for later application in the fields of industry, utilities and infrastructure. The council’s mandate in order to provide market-driven directions and research efforts, share risks and benefits and plan for long-term projects. The PCIEERD offers grants-in-aid for approved research projects and the prioritization of R&D investment. The priority areas are energy, environment and food.

The PCARRD takes a leading role in research on agriculture and natural resources. In 2006, it published the ‘Integrated S&T Agenda in Agriculture, Forestry and Natural Resources’ (IPAG-IFNR). In the ‘Integrated S&T Agenda in Agriculture, Forestry and Natural Resources’ (IPAG-IFNR), the Council for Health Research and Development (PCHRD) was responsible for health research and development. PCHRD’s mandate concerns the enhancement and strengthening of linkages and networks; and the creation of a culture of sharing ideas and experiences.

The remaining research council, the PCARDM, is called the ‘Water and Fish R&D Center’. It coordinates R&D in national aquatic resources, in order to achieve the sustainable management of these resources. The PCHRD produced the ‘Water and Fish R&D Center’. It coordinates R&D in national aquatic resources, in order to achieve the sustainable management of these resources. An important aspect of this council’s activity is the capacity building in coastal resources and fishery management, which is funded by a number of international donor institutions and the government. In the council’s annual reports, all R&D topics and projects funded through grants-in-aid allocations are listed.

In sum, all councils have the mandate to formulate plans, strategies, policies and programmes for S&T development; allocate government and external R&D funds to programmes, monitor and evaluate R&D programmes and projects and generate external funds for R&D. The councils’ sectoral policies and programmes are embedded in DOST’s medium- and long-term planning. In its critical review of S&T plans, the DOST briefly assessed the Science and Technology Master Plan (STMP), the Science and Technology Agenda for National Development (STAND) and the DOST Medium-Term Plan (DMTP). These plans addressed the weak performance in terms of low expenditure on R&D and the lack of scientists and private sector involvement in S&T. The STMP (1997-2000), for example, requested an increased in R&D expenditure from 0.1 to 1 per cent by 2010. Due to the lack of financial support from the government, this figure was difficult to achieve and therefore reduced to...
The DOST’s research and S&T services institutes receive energy; and manufacturing and process engineering. The NSTP proposed a number of long-term Western research institutes, the portfolio of Philippine 2004, Manila, pp. 5–6.

A long-term policy direction and vision is given in DOST’s National Science and Technology Plan (NSTP), covering the period 2002-2020 and in the DOST Seven-Point Agenda (DSPA) for the time span 2006-2010. The broad vision for 2020 is to achieve the level of world-class S&T universities, a well-developed SME sector based on S&T, internationally recognized scientists and engineers, and the development of the Philippines into a model of S&T management and governance. The plan recommends that the following ideas and challenges should be considered in the future: niching and clustering, human resource development, support of industries—especially SMEs—acceleration of technology transfer, building of S&T infrastructure, international linkages in S&T, competitiveness and the popularization of S&T to create a culture of innovation. The NSTP proposed a number of long-term priority areas for S&T: agriculture, forestry and natural resources; health sciences and biotechnologies; public health and medical sciences; food and agriculture; information and communication technologies; materials sciences; marine and engineering; earth and marine sciences; fisheries and aquaculture; culture; environment; environment (including water resources); alternative energy; and technology transfer and S&T services. Based on DOST’s project on S&T-based interventions to improve the productivity of metals and engineering industry, among the services offered by the institute are: the training of engineers and technicians; trade accreditation services; quality control and testing; and business advisory services. The center is currently involved in a project on the ‘Clustering of the Regional Enterprises of CAR for Agro-Industrial Machinery and Parts Manufacturing’ (CREAMM). This project aims to improve the productivity of metals and engineering companies by organizing them into clusters. Similar to the MRIDC, the Philippine Textile Research Institute (PTRI) was established to support the development of single industry. It conducts applied R&D for the textilizing industry and offers technology transfer, training and consultation services. The PTRI assists the Philippine industry in finding market niches, focusing on local raw materials—such as abaca and pineapple—cotton. The Forest Products Research and Development Institute (FPRDI) conducts basic and applied R&D to improve the value-added chain of wood and non-wood products. Its R&D programmes are focused on material science, bio-based composites, furniture and handiworks, food and agriculture, environment, and technologies for forest-based industries. As of 2010, the total number of staff amounted to 171, including 12 PHDs. The Philippine Nuclear Research Institute (PNRI) is one of the oldest GRIs. It was established in 1958, and conducts R&D in the peaceful uses of nuclear energy. Its mandate also covers the transfer of research results to end-users and the licence and regulatory activities with regard to the production, transfer and utilization of radioactive materials. Research includes the application of radiation and nuclear materials in the sectors of food and agriculture (crop improvement through mutation breeding), for pest control and animal production, but also in industrial production and technology. The PNRI offers irradiation services at two gamma irradiation facilities as well as nuclear training.

The Philippine Institute of Volcanology and Seismology (PHIVOLCS) studies natural disasters, especially earthquakes and tsunamis, and works on disaster forecasting—including tsunami warnings and hazard mapping. Currently they are developing sensors for early-warning systems for tsunamis. The PHIVOLCS operates eight stations for volcano observation and 66 stations for earthquake observation. This service is offered free in monitoring and disaster preparation for local communities and coastal areas. In addition, services offered by the institutes can be used to generate funds. The ITDI’s mixture of funding sources provides a good example: 65 per cent of their budget is government allocated while 35 per cent is generated from services. Some of the institutes rely heavily on foreign funding, for example the PNRI. About 40 per cent of the centre’s budget is covered by the International Atomic Energy Agency (IAEA), while the rest comes from the allocation for R&D and from services. Compared to scientists in GRIs, those working in the S&T service institutes have greater difficulty to attend international conferences. They have no access to national mobility schemes and need to be invited in order to participate at international conferences. As a result, the institutes often try to compensate for the lack of international visibility of the institute’s research by being active in international conferences. The Philippines Atmospheric, Geophysical and Astronomical Services (PAGASA) is one of the institutes affiliated with the Philippine government (PAGASA) is one of the institutes affiliated with the PHIVOLCS. Its mandate relates to weather forecasting, climate modelling and data archiving. About 50 per cent of its budget is earmarked for R&D. The topics pursued are weather extremes, i.e. tropical cyclones and other disaster-inducing phenom- ena. Scientists working at PAGASA need special skills in advanced computer programs and simulation techniques. Recently, the institute has been focusing on the upgrade of equipment and capacity improvement. Researchers are offered incentives for publications. For an article published in an international journal scientists receive, for example, a bonus of 15 per cent on top of their salaries.

<table>
<thead>
<tr>
<th>Name</th>
<th>Budget (million US$)</th>
</tr>
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<tbody>
<tr>
<td>SEI</td>
<td>11.490</td>
</tr>
<tr>
<td>PCHRD</td>
<td>23.769</td>
</tr>
<tr>
<td>PCAMRD</td>
<td>0.823</td>
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<tr>
<td>PCARRD</td>
<td>0.877</td>
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<tr>
<td>CS</td>
<td>3.043</td>
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<tr>
<td>PNRI</td>
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<tr>
<td>FPRDI</td>
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The table presents a summary of the budgetary allocation to research councils, GRIs and S&T service institutes in 2005.
ple, only 200 actually work at PHIVOLCS. Many of the better-educated scientists prefer to work in the private sector or to go abroad. There is no specific incentive system in place to encourage scientists to publish in refereed journals.

There are a number of advisory bodies that act as intermediaries between different agencies within the Philippines and between domestic and foreign agencies. The National Academy of Science and Technology (NAST) advises the legislators and the Senate, other policy-making bodies and NGOs on policies related to S&T. NAST is also responsible for the recognition of outstanding research achievements by giving awards to Filipino scientists. In addition, the Academy supports international and national scientific linkages and promotes cooperation between Filipino and foreign scientists. Besides the yearly award ceremony, the NAST organizes a large number of roundtable discussions (148 in 2010) and maintains linkages with 35 counterpart organizations in the Philippines and abroad, especially within the US, UK and Australia. In 1998, the NAST established the Philippines Science Heritage Center that exhibits the scientific achievements of Filipino scientists and serves as a location for seminars and lectures. Another body, the National Research Council of the Philippines (NRC), focuses on basic research. It also supports the set up of linkages with local and international scientific organizations and provides local research support wherever possible. The NRC is organized into 13 scientific divisions with a total of 5,176 members coming from the academic, government and private sector with special knowledge and research experience. The NRC assigns research grants based on the NRC’s ‘National Integrated Basic Research Agenda’. This agenda is based on the priority areas for basic research of the NSTP (2002–2020).

In addition to the large network of institutions and agencies that perform a huge number of different tasks, with the country’s total R&D budget of about 0.3 per cent of GDP currently, the funding for all the above-mentioned activities is not sufficient to support all the other local government agencies and departments, the private sector and international organizations. Other line ministries—for example, the Departments of Agriculture or Energy—also provide funding and conduct R&D. In terms of the total value of R&D funding, the Department of Agriculture has a higher budget than DOST. In order to coordinate the different government agencies’ R&D activities and supervise the budget allocation, President Arroyo established the Presidential Coordinating Council on Research and Development (PCCRD) in 2007. Based on the consultation of all agencies and the recommendations of a private inter-agency committee agreed upon a list of priorities, which is similar to the long-term R&D plan for 2002–2020. While nanotechnology was added to the new list of priorities, two other fields of research—materials science and engineering and earth and marine science—do not appear in the revised list. According to the guidelines on R&D priorities, the timeframe for the priorities will be six years, covering the period 2010–2016 and subject to a mid-term review in 2015.227

Institutions of higher education

The universities represent another important group of actors in the Philippine innovation system. Private institutions of higher learning dominate the higher education system, accounting for about 80 per cent of the total number present. They are basically tuition-funded and have strong worldwide alumni networks. Two-thirds of these institutions are run by private organizations and about 20 per cent by religious congregations. The enrolments by disciplines show a strong tendency towards business administration and related fields (22 per cent), while most students in S&T-related disciplines can be found in medicine and healthcare. Few students enrol in doctoral courses.228 Private universities can rely on tuition fees to basically cover all expenses— including salaries, maintenance and research—but can also apply for research grants from the DOST. However, they need to act in a similar way to a private enterprise in order to attract funds from other sources. Therefore, the DOST’s grants serve as another source of potential revenue for the schools and private universities who have set up technology-licensing offices to secure royalties from patents.229

The main actors are the University of the Philippines (UP), the De La Salle University (DLSU) and the Ateneo de Manila University (AMU). While UP is a public university, the other two universities are private ones. All three have become involved in the Filipino innovation strategy that requires firms and industries to upgrade and increase global competitiveness and universities to get more involved in multi-sectoral partner- ship with the industry to both benefit from the industry. The authors conducted interviews with repre- sentatives from these universities, as well as the private Mapua Institute of Technology (MIT). The MIT is ranked number 25 on the list of the 187 institutions of higher learning in the Philippines in 2011. The leading university is the UP, followed by the AMU in second place the DLSU at number 5 and the UP Diliman at number 8.230

One of the newly-established institutions that pro- vides S&T-related studies and research is the UP Dili- man Technology Management Center. This center offers Masters in Technology Management (MTM), short-term executive training courses and research and consulting services. Research is reflected in studies for various de- pending agencies related to R&D and industrial restructuring. Most of the stu- dents come from the private sector, are medium-level executives and will go back to their companies after they have obtained their Master degree. In regard to their role in the Filipinnovation strategy, the faculty represent- atives see themselves as still being predominant- ly a teaching university. In addition to the Technology Management Center, the UP has set up the first busi- ness incubator in cooperation with the Ayala Founda- tion (UP-Ayala Technology Business Incubator) at the UP Diliman campus. The aim is to commercialize the research output of faculty members and students. The technology-based projects concentrate especially on ICT. Supported by the Department of Science, other incubators and science parks are planned or are already set up on different UP campuses.231

The Ateneo de Manila University (AMU) was estab- lished by the Jesuits, who started their educational ac- tivities in Manila in 1859 by founding a public primary school. In 1917 it was converted into a college, it was trans- formed into a university in 1959. At the AMU a number of topics are pursued in line with the Filipinnovation strat- egy. One of the key research topics is social entrepre- neurship, which includes the establishment of industries for under-served communities such as the urban poor and farmers. This research initiative is headed by the School of Management and the School of Science and Engineering. The research is related to environmental issues such as water and air quality and education, fo- cusing on teacher’s training, curriculum review and the support of schoolchildren nutrition. The Philippine di- sadvantaged rural areas are the focus of other research top- ics. About 25 per cent of the university staff are engaged in R&D. According to faculty members’ self-perception, this university has not yet developed such a strong re- search culture as the UP, most of the research is client- driven and not so much research problem-driven. Scientist’s publications play a certain role in internal assessment, however, in contrast to Western countries they are not a major criterion for university funding.

The De La Salle University (DLSU) was established in 1911 by the Brothers of the Christian Schools and be- came a member of the International Federation of Cath- olic Universities in 1968. It developed into a large pri- vate university with many branches established abroad. The DLSU has 13,058 undergraduate students and 5,431 graduate students and a faculty of 410 full-time faculty members (headcount) of which 196 (headcount) have a PhD (statistics related to the school year 2010–2011). The DLSU amounts of research in the total budget amounts to 16–17 per cent. Research at the DLSU takes place in 16

229 University in Philippines by 2010 Web Ranking, online at: http://www.4icu.org/ph/, accessed 10 August 2011
230 Velasco (2009)


234 September 2011, p. 490

235 September 2011, p. 490

236 September 2011, p. 490
The crucial role of S&T for the country’s economic catching-up process has been emphasized by the Philippines government since long. In the medium-term economic development plan for the period 2004-2010 the National Economic and Development Authority (NEDA) dedicated a whole chapter to S&T policy. International S&T collaboration – including technology transfer through foreign direct investment and international R&D cooperation projects – was described by NEDA as important to achieve the country’s ambitious goals. The NEDA requested ‘to adopt policies focused on making the Philippine National Innovation System work’.235 Representatives from GRI’s S&T service institutions and institutions of higher education interviewed in Manila also stressed the need for international collaboration (see figure 89). Most of the interviewees emphasized transnational learning as being the central motive for S&T collaboration. ODA support for Philippine development still plays an important role and, thus, affects access to S&T funding as well. But funding has only a complementary function and was assessed by the interview partners as being not the number one reason. With the rise of awareness that regional and global competitive pressure is growing, innovation benchmarking has become another motive for S&T collaboration. The country-specific and global thematic priorities are equally important, especially with regard to topics such as climate change, disaster mitigation and adaptation, as well as ICT.

Reyes-Macasaquit235 points to systemic failures within the innovation system and ‘the inability of the government, the private sector and the academe to collabo- rate meaningfully’.

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The extent to which GRI’s and S&T institutes are involved in international S&T collaboration varies, especially with regard to cooperation with European partners. For example, ASTI – as one of the GRI’s – underlined the central role of international cooperation because of knowledge spillover. The institute follows a strategic approach to find partners for research collaboration. Recently, they became aware that Taiwanese research institutes possess a strong capacity in specific ICT fields and approached them to establish joint teaching programmes with the aim of cooperating in research and education. The University in the EU FP7-funded ICT projects SEACOOP and the Trans-Eurasia Information Network 2 (TEIN2). These projects offer not only funding, but also access to research and education networks, and capacity building, and imply the idea of transferring the project management into Asian ownership. International conferences are assessed by the ASTI’s director as being crucial to keeping abreast with cutting edge research outside of the Philippines. The institute encourages its staff to publish in international journals, although not through pecuniary incentives. In the application of resources research and institute includes travel costs for international conferences. Currently, PAGASA cooperates with Vietnamese climate change. The ASTI also cooperates with ASEAN partners in the field of microelectronics, organized through the ASEAN Information Centre. In this cooperation the ASTI offers ICT training to other ASEAN countries.

For PAGASA international cooperation is essential for funding capacity building and mobility programmes that allows scientists to attend international conferences. Currently, PAGASA’s capacity building is supported by a number of donor organizations from Australia, Japan, South Korea and through the World Meteorological Organization. On the regional level, PAGASA cooperates with Vietnam on climate change and research with Thailand in training programmes. It offers a Masters programme on S&T for students from both countries. PAGASA has not participated in EU-funded research projects and is not familiar with the FP7. However, it cooperates with some scientists and institutions from Europe, for example with the National Meteorological Services in Germany and Finland. The PHIVOLCS participates in an EU-funded FP7 project, MIWITA (Mitigate and Assess Risks from Volcanic Impact). The cooperation includes all aspects of the institute’s work, especially disaster preparedness, tsunami warning, and hazard mapping. The collaboration with European partners was described as being very positive, involving a strong research component and a learning process of theoretical and technical knowledge. Another positive impact is the transfer of project management know-how. The PHIVOLCS’ collaboration within the region concentrates on Singapore (Earth Observatory, Japan (Kyoto University, Kyushu University and Kagoshima University), Taiwan (Academia Sinica and Australia); cooperation within ASEAN is assessed as being still rather underdeveloped. There are also S&T cooperations with individual European countries, especially with France. The institute has offered a collaborative scholarship and training scheme. Most projects are rather small in scope. Some support for training also comes from donor organizations, for example, AusAid, JICA and UNDP.

International S&T collaboration is generally more intensified in institutes of higher education, particularly in private universities. Due to its worldwide network of 72 branches, the DLSU has many cooperative agreements with aspiring universities in the region. The University has established a mobility scheme for its scientists, including funding for participation at scientific conferences, or setting up linkages with other institutions for visiting lecturers. These projects are naturally also a source of funding for research to the DLSU. In addition, the DLSU also applies for research grants at the DOST or international donor agencies such as JICA (for scholarship programmes), SIDA, USAID or the Canadian funding agency. On the cooperation is intensively sought for by all faculties at the DLSU. The College of Science cooperates, for example, with some Japanese universities (in nanotechnology with Osaka) and with Harvard University (on “research programmes. Close cooperation exists with Japan, especially in informatics; there is also a cooperation with the University of Osaka. Some funding for Philippine students has been obtained through the ERASMUS + Programme. For visiting foreign scholars, the college trains also from donor organizations, for example AusAid, JICA and UNDP.

In the development of a biomedical and clinical engineering programme they cooperate with the Royal Institute of Sweden, the University of Pisa in Italy and a university in Indonesia. Many of their professors are UK graduates, making use of their scholarly ties with British universities. Research relations with the Tokyo University of Technology and universities in Kyoto, Hokkaido and Osaka have been established. The Finnish ODA agency SIDA funded the Asian Regional Research Programme on Environmental Technology for the period 2004-2010, in which Lund University was also involved as several Asian universities participated.

At DLSU, evaluation of international research collabora- tions takes place annually. The internationalization of each faculty is assessed by counting the number of graduates from foreign universities, research projects and mobility programmes funded by foreign institutions; publications in interna- tional journals; and, visiting foreign scholars. Interna- tional collaboration by the Ateneo de Manila University (AMU) covers a broad range of fields and partners. In environmental science, an institutional cooperation takes place with the University of Bordeaux in France; there are also teaching relationships with other universities and a number of partnerships on the level of the individual researcher. Most of the students from this university studying abroad are, currently, in France (70), followed by Japan (20), Germany (15) and Spain (10). In environmental sciences, AMU cooperates with Australia, while the department of mathematics has research contact with Bulgaria and Japan. Japan has become increasingly important, especially in lecturer exchange programmes. Close cooperation exists with Japan, especially in informatics; there is also a cooperation with the University of Osaka. Some funding for Philippine students has been obtained through the ERAS- MUS + Programme. For visiting foreign scholars, the college trains also from donor organizations, for example AusAid, JICA and UNDP.

In contrast to other faculties, the DLSU School of Economics conducts extensive research collaboration with the ASEAN region, for instance with Vietnam, Ma- layasia and Indonesia. Currently, a research initiative exists with the Chulalongkorn University in Thailand on innovation in Asia (ODRC funded). Individual staff mem- bers conduct research contacts with the University of Nevada. The College for Engineering is involved in research with EU partners through the ASIA-LINK project. In the development of a biomedical and clinical engineering programme they cooperate with the Royal Institute of Sweden, the University of Pisa in Italy and a...


Carolina on environmental issues was also established. Comparing cooperation with EU partners and the existence of cooperation with Taiwan, Mapúa representatives stressed the latter’s geographic proximity, facilitating research cooperation.

Summarizing the Philippine scientists’ assessment of international S&T collaboration, four objectives seem to dominate (see figure 90). Besides access to S&T and collaboration networks, the increase of reputation and research capabilities were the most important incentives for Philippine scientists to engage in international research collaboration. While the exchange of students and researchers, research infrastructure and scientific publications are regarded as being also important, co-patenting was not a decisive factor for international S&T collaboration.

In conclusion, regional preferences for research cooperation seem to exist. The USA has been mentioned by scientists and representatives from GRIs and S&T services as an outstandingly important research partner. Benefits of S&T cooperation with the USA are: 1) no language barrier, 2) Philippine culture has historically been strongly influenced by US culture and is quite similar to the Filipinos, 5) the legal and administrative systems of both countries are similar, 4) Philippine academic degrees are recognized in the USA, but not in the EU, 5) Filipinos can have dual citizenship in the USA and the Philippines.

In terms of preferences for specific partners, cooperation with countries in Asia — especially the ASEAN+3 region predominates due to the lack of knowledge and research capabilities. The Philippines has active donor organizations that provide capacity building programmes and scholarships. China has not yet become important for research collaboration due to the language barrier. However, China is increasingly offering short-term scholarships for Filipino students and researchers.

Those Philippine partners involved in EU-funded research programmes and research activities appreciate the positive impact of knowledge spillover, capacity building and administrative learning. According to some interviews partners, challenges in the cooperation with the EU or European partners in general exist, namely: 1) Information on EU-funded projects is rather difficult to obtain, and the priorities of EU-funded research are not known, 2) there is a language barrier, because not many Filipinos speak other European languages, even Spanish is uncommon, 3) the EU has cooperated with other regions and the Philippines has been downgraded as a S&T partner; closer cooperation with Europe might need an improvement of the Philippine education system, 4) S&T cooperation between universities in the EU and the Philippines is more common with GRIs, but due to differences in the academic year actual cooperation can be difficult to establish, 5) EU-funded projects and scholarships (i.e. FP7, Erasmus Mundus, Marie Curie, etc.) are very competitive and difficult to obtain, 6) the EU is very particular with financial management.

With regard to the field of S&T cooperation, the scientists interviewed stressed that the national research priorities are very important. These priorities have been worked out in cooperation with research organizations in the Philippines and therefore basically represent the interests of the scientists. The national priorities, i.e. government basic funding and grants and offer therefore more opportunities for scientists to do research. These national priorities include internationally important topics as well as the fact that S&T in addition, the president’s priorities are also reflected in the national agenda, with poverty reduction and other MDGs appearing high on the list. Apart from the national priorities, the scientists also take international funding into account when deciding about which research topics to pursue.

Voices from governmental institutions and scientists in the Philippines on international S&T cooperation

The issue of a brain drain has become a challenge to many research organizations in the Philippines. As a reaction, the government has introduced a reverse brain drain policy called the Balik (‘return’) programme to lure highly qualified personnel back home. In this context the following remarks have been made:

There is an aggressive campaign for student exchange by European countries, they want the best of the students. Don’t let them stay in Europe, encourage them to go home.”

“DOST might not be able to cope with the financial package necessary to make them come back permanently, so they are invited to spend some time i.e. 3-6 months in the Philippines.”

Summary of findings in the Philippines

- The Philippines has a complex national innovation system, characterized by a large number of actors for the coordination of national research activities, by GRIs that have only limited impact on the private sector and by a predominance of private universities that are more focused on teaching than on research.
- The complexity of the system and the large amount of stakeholders—often conflicting interests—are hindering the implementation of ambitious S&T programmes.
- The national expenditure on R&D is very low and dispersed among the various actors, which is hampering the development of S&T programmes. This is also the case for the available financial resources. The dispersing of funding among many stakeholders dilutes the low expenditure to even lower amounts, making the implementation of research programmes very difficult.
- Government funding is primarily focused on equipment and research facilities. There are very limited funding opportunities to train GRIs’ personnel to use costly instruments and to keep the equipment in working order.
- At the national policy level, funding is, however, not the number one reason to expand international S&T cooperation, but international training is regarded as very important.
- The low level of domestic economic development has an impact on the brain drain of researchers, whereas international cooperation and mobility represent a bottleneck in many research organizations.
- Due to the lack of sufficient financial resources to provide internationally competitive incentives, scientists trained abroad often do not return to the Philippines.
- The Philippines introduced a ‘brain circulation’ programme which allows researchers to come back for a limited period of time, i.e. 3-6 months, to refresh networks and to exchange research ideas for mutual benefit.
- Scientists’ interests in international S&T collaboration is strongly related to the factors inherent to science, i.e. reputation, collaboration networks, access to S&T and research capabilities.
- The importance of EU-funded projects is still limited, while research with partners in the USA and the ASEAN region predominates due to the lack of knowledge on EU research priorities, language issues and the strong competitiveness of EU research programmes.
- Their proficiency in the English language gives Philippine scientists a competitive advantage over many of their ASEAN competitors when it comes to application for funding and communications skills with partner organizations in the USA and the EU.
- EU funding schemes are almost inaccessible for Philippine researchers under the current conditions. If the EU seeks to raise the level of participation, future programmes should include training courses in project management, administration and reporting tailored to the entrance level of potential partners.
- The industry sector is not a major driver of R&D in the Philippines and there seem to be little cooperation on the basis of public-private partnerships.

7.4.5 Singapore

7.4.5.1 Key characteristics of Singapore’s S&T system and policy

Singapore is a city-state with a population of around 5 million people and very limited natural resources. An important factor that explains Singapore’s ability to attract foreign investments from MNCs played a crucial role in turning this small state first into an international manufacturing centre and then into a knowledge-based economy.259 Despite having strong governmental support, Singapore did not follow a technocratic approach. Industrial policy concentrated mainly on setting the framework conditions for an outward-oriented economy and for the development of human resources and the strengthening of the transport and telecommunications infrastructure.

In contrast to other ASEAN countries, Singapore does not have a single ministry responsible for S&T formulation and implementation. Long-term economic strategies are set at the cabinet level, with various ministries and agencies involved in detailed S&T policy formulation and implementation. These are, first of all, the Economic Development Board (EDB) and the National Science and Technology Board (NSTB), reorganized into the A*STAR (Agency for Science, Technology and Research) in 2007, both of which report to the Ministry of Trade and Industry (MTI). The MTI formulates S&T policy, assisted by the A*STAR in the design of the five-year plans on S&T. An important role is also played by the Ministry of Information, Communications and the Arts (MICA) and its subordinate the Infocomm Development
ment Authority of Singapore (IDA), which supports Sin- 
gapore’s ICT development. In addition, the Ministry of 
Education is also involved in R&D. The higher-education 
sector comprises the three public universities and five 
polytechnics. Two of these universities are of crucial im-
portance for R&D: the National University of Singapore 
(NUS) and the Nanyang Technological University (NTU).
Approximately 90 per cent of R&D expenditure by the 
higher-education sector comes from the government, 
and about 95 per cent of the R&D spending of GRIs is 
governed by governmental funding. 214

In 2006, the National Research Foundation (NRF) 
was created under the Prime Minister’s Office; it is man-
dated with the task of setting the national direction for 
R&D and coordinating the research agenda of different 
agencies. It is also responsible for implementing and 
funding the policies, plans and strategies proposed by 
the Research, Innovation and Enterprise Council (RIEC), 
which is chaired by the Prime Minister and several Cabi-
net Ministers. The A*STAR oversees 21 research insti-
tutes, centres and consortia. It comprises two research 
councils – the Bio-Medical Research Council (BMRC), 
which is focused on R&D in life sciences, and the Sci-
ence and Engineering Research Council (SERC), which is 
responsible for R&D in specific sectors such as ICT, 
chemicals and engineering. 215

Long-term visions and plans combined with short-
term interventions in some areas are characteristic of 
Singapore’s innovation policy. An example is the target-
ing of the IT industry and IT research. In the middle of 
the 1980s the National Computer Board introduced the 
National IT Plan for Singapore, emphasizing the devel-
opment of an environment that would attract research, 
industry and the application. One important element of 
this IT policy was the liberalization of the telecommunications 
industry and the development of broadband infrastruc-
ture. The Government’s Telecoms Development Plan 
in the 1990s helped with the diffusion of e-commerce. 216

Since the 1990s, the strategic focus of S&P policy has 
changed to some extent and the development of indig-
ous technological innovation capabilities has been 
given stronger support. The S&T Plan 2005 underlined 
the new focus on R&D capabilities in niche areas such 
as biomedical R&D. An important element in the sup-
port of this S&T field is the emphasis on the recruitment 
of global talents and on strong international research 
relationships and networks. Policies in support of bio-
medical development include not only financial incen-
tives but also the attraction of foreign experts and close 
service cooperation with private firms. 217 In order to achieve 
the ambitious goal of becoming the region’s R&D hub, the 
government has restructured the innovation system by 
founding new research institutes and broadbanding its 
international S&T cooperation. 218 It has also invested 
heavily in research and industrial parks and introduced 
financial assistance for start-up companies. Two of the 
most famous innovation infrastructure projects are the 
Biopolis and Fusionopolis, which focus on biomedical 
research and on ICT, media, physical sciences and engi-
neering. Both take part in a larger infrastructure project 
called the One North. 219

The Science and Technology Plan 2010 (STP 2010), 
introduced in 2006, was the country’s fourth five-year 
S&T development plan. 220 This strategic plan aimed to 
secure sustained economic growth and the strengthen-
ing of international competitiveness. It identified five 
so-called ‘key strategic thrusts’ for R&D, including: 221 (1) 
more resources for R&D; (2) focus on selected areas of 
economic importance; (3) balance of investigator-led 
and mission-oriented research; (4) encouragement of 
more private sector R&D; (5) support for development of 
linkages between knowledge institutions and industry. 

The STP 2010 also included some quantitative targets. 
For instance, the government aimed to increase the GERD 
rate from 2.6 per cent in 2006 to 3 per cent. The private sector was requested to be the 
most important driver for S&T, funding two-thirds of 
total R&D. In addition, the STP 2010 aimed to increase 
the number of research personnel and the scientific 
output. In order to achieve these objectives, the govern-
ment planned to invest US$15.5 billion over the programme’s 
duration. The NRF received US$5 billion to fund new 
growth areas such as water and digital media technolo-
gy. The programme’s overall budget of US$5.6 billion 
was allocated S$1.45 billion for its academic institu-
tions, while the MTI was provided with the largest share 
of S$3.75 billion to promote R&D through A*STAR and 
the EDB. 222

Under the STP 2010, various programmes were 
conducted to enhance the identified strategic thrusts. 
The three research programmes coordinated by the 
NRF/RIEC are the Biomedical Sciences Translational and 
Clinical Research, the Environmental and Water 
Technologies (EWT – Clean Water and Clean Energy) 
and the Interactive and Digital Media (IDM). To encour-
ge more private sector R&D, the government strength-
ened the technology capability of SMEs through 
some technical, human resources and financial assist-
ance programmes administered by the SPRING (Stand-
ards, Productivity and Innovation Board). The STP 2010 
also requested the establishment of stronger linkages 
between SMEs and research institutes. 223

For the on-going five year plan 2011–2015 the R&D 
budget has been increased by 20 per cent above that 
of the STP 2010. At the presentation of the budget in 2010, 
the Prime Minister stressed the growing importance of 
R&D in Singapore’s development and the need to solve 
complex national challenges with R&D – such as the is-
sues of energy resilience for sustainable growth. By ex-
panding private sector R&D, the new five-year plan re-
quests that total R&D should attain 5.5 per cent of GDP 
by 2015. 224 The S&T input and output indicators clearly show the 
outstanding position of Singapore among the member 
countries of the ASEAN. However, from the impact of the 

global financial crisis, Singapore’s economy contracted 
by 5.1 per cent in 2009 and business expenditure on 
R&D fell by 27.5 per cent. This led to the GERD’s over-
all decline to 2.3 per cent in 2009 compared to 2.6 per 
cent a year earlier. Out of the total GERD of around S$6.6 

billion, business expenditure on R&D (BERD) amounted 

to S$3.7 billion. The private sector’s largest share of 

R&D was in the fields of electronics and ICM, biomi-

do logical sciences, precision and transport and 

chemicals. 225 MNCs are still the most important contribu-

tors to private sector R&D, accounting for about three-quarters of 

R&D in 2009. In contrast, indigenous Singaporean firms 

remained strongly dependent on technological knowl-
dge produced by MNCs operating in Singapore. 226

The public sector, including 60 institutions for 

research, higher learning, hospitals and so on, increased 
its R&D budget by 15.4 per cent to US$2.5 billion. 

246

Their research was concentrated on similar fields to 

the GRI’s, but with a slightly different ranking of priorities 

with regard to research funding. The largest share 

was allocated to biomedical sciences, followed by chemis-

tries and ICM, precision and transport and chemicals. 

Singapore also has an advantage in terms of researcher 

intensity. Measured in full-time Equivalent/1,000 labour 

force, Singapore’s researcher intensity grew from 9.5 

in 2008 to 10.1 in 2009. This compares very favourably 

with other ASEAN member states and even with the

239 Chaturvedi, Sachin (2015): Evolving a National System of Biotechnol-
gy Innovation: Some Evidence from Singapore, in: Science, Technology 
and Society 10(1), pp. 109–111
240 OECD (2016): Science and Technology Policy 
241 OECD (2013): Science and Technology Policies for Growth 
242 OECD (2010): Science and Technology in the Development Policy 

239 Chaturvedi, Sachin (2015): Evolving a National System of Biotechnol-
gy Innovation: Some Evidence from Singapore, in: Science, Technology 
and Society 10(1), pp. 109–111
240 OECD (2016): Science and Technology Policy 
241 OECD (2013): Science and Technology Policies for Growth 
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239 Chaturvedi, Sachin (2015): Evolving a National System of Biotechnol-
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239 Chaturvedi, Sachin (2015): Evolving a National System of Biotechnol-
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239 Chaturvedi, Sachin (2015): Evolving a National System of Biotechnol-
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and Society 10(1), pp. 109–111
240 OECD (2016): Science and Technology Policy 
241 OECD (2013): Science and Technology Policies for Growth 
242 OECD (2010): Science and Technology in the Development Policy
other leading countries in innovation — for example, the USA (9.2 in 2007), South Korea (9.7) and Sweden (9.8).\(^\text{140}\)

In sum, Singapore has become one of the most competitive countries in the world in these domains and is in close proximity with some of the world’s leading countries in innovation. Several factors led to this developmental path, including a strong focus on national S&T policy and development within the ASEAN region. Despite the impressive progress made, though, the city-state’s ranking in the World Economic Forum’s (WEF) Global Competitiveness Report 2011–2012 points to some weaknesses in the innovation policy and system. While Singapore ranked second in terms of overall competitiveness, it was only eighth in innovation. The WEF’s critique was focused on the country’s capacity for innovation and development, suggesting that it could encourage even stronger adoptions of the latest technologies.\(^\text{141}\)

7.4.5.2 Singapore’s international S&T cooperation policy

Interviews with representatives from governmental organizations (A*STAR and NRF) that were conducted in 2008 confirmed our initial assessment based on the literature review: namely, that international S&T cooperation is high priority for the Singaporean government and key scientists in Singapore. Two topics dominated the discussion with local experts — first, the need to concentrate on new or emerging fields of S&T and, second, the shortage of skilled manpower for R&D and possible strategies to overcome this constraint. In both cases, international cooperation was regarded as being crucial. Up to the highest level of government, the experience of foreign experts and advisors from the academia arena and from leading international companies was actively sought. Foreign experts, for example, were involved in the discussion about the S&T fields Singapore should focus on, providing advice on future technological priorities.

In our graphical assessment of the reasons why Singapore was cooperating in S&T with other countries, governmental organizations placed great emphasis on the need for research and development (R&D) cooperation and co-patenting (see figure 92). In all three areas, the government has designed specific policies — including a strict regime for the protection of intellectual property rights (IPR) and incentives for foreign companies to invest in R&D. In contrast to most other ASEAN member countries, global thematic priorities were regarded as much more important than country-specific priorities, a reality which fits with the city-state’s overall policy of seeking specific S&T niches. It is interesting to note that funding was given a secondary ranking as a reason for international S&T cooperation. Considering Singapore’s overall budget for R&D, this did not come as a surprise.

In the discussion with governmental agencies, the shortage of skilled manpower for R&D was stressed as one of the core motivations for Singapore’s search for international S&T cooperation. With the growth of knowledge-intensive industries relying on R&D, this problem became very urgent. In order to be attractive for investment from high-tech MNCs, the shortage of home-grown scientists had to be quickly addressed. In 2008, around 80 per cent of Ph.D. students came from foreign countries. The main reason for this development is the strong preference of local graduates to enter directly into the business world instead of becoming PhD students. The Singaporean government reacted to this problem by designing a special programme (the ‘Singha’ programme for graduates) that enabled them to study abroad or alternatively to enter global networks. In addition, activities to attract foreign researchers and students to work and study in Singapore were intensified as well.

A complex web of capacity-building programmes at universities, polytechnics and research institutes has been created by the government in order to increase the number of home-grown scientists. A*STAR is heavily involved in attracting foreign scientists and encourages Singaporean students, at all levels, to go abroad. The NRF provides block grants for specific S&T fields. The NRF Research Fellowship Scheme is a globally competitive programme that enables young researchers to undertake independent research in Singapore. The programme CREATE (Campus for Research Excellence and Technological Enterprise) aims to bring the world’s top research universities to Singapore to work together with Singapore’s universities and research institutions. The NRF also encouraged the establishment of Research Centres of Excellence (RCEs) at Singapore universities, staffed with renowned international scientists. The RCEs’ directors are given an attractive R&D budget, which they can spend independently, for example, to invite top scientists from around the world.

![Figure 99: Reasons for international S&T cooperation: the view of scientists in Singapore](source: Authors’ own assessment based on interviews)

Figure 99: Reasons for international S&T cooperation: the view of government and international institutions in Singapore

For scientists working in high-level positions in GIs or universities, finding well-trained researchers and students for laboratory work was one of the major challenges. Foreign scientists — for example, from Europe and the US — greatly appreciated the comfortable funding situation and the well-equipped labs. Most of them found the environment that they work in very conducive to R&D. However, some of them had their doubts about whether the administration had a comprehensive understanding of the requirements and benefits of basic research, as well as its long-term design.

Fields of international S&T cooperation most important for Singapore

The government’s preferences in international S&T cooperation were based on the three strategic areas of research coordinated by RIEC, which are: biomedical sciences, translational and clinical research, environmental and water technologies and interactive and digital media. In addition to this top-down approach, the NRF supported individual research activities through programmes such as CREATE and fellowship schemes. This bottom-up approach was intended to make sure that new research other than those currently supported could be identified.

![Figure 95: Reasons for international S&T cooperation: the view of scientists in Singapore](source: Authors’ own assessment based on interviews)

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That Singaporeans have a strong tendency to study and work in Japan, the Netherlands, Norway, Sweden and Switzerland. The universities established international cooperation for student and researcher exchanges. For GRIs, in contrast, some special incentives existed to cooperate with foreign universities and research institutions. Although students from Singapore were able to choose whichever country they wanted to study in, they preferred the Netherlands and the US, according to some interview partners, the third most important geographical destination for students wanting to study abroad was Japan. In summary, the questions of why Singapore is engaged in international S&T cooperation, what its most important partners are in S&T, and which fields of cooperation are preferred can be answered as follows:

- International S&T cooperation is the key to Singapore’s economic and technological success and is strongly supported by the government.
- Attracting and keeping experts in those S&T fields in which Singapore wants to become internationally competitive is one of the biggest challenges facing the city-state in the global race to secure the best experts.
- Biomedical research in particular requires highly qualified scientists with a good reputation who can sell Singapore to other well-known scientists to come to Singapore.
- As the government offers comprehensive funding for the strategic fields of S&T, the inflow of foreign researchers has grown in the last few years.
- While the EU acknowledges that ‘Singapore has emerged as a world-class research performer in its own right’, the incentive problem for scientists in Singapore—because they are no longer eligible for direct FP funding—is often overlooked as being a barrier to cooperation.

7.4 Thailand

7.4.1 Key characteristics of Thailand’s S&T policy and system

Thailand has undergone an impressive economic and social transition that is often cited as one of the great development success stories. As of July 2011, the World Bank re-classified Thailand from a lower-middle income economy to an upper-middle income economy (World Bank, 2011). Thailand’s outward-oriented development strategy proved to be effective for the absorption of foreign direct investment (FDI) and for becoming a global manufacturing hub. Technological spill-overs from MNCs into the Thai economy, as well as indigenous innovation performance, remained, however, limited and were insufficient to ensure further productivity-driven economic growth. Although the need to strengthen S&T capacity has been included in many policy documents by the government since the 1980s, the Asian financial crisis triggered a change in policy direction and led to a restructuring of the research system in many countries (OECD, 2006). The new National Science and Technology Development Agency (NSTDA) as an autonomous organization operating under the policy guidance of its own board, and chaired by the Ministry of Science and Technology (MOST) from 1991, was the first step towards a profound change. The MOST controls the NSTDA through the National Science and Technology Board, which is composed of an equal number of representatives from public and private sectors. The ministry itself was established in 1979 as MOSTE (Ministry of Science, Technology and Energy) and later renamed MOST, reflecting its new focus on S&T. The NSTDA defines itself as a bridge between the academic research and innovation requirements of industry and as an umbrella organization that plans and executes four tasks: namely, R&D, technology transfer, human resources development and infrastructure development. It is involved in the formulation of national S&T policy, the funding of R&D projects and the administration of plans and budgets of the government agencies and societies that are involved in S&T activities.

Clinical Sciences

Historical and cultural ties between China and the Chinese diaspora in Singapore explained the large number of exchange programmes for students and scientists in China. Other extra-scientific factors help to explain why Singapore cooperates closely with its neighbours. As the most technologically-advanced country within the ASEAN, the Singaporean government is committed to cooperating with other ASEAN member states. Research cooperation was concentrated in 2008 on more advanced neighbours such as Malaysia, while exchange programmes at universities and polytechnic institutes were offered to scientists in other ASEAN member countries that are still in the capacity-building stage. When we looked in detail at Singapore’s international S&T cooperation policy, we found that national S&T policy did not specify any preferences for who S&T cooperation partners or regions should be. Singapore’s government agencies were globally oriented. A STAR, for example, picked the best scientists in each research field and approached them directly for cooperation. NRF has no special funding for international networking among scientists. They described their way of finding partners for S&T as a bottom-up process, with universities establishing international cooperation for student and researcher exchanges. For GRIs, in contrast, some special incentives existed to cooperate with foreign universities and research institutions. Although students from Singapore were able to choose whichever country they preferred to study in, they preferred the Netherlands and the US, according to some interview partners, the third most important geographical destination for students wanting to study abroad was Japan.

Universities’ international cooperation policies have traditionally been oriented towards bilateral S&T relations as the preferred mode of cooperation, and not towards regional or continental partnerships. Yet, in recent years, the NTU and NUS have significantly increased their activities in international S&T cooperation, what its most important partners are in S&T, and which fields of cooperation are preferred can be answered as follows:

- International S&T cooperation is the key to Singapore’s economic and technological success and is strongly supported by the government.
- Attracting and keeping experts in those S&T fields in which Singapore wants to become internationally competitive is one of the biggest challenges facing the city-state in the global race to secure the best experts.
- Biomedical research in particular requires highly qualified scientists with a good reputation who can sell Singapore to other well-known scientists to come to Singapore.
- As the government offers comprehensive funding for the strategic fields of S&T, the inflow of foreign researchers has grown in the last few years.
- While the EU acknowledges that ‘Singapore has emerged as a world-class research performer in its own right’, the incentive problem for scientists in Singapore—because they are no longer eligible for direct FP funding—is often overlooked as being a barrier to cooperation.

7.4.6 Thailand

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ivation of four national research centres. These centres were established between 1995 and 2005 and represent the core technologies on which government support is concentrated: namely, BIOTEC, MITEC (for metal and materials technologies, and computer technology), NANO Tecnology, and TMC (Technology Management Centre). Another step towards an institutional structure that offers better support to Thailand’s transition to an innovation-driven economy was the establishment of the National Innovation Agency (NIA) in October 2003. Similar to the NSTDA, the NIA was also set up by the MOST as an autonomous agency, operating under the supervision and policy guidance of the National Innovation Board. Since September 2009, NIA has been upgraded to a public organization, but remained under the MOST’s umbrella policy guidance. The NIA focuses on strategic and sectoral industrial innovation, national productivity, the coordination of industrial clusters at policy and operational levels and on the fostering of a culture of innovation. Under the roof of NIA two funding schemes have been merged: the Innovation Development Fund, previously attached to NSTDA, and the Revolving Fund of Research and Technology Development, formerly under the direction of the Office of MOST’s Permanent Secretary. Both funds are now combined and coordinated by NIA for the support of innovation development, specifically strategic innovation and cluster platforms. NIA follows three main goals: (1) the access to foreign technology, (2) the promotion of Thailand as an innovation culture and awareness of innovation, and (3) the development of the national innovation ecosystem.

The institutes of higher education play only a minor role in R&D. Most research is concentrated in a few large universities located in the country’s capital, Bangkok. In 2009, the Ministry of Education launched the National Research & Development Board to create a national coordinating agency for fostering research capacity building, especially human resources in research and innovation. The nine universities selected include Chiang Mai University, Chulalongkorn University, Kasetsart University, King Mongkut Institute of Technology Thonburi, Kohn Kaen University, Mahidol University, Prince of Songkla University, Suranaree University of Technology and Thammasart University.266 Critics of the R&D performance of the higher education sector point to the low proportion of S&T graduates compared to social science graduates and to the insufficient participation of industry in curriculum development at universities. This has let to the industrial sector’s negative perception of the role that the higher education sector could play in cooperation with companies. Due to a change in government policy towards the higher education sector, comprising the universities’ greater autonomy, the introduction of a performance-based funding system and the establishment of the University Business Incubator Programme, the climate for closer cooperation between companies and universities was improved.267 Close university–industry linkages were, however, found only among a few large firms.268

The private sector is still investing very little in technological development in Thailand. Between 1999 and 2005 the business sector’s share of GERD even declined. This seems to be a reflection of both structural problems in the manufacturing industry and the predominance of small enterprises that are not willing or able to invest in R&D. The percentage of Thai firms doing process innovation is very low (2.9 per cent) compared, for example, to companies in South Korea (21 per cent). Only in recent years has this situation changed to some extent with more large conglomerates investing in R&D and a stronger R&D collaboration between small firms and universities.269 According to the most recent survey of R&D expenditure, the business sector contributed 55 per cent of total R&D in 2007.270 MANC still play an important role in the transfer of technology. According to information from the NSTD in 2008, about half of the R&D occurring in the business sector can be attributed to foreign owned companies. The NSTD and the NSTDA are responsible for raising foreign technology and for setting up technology policies and fiscal policies related to technological cooperation. However, the low absorptive capacity of local firms has not allowed for many spillover effects from FDI.266 Although the idea of S&T funding of the private sector can be found in most of Thailand’s five-year development plans, it was only after the Asian financial crisis that specific policies were introduced to encourage R&D. The benefit is expected to encourage the establishment of intermediaries such as science parks, and to strengthen the country’s long-term competitiveness. The objectives of this plan, as well as MOST’s ‘vision’ statement, can be interpreted as an adjustment of the government’s S&T policy in order to better cope with the increased competition from within the greater Asian region—especially from China—as well as that of the projects to be focused on. This plan sets a target that R&D spending should reach 0.5 per cent of GDP in the period 2003–2007. The plan states that the R&D expenditure should be split between industry and government funding of 45 per cent to 55 per cent. The government has also a R&D investment goal of 0.5 per cent of GDP in the period 2007–2011. The government’s S&T policy since the 1990s. An important new policy direction was the introduction of a performance-based funding system and the establishment of the National Innovation Agency (NIA) in October 2003. The new long-term STI policy for the period 2012–2021 is currently under discussion. Given the many changes in the government, the current long-term STI policy will continue to change in the near future. The German Development Institute, Bonn, pp. 1–14, available online at: http://www.garrettstokes.com/wp-content/uploads/2010/04/Thailands-National-Innovation_Policy-Act.pdf, most recent access date: 31 August 2011

269 Lorlowhakarn, Supachai / Ellis, Wyn (2005): Thailand’s National innovation system: the Thai-German Programme for Enterprise Competitiveness, Bangkok, p. 60


7.4.6.2 Thailand’s international S&T cooperation policy

Thailand has traditionally been open to the transfer of technology by MNCs, which required liberal economic...
Thai scientists’ views on the reasons for international S&T cooperation diverged to some extent from those of the interviewee governments (see figure 94). The three most important reasons for collaborating with foreign colleagues were: (1) access to new S&T, (2) access to collaboration networks and (3) research capabilities and funding. Still important, but placed on a lower level of significance, was access to research infrastructure, the exchange of students and reputation. The exchange of research personnel and increases in co-publishing and scientific publications were rated as being of the lowest importance as well. The exchange of research personnel received such a low rating as a reason for international S&T cooperation as came as a surprise to us. Thai people in general — as was explained to us during our interviews in 2008 — were not very eager to stay abroad after their studies had finished because of adverse living conditions. Nevertheless, over the last few years the exodus of Thai scientists has increased and represents both a challenge and opportunity for the government. 172

Figure 94: Reasons for international S&T cooperation: the view of government representatives in Thailand Source: Authors’ own assessment based on information from interviews and questionnaires

 Preference for specific fields and partners in international S&T cooperation

When discussing international cooperation, governmental representatives listed the most important S&T priorities: health, food, including agriculture; bio- and nanotechnology; energy; environment; and ICT.

The international networking of governmental agencies such as NSTDA was very extensive in 2008, including connections with more than 15 countries as well as with multilateral agencies and programmes (for example, AIDSEAN COST and the Asia-Pacific Economic Co-operation (APEC) Industrial Science and Technology Working Group (ISTWG)). In interviews with government representatives, we learned that countries were basically chosen as cooperation partners on the basis of their S&T strength in particular technologies. In MOST’s assessment of the intensity of S&T cooperation with specific countries or regions, the ASEAN, India and Japan were given the highest rating. Networking and the mobility of researchers were chosen as the most important reasons for cooperation. Only in relation to cooperation with the ASEAN was access to funding also mentioned as a reason for cooperation.

A strong S&T relationship existed with Japan, the technological leader in Asia. Japan is also one of Thailand’s most important economic partners. FDI from Japan constitutes the largest share of total investment from overseas. The institutional relationship between the NSTDA and Japan (with the National Institute of Advanced Industrial Science and Technology, AIST) revolves around a MoU. Japan is also driving the discussions on international cooperation in SEA. The Japanese Society for the Promotion of Science (JSPS) organized a conference in Bangkok in February 2008 entitled, ‘International Collaboration for the Formation and Development of a Science and Technology Community in Southeast Asia’. Alongside the NSTDA, S&T organisations from Indonesia, the Philippines, Singapore and Vietnam also attended this conference.

Thailand also has a long-standing S&T relationship with the US, based on an S&T agreement that was signed in 1984. Through a Thai-US network (Wisconsin Alumni Association of Thailand (WAAT) and the Wisconsin Alumni Thailand Foundation (WATF), human resource development is supported. The length of the awarded scholarship is one year; participants are scholars and university administrators.

Table 19: Thailand’s most important partner countries and regions in selected S&T fields

This table. We can only assume that the reason for this is that up until now no concrete S&T cooperation has been undertaken.

Table 19: Thailand’s most important partner countries and regions in selected S&T fields

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<tr>
<th>Field</th>
<th>Australia</th>
<th>Korea</th>
<th>China</th>
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<td>Agriculture and Fisheries</td>
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<td>Nontoxicology, Minerals and New Production Technologies</td>
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</table>
7.4.7.1 Key characteristics of Vietnam’s S&T policy and S&T activities.

• The choice of cooperation partners is primarily based on their strength in a particular S&T field, not on historical or extra-scientific reasons.

• Japan is Thailand’s largest source of FDI and ODA.

7.4.7 Vietnam

7.4.7.1 Key characteristics of Vietnam’s S&T policy and system

Vietnam’s outward-oriented market transition has supported economic growth and the gradual upgrading of the country to a lower-middle income economy. Based on the World Bank’s means of income classification (the means of incomes amounted to US$ 1,100 in 2010 and has, thus, passed the threshold for lower-middle income economies, which ranges from US$1,006 to 3,766). In November 2006, Vietnam became a member of the World Trade Organization (WTO), marking a final step towards its integration into the global economy.

As with other countries in transition, the change from state planning to a market-oriented system has led to a change in S&T policy directions and institutional actors. The Ministry of Science and Technology (MOST) plays a prominent role in policy formulation and implementation, but its position seems to be not as strong as in other countries. Policy directions are set by the Communist Party of Vietnam and the central government (See figure 96). The Committee on Science, Technology and the Environment of the National Assembly (MOST) is responsible for the allocation and specific financial mechanisms for S&T activities. The Ministry of Planning and Investment has the task of instructing ministries, ministerial agencies and agencies under the control of the central government in order to integrate S&T development plans into regular socio-economic development plans, as well as coordinating with the MOST in the allocation of funds for S&T infrastructure projects. The Ministry of Education and Training and training coordinators, together with the MOST, the plans and policies related to human resources for S&T and to research academies of the nation’s universities. Other line ministries include the Ministry of Industry, the Ministry of Agriculture and Rural Development and the Ministry of Post and Telecommunications.

There are also a number of advisory bodies, including the National Council for Science and Technology and the National Institute for Science and Technology Policy and Strategy Studies (NISTPASS). The latter is subordinated to the MOST and has the mandate to undertake research so as to provide the foundations for developing S&T strategy, policy and management. One of the more recent activities of NISTPASS was a seminar with the Chinese MOST on ‘sharing China’s experience in the process of formulating strategies to develop science and technology’ (S&T), held at the end of August 2011. R&D funding institutions have been set up in Vietnam as well – including the National Fund for Technology Transfer in 2006, which has, however, not yet started its activities. There are also the National Fund for Science and Technology Support, the National Programs for Science and Technology Development, the National Centre for Technology Promotion, and the National Program for Laboratory Development, which are all subordinated to line ministries or other governmental agencies. Funding for basic research is supplied by the National Foundation for Science and Technology Development. The agency in charge of information about S&T, documentation and statistics is the National Agency for Science and Technology Information (NASATI). GRIs play a predominant role in Vietnam’s innovation system, and the two national research centres include many of them. The Vietnamese Academy of Science and Technology (VAST) represents one of these centres, focusing on natural and engineering sciences. It receives direct funding from the central government in order to carry out the so-called ‘state S&T missions.’ The VAST has 30 national institutes and seven non-academic units (including, for example, the Vietnamese National Museum of Nature, a publishing house for S&T publications, etc.), nine state-owned enterprises, more than 20 ‘production units’ and 35 institute branches, which are mostly located in Hanoi and Ho Chi Minh City. VAST established these enterprises and institutions of higher education after 1992, in reaction to the reform of the S&T structure that allowed GRIs to establish commercial spin-offs. In 2008, total employment amounted to 2,464 permanent staff, including 207 professors and academicians. According to VAST’s 2011 report, 6 GRIs with research fields approved by the prime minister comprise, for example, IT and automation, S&T in materials, eco-agriculture and biotechnology, natural disaster prevention, environment technology and space research. The other significant national research centre is the Vietnamese Academy of Social Sciences (VASS). In 2003, this research centre employed a staff of 1,580 people and was subordinated to the MOST. The VASS is an executive body of the former Vietnam Academy of Agricultural Research and Development for the Mekong River Delta. The Vietnamese business sector’s role in innovation is also rather small and is incapable of undertaking investment in R&D, while research by MNCs is mostly done not in Vietnam but in their overseas headquarters. In 2005, only per cent of scientists and engineers working in the business sector were engaged in R&D, while more than two-thirds worked in national centres for R&D, governmental agencies and universities.

In sum, the questions of why Thailand is engaged in international S&T cooperation, what the most important partners or regions in S&T are, and which fields of cooperation are preferred can be answered as follows:

• International S&T cooperation is regarded as crucial for Thailand’s technological catching-up.

• The choice of cooperation partners is primarily based on their strength in a particular S&T field, not on historical or extra-scientific reasons.

• Japan is Thailand’s largest source of FDI and ODA and its most important S&T partner.

• The FP application procedures are regarded as being very difficult, access to information on potential cooperation partners in Europe is also limited.

273 See figure 96. Vietnam’s national system of innovation

Source: Nguyễn Thanh Tung, MOST.


274 NISTPASS Website, available online at: http://www.nistpass.gov.vn/, most recent access date: 29 September 2011.


278 Ibid.


280 See NISTPASS Website, available online at: http://www.nistpass.gov.vn/, most recent access date: 29 September 2011.


285 Ibid.


287 Ibid.

288 Ibid.

289 Ibid.

290 Ibid.

291 Ibid.
The Vietnamese government has given international S&T cooperation a prominent place in overall policy making. In the introduction to its long-term S&T development strategy, the MOST stressed the importance of international S&T integration. During our study visit to Vietnam in 2008 we found that government representatives were very much in favour of international collaboration. They see an urgent need to bring Vietnamese scientists into closer contact with the global community, by creating and supporting transnational scientific networks. In addition to the MOST scholarship programme that enables Vietnamese students to train abroad, as well as special programmes by a number of line ministries, the MOST itself has a budget for matching selected projects. To assist scientists in their research, the MOST recently acquired the licences for the Web of Science, the world’s leading citation databases. The National Centre for Scientific and Technological Information (NACESTI), part of the MOST, also organizes training courses on how to publish in international journals.

When discussing some of the major reasons for international collaboration, government representatives put most emphasis on transnational learning, country-specific priorities and the acquisition of funding (see figure 97). Other important reasons included thematic priorities and innovation benchmarking, while co-patenting was ranked as being less important as a reason for international collaboration in S&T.

Figure 97: Reasons for international S&T cooperation: the view of scientists in Vietnam

Source: Authors’ own assessment based on information from interviews and questionnaires

Fields of international S&T cooperation

The main areas of international S&T cooperation cited by our interviewees were: 1) ICT, with a focus on software development; 2) biotechnology, with a focus on the application of biotechnology, new crops, seeds, and so on; 3) health, with a focus on tropical diseases; 4) advanced materials; 5) automation and electronical- mechanical technologies; 6) atomic energy and new energy; 7) space technologies; and, 8) mechanical-machinery technologies. These priorities were also listed in the long-term strategy up to 2010.

Preferences for specific partners in international S&T cooperation

In our discussions with government representatives we learned that a shift in partners and regions in international S&T cooperation has taken place over the last few decades. Before the Vietnam War (which began in 1959) and directly after it (it ended in 1975), collaboration with European countries in the form of technical assistance dominated. Projects were sponsored mainly by Finland, France, Germany, Italy, the Netherlands, Sweden, and the UK. In addition, France and the UK were interested in training for public personnel. Cooperation with Russia and with a number of Eastern European countries was quite strong during the Cold War, and even still exists, especially with the Czech Republic and Poland. In terms of funding, the EU, Japan and the US were the most important cooperation partners. Because of the limited S&T budget and the lack of human resources, there was still a strong interest on the side of the government in capacity-building projects, especially the training of Vietnamese scientists. Bilateral and multilateral cooperation projects (with the ADB, Red Cross, UN, UNIDO and the World Bank) were, therefore, often still financed through ODA.

Some sources also pointed to a shift in S&T cooperation partners. While, until the end of the 1980s, Eastern Europe and the former Soviet Union were the most important S&T partners for Vietnam, more collaboration with Asia, Europe and North America has since taken place. Each of the research institutes that the authors visited had already established S&T cooperation linkages with these countries and regions.

For political reasons, official research collaboration with the US only began in 2001 with the signing of the Vietnam-US Agreement on Science and Technology Cooperation. In May 2006, a ‘Vietnam–US Science and Technology Day’ was held, and research fields and initial findings were presented. According to the MOST, cooperation on following fields was included: information technology, standardization and measurement, marine studies, hydrometeorology and environment, public health, agriculture, biotechnology, education and research exchange. Through the Vietnam Education Fund, masters- and doctoral-level courses were offered in the US. Compared to bilateral cooperation with other S&T partners, with the US this type of cooperation was perceived as being different from the MOST, because most US actors were from private enterprises. Funding came from a variety of different sources, including universities and philanthropic foundations that have offered support for education and public health.

Cooperation with ASEAN member states started a few years ago. There are some collaborative projects with Thailand, for example, in the field of agriculture and health care. Research collaboration with the EU is regarded as becoming very important now that the process of integration within the EU has been essentially completed, and thus several of Vietnam’s former Eastern European cooperation partners are now part
In sum, the questions of why Vietnam is engaged in international S&T cooperation, what the most important partners or regions in S&T are, and which fields of cooperation were preferred were answered in 2008 as follows:

- With the transition to an outward-oriented market economy, there has been a shift towards a strategy of open technonationalism.
- S&T cooperation was assessed by Vietnamese interview partners as being of crucial importance and is supported by the government.
- The choice of cooperation partners has diversified from Eastern European countries and Russia to include other European countries and the US.
- Access to funding, research infrastructure and research capabilities all play a major role in scientists’ choice of cooperation partners.
- Although there is a positive perception of Europe, cooperation with China and Japan is increasing significantly. Geographical and cultural proximity are among the reasons for this.
- Vietnamese GRs and individual scientists are eager to cooperate with international partners and are prepared to take on a ‘junior partner’ role for the time being.

7.5 Conclusion and policy recommendations

Southeast Asia is a region in transition, and one consisting of countries with huge differences in their degrees of economic and scientific development. While some countries already belong to the S&T frontrunners, others are rapidly catching up, but in that are starting from a very low level of innovation. Our study of the S&T policies of the seven ASEAN member states and the ASEAN as a regional grouping demonstrates that governmental actors are very aware of the opportunities that the globalization of R&D and international S&T collaboration used by these countries should be studied carefully, so as to have a more precise understanding of exactly how and why S&T are evolving within and between the ASEAN member states, while even more collaboration with external dialogue partners such as the EU will also be crucial. In the case of bi-regional S&T collaboration, the access to research networks that include EU scientists, to education and training as well as to research funding programmes represent ‘pull’ factors that makes this cooperation attractive for the ASEAN.

However, other leading global technology powers (for example, Japan and the US), as well as newly-emerging ones (such as China and South Korea), are actively engaged in fostering new forms of S&T cooperation with the EU. Successful mechanisms of cooperation used by these countries should be studied carefully, so as to have a more precise understanding of the EU’s and why S&T are evolving within and between the ASEAN member states, while even more collaboration with external dialogue partners such as the EU will also be crucial. In the case of bi-regional S&T collaboration, the access to research networks that include EU scientists, to education and training as well as to research funding programmes represent ‘pull’ factors that makes this cooperation attractive for the ASEAN.

Although the ASEAN has set up an institution-al framework for international S&T cooperation, each country has its own policy focus, preferences for S&T partners and strategies. Any preferences for S&T collaboration with specific countries or regions seem to have been shifting in most of the ASEAN member states in recent years. Historical ties with EU countries have played a role to a certain extent, but changes in foreign policy relations and increasing global competitive pressure have definitely had an influence on the design of bilateral and international S&T cooperation. Today, most policy-makers in the ASEAN member states strive for cooperation with those partners who hold a leading global position in specific research fields. As their global integration becomes stronger, ASEAN member states’ choice of international S&T cooperation partners has diversified. In the ASEAN’s competitive S&T arena, countries that want to be at the forefront of S&T innovation have to tackle the very significant issues of brain gain and brain drain.

While most ASEAN member states have no published policies on their international S&T strategies, this issue has gained much importance in recent years as countries have tried to position themselves regionally and globally as competitive players. Through bilateral S&T agreements and MoUs, governments in the ASEAN region have been trying to reduce the burden and costs of establishing international scientific networks for the individual scientist.

Scientists in the ASEAN 5 countries tend to pursue their own academic agenda in order to join international networks, more or less regardless of official policy preferences. Due to the globalization of research and the adoption of international standards in R&D, academic recognition has become an important push factor for entering into international research collaboration. Although scientists from the ASEAN region are pulled abroad by leading-edge research equipment and researchers, international S&T collaboration tends to be significantly connected with alumni networks, personal ties to foreign academic supervisors and to access to funding. Due to the paucity of information on international funding possibilities and the lack of access to scientific networks, scientists in less developed ASEAN member states often rely on established connections with former colleagues and supervisors abroad. Personal contacts, as an important trust-building measure, frequently play a crucial role in establishing and maintaining transnational scientific networks.

There is often an asymptoting between expectations and interests in international S&T cooperation, as ASEAN scientists strive to work in long-term programmes with structural follow-up whereas non-ASEAN scientists tend to see the region as providing transnational scientific networks. Scientists in the ASEAN region find face-to-face monitoring in accompanies to cooperation projects more helpful than inflexible bureaucratic reporting procedures, which they consider to be a burden and to indicate a lack of trust. EU strategies for closer S&T cooperation with SEA countries should, therefore, take into account not only different economic and S&T development levels, but also the different cultural approaches to cooperation.

Voices from Governmental Institutions and Scientists in Vietnam on International S&T Cooperation

Governmental institutions: “Regarding the participation in previous FPs, the top-down approach of the government failed. The ministry itself did not have a comprehensive understanding of the programme and was not focused on the collaboration with the EU. Now that Europe has completed its regional integration and is becoming an increasingly important S&T partner for Vietnam, the government will put more energy into supporting scientists’ applications to FP7.”

Source: Face-to-face interview with representatives from the MOST

Vietnamese Academy of Science and Technology (MOST) Vietnam’s Academy of Science and Technology (MOST) with VAST, international cooperation is always regarded as an important factor to build its capabilities. From 1991 to 2004, VAST established new partnerships with JSPS, JAIST, AIST (Japan), KOSEF (South Korea), CSIRO and RMIT (Australia), CNR (Italy), CEA (France), and some other foreign institutions, which provided funds for VAST’s staff training and research. This cooperation has been of great significance to VAST’s capacity building. In addition, many scientific institutions in Asia, Europe and North America signed agreements of cooperation with VAST.”

Source: Vietnamese Academy of Science and Technology/International Cooperation

7 COOPERATION POLICY
8 The role of EU-ASEAN scientific cooperation in tackling global challenges

Rapela Zaman, Tessa Gardner

8.1 Executive summary

This chapter aims to complement other qualitative and quantitative analysis presented in this booklet. Here we take a case study approach, to explore the challenges, opportunities, and their implications for bi-regional scientific cooperation on global challenges. The conclusions and recommendations are broadly supportive of and consistent with those set out in other chapters in this booklet.

Overall, we argue that owing to its rapidly developing scientific credentials and its unique set of populations, geographic and environmental features, the ASEAN region is a key region for scientific cooperation on global challenges such as climate change, biodiversity, water and food security and health.

It is encouraging that the EU already leads scientific co-authorship with the region; ahead of the US and the rest of the European continent. There is however a gap in the scope to improve the quality of partnerships in global challenges in the face of increasing competition.

Recommendation 1: Successor(s) to the Framework Programme should continue to remain open to participation from ASEAN Member States. This sends an important signal that the EU remains open and committed to building relations with the ASEAN region. A sustained long-term commitment will allow for a more comprehensive approach and it is a unique selling point for bi-regional collaboration.

Recommendation 2: The European Commission should also consider scope for Specific International Cooperation Actions (or similar actions) for global challenge research that permit greater integration of South-east Asian research effort. The specific themes and aims for such actions should be co-defined by the two regions, and should build on existing regional frameworks.

Recommendation 5: EU Member States should be encouraged to nurture bilateral research collaboration on global challenges with the ASEAN region. These play an important role in wider bi-regional cooperation.

Recommendation 4: The European Commission and Member States should consider actions (such as bibliometric analysis or other on-line social networking tools) to ensure that current research and collaboration trends are visible to interested parties.

Recommendation 5: The potential wider benefits of scientific research collaboration on global challenges (e.g. tangible impact on local communities) should be recognised and be coupled with an assessment of how funding and collaboration approaches (successors of the FP) can be modified. New forms of global challenge research cooperation beyond the scope of the Framework Programme, through for example READI (the non-trade related political dialogue) or through other cross-Directorate mechanisms (e.g. innovation platforms), that permit a multidisciplinary ‘systems approach’ to problem solving are needed.

Recommendation 6: A proportion of bi-regional research effort should aim to deliver tangible impacts for managing global challenges and help towards effecting practical outcomes. This may require more flexibility in the design and approach to specific projects and should take account of policy and local contexts.

Recommendation 7: A diverse range of links to local stakeholders or local networks should be encouraged, and include non-scientists, citizens and civil society groups. These could be engaged through, for example, advisory boards which may also help inform the research effort. Consideration should also be given to the important role of grey literature in informing and disseminating research.

Recommendation 8: Consideration should be given to the allocation of follow-on grants (similar to those deployed by the European Research Council) to encourage researchers to engage in high quality dissemination and knowledge transfer.

Recommendation 9: There should be sufficient time during project proposals to allow participants to identify suitable collaboration partners. There may be a role for Member State’s Embassy representatives, EU Delegation representatives and National Contact Points.

Recommendation 10: The EU should support ASEAN-COST in their continued development of multi-disciplinary centres of excellence, and research platforms across the ASEAN region.

Recommendation 11: Recognising that strong research relations can take years to mature, where appropriate, the personal interest and commitment of those involved in individuals taking part in projects should be taken into consideration. Sustained commitment and time-spent in country, in both regions should be encouraged and should feature as an integral part of projects where appropriate. This may also require additional opportunities for language training.

Recommendation 12: Harnessing diaspora more effectively for bi-regional cooperation would also help capitalise on existing resources.

8.2 Challenges for global collaboration on global challenges

This section sets out four key challenges for bi-regional science collaboration on global challenges and explains the purpose and approach to this chapter.

8.2.1 Generating and co-ordinating global responses

On 7 February 2011, Māire Geoghegan-Quinn, made her first speech in London as the new European Union’s (EU) Commissioner for Research, Innovation and Science. In her address to leading scientists at the Royal Society, the UK’s national academy of science and one of world’s oldest academies, the Commissioner acknowledged that European research efforts must have the scale and scope to tackle major societal challenges.

The major societal challenges of our time are also the high-tech research priorities of the best laboratories in the world and the practicalities of responding to global challenges on the ground: to have impact and effect real change, appropriate economic, social and political structures and behavioural changes are also needed. But, science has a major role to play in understanding the nature of global challenges. Science can be used to measure effects, predict impacts, assess risks, contribute to problem solving and suggest alternative pathways for action. In recent decades, science-based innovations have eradicated or attempted to eradicate life-threatening diseases, increased agricultural productivity and pioneered low-carbon technologies. They are now in development and set to be deployed by the European Research Council) to encourage researchers to engage in high quality dissemination and knowledge transfer.

Recommendation 9: There should be sufficient time during project proposals to allow participants to identify suitable collaboration partners. There may be a role for Member State’s Embassy representatives, EU Delegation representatives and National Contact Points.

Recommendation 10: The EU should support ASEAN-COST in their continued development of multi-disciplinary centres of excellence, and research platforms across the ASEAN region.

Recommendation 11: Recognising that strong research relations can take years to mature, where appropriate, the personal interest and commitment of those involved in individuals taking part in projects should be taken into consideration. Sustained commitment and time-spent in country, in both regions should be encouraged and should feature as an integral part of projects where appropriate. This may also require additional opportunities for language training.

Recommendation 12: Harnessing diaspora more effectively for bi-regional cooperation would also help capitalise on existing resources.

8.2.2 Bi-regional cooperation

The European Union (EU) and the Association of South-east Asian Nations (ASEAN) are perhaps the two most regionally integrated regions in the world. As other chapters in the booklet have argued, the EU’s formal relationship with the ASEAN is therefore a unique bi-regional partnership. It builds on over 40 years of dialogue on political, security and economic issues and complements a plethora of unilateral, bilateral and multilateral initiatives between the two regions.

The European Commission’s Framework Programmes for Research and Technological Development (FP) has had a major effect on intra-regional European research collaboration. However, the ASEAN equivalent of the EU’s Framework Programme, referred to as the ‘Krabi initiative’ was only recently endorsed in December 2010 and EU-ASEAN bi-regional science cooperation remains a relatively new-comer on the wider EU-ASEAN political agenda. Formal EU-ASEAN science cooperation is currently enabled through the Framework Programme and the Regional EU-ASEAN Dialogue Instrument (READI), which covers non-trade related partnerships.


References

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As the two regions continue to build their regional scientific capacities and capabilities, the challenge for government, scientists, NGOs and others is to identify and access best opportunities and design instruments, to deliver real impact where the need exists.

8.2.3 The role of science and innovation

Science300, and the technology and innovation enabled by science, are key to delivering long-term economic and social development.301 Scientific advice is also a vital asset in governance, through the opportunity to make decisions based on evidence and research.302-304 Since the beginning of the 21st Century, global spending on research has nearly doubled, publications have grown by a third, and the number of researchers continues to increase.305 Over a third of research papers are the direct result of international collaboration.306 In citation terms (a proxy for quality), research collaboration is beneficial. For each international author on an article, there is a corresponding increase in the impact of that paper, up to a tipping point of around 10 authors.307 In other words, science is collaborative and a growing enterprise.

At the same time, we know that the geography of science is changing. Although the traditional scientific superpowers (the USA, Europe and Japan) still lead the field, new players are emerging. Countries like Singapore are making valuable contributions to the global pool of science.

Table 20 below shows the growth in ASEAN research output, which far outpaces EU output from a low base. The average increase in ASEAN stood at over 100% between 2000 and 2007, compared to the EU’s ~25% growth (between 2002 and 2008) and the world average ~35% growth (between 2002 and 2008).308

This increase in scientific activity is both a welcome and essential development in tackling complex challenges like climate change and energy security, where there is no technological solution.309 Moreover, with multiple lines of inquiry across scientific disciplines and regions are vital to understanding how different ways around the world.310

8.2.4 ASEAN’s global challenge scientific cooperation credentials

The ten members of the Association for Southeast Asian Nations (ASEAN) region; Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei, Vietnam, Laos, Myanmar, and Cambodia, represent a critical region for global challenge research.

First, the region is highly populated. The ASEAN region is home to 590 million people, accounting for about 9% of the world’s total population. Indonesia itself is home to a population of 250 million people, and ranks number 4 in the world behind China, India and the US.

Second, its unique geography and combination of rich natural resources sustain essential life support systems for the region and the world. The region holds only 5% of the world’s total landmass but 20% of the world’s biodiversity, rich marine life including the most species-diverse coral reefs in the world, and abundant mineral resources. These vital natural resources play a major role in sustaining a wide range of economic activities and livelihoods (including through oil exploration, commercial and small-scale fisheries, and tourism). This combination of population and geography and demography also leaves the region particularly vulnerable to the effects of some global challenges. For example, as a result of its climate and huge population the ASEAN region carries over a quarter of the world’s burden for infectious and parasitic diseases.

Third, science and technology policy play a central role in the national development strategies for many countries in the region.311-313 and scientific output from the ASEAN region is growing impressively.314 These developments and ASEAN’s recent ‘Krabi Initiative’, aim to increase and intensify intra-regional scientific cooperation315 and are in line with wider initiatives for ASEAN integration by 2025.316

Based on scientific co-authorship, EU cooperation with the region is already doing well, ranking ahead of the USA and nearer neighbours, China, India, Japan, Australia, South Korea and Taiwan. However, recent analysis, as measured by publication output317 shows that EU scientific co-authorship tends not to be in areas of ASEAN research strengths such as nanotechnology, ICT and Industrial Technology. Although Singapore is dominant in these areas, Malaysia and Thailand are active in other areas and research strengths are more diverse. For example with respect to Food, Agriculture, Biotechnology, and Environment, there is widespread research performance across Thailand, Singapore, Malaysia, Philippines, Indonesia and Vietnam.

The challenge for government, scientists, NGOs and others will be to ensure that EU and ASEAN scientists are poised to benefit from research cooperation that is both excellent and relevant to global challenges.

Table 20: Trends in ASEAN science publications (2000-2009)**

<table>
<thead>
<tr>
<th>Country</th>
<th>2000</th>
<th>2007</th>
<th>% growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>5795</td>
<td>5795</td>
<td>0%</td>
</tr>
<tr>
<td>Thailand</td>
<td>702</td>
<td>702</td>
<td>0%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>527</td>
<td>535</td>
<td>4%</td>
</tr>
<tr>
<td>Philippines</td>
<td>344</td>
<td>445</td>
<td>31%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>18</td>
<td>18</td>
<td>0%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>712</td>
<td>1832</td>
<td>157%</td>
</tr>
<tr>
<td>Myanmar</td>
<td>51</td>
<td>59</td>
<td>16%</td>
</tr>
<tr>
<td>Laos</td>
<td>19</td>
<td>21</td>
<td>10%</td>
</tr>
<tr>
<td>Norway</td>
<td>1850</td>
<td>1850</td>
<td>0%</td>
</tr>
<tr>
<td>ASEM Total**</td>
<td>5799</td>
<td>12081</td>
<td>108%</td>
</tr>
</tbody>
</table>

*Articles, reviews, proceedings and notes **Numbers do not add up to total due to co-publications

8.2.5 The purpose of this chapter and a word on our approach

In this chapter we aim to complement the other chapters in this booklet and the extensive country analyses, quantitative and thematic work already produced by the SEA-EU.net project and others.318 We take a case study approach, which includes a selection of European Commission-funded projects and non-European Commission-funded projects that are related to global challenge themes. Our approach is by no means comprehensive, or representative of the range of initiatives between the two regions. This is not a comparative exercise; the projects are not comparable in terms of scale and scope. We accept that there are gaps and our analysis does not prioritise between and within themes. Rather, by reviewing a range of examples across just five themes we hope to complement the findings of other chapters and identify some broader lessons for the design of future global challenge collaboration programmes between the two regions. The five themes chosen (also discussed in other chapters of this book) are climate change, ecosystems and biodiversity, water, food and health. We also include some ‘cross-cutting’ projects, on education and research and information and communication technologies, to complement our thematic understanding. We have selected ten case studies in total and have undertaken thirty interviews with project participants, country experts and other organisations or individuals who have experience of bilateral collaborations between the EU and ASEAN.

A summary of the case studies is presented in table 21 below. The findings of the authors—as well as any mistakes—are entirely the responsibility of the authors.

Table 21: Case study summary

<table>
<thead>
<tr>
<th>Case study</th>
<th>Name</th>
<th>Global challenge theme</th>
<th>Project type (FP/non FP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intergovernmental Panel on Climate Change</td>
<td>Climate Change</td>
<td>Non-FP</td>
</tr>
<tr>
<td>2</td>
<td>South East Asia Rainforest Research Program (SEARRP)</td>
<td>Ecosystems and biodiversity</td>
<td>FP</td>
</tr>
<tr>
<td>3</td>
<td>Developing ubiquitous regenerative systems for Indo-Pacific reefs (REFFRES)</td>
<td>Ecosystems and biodiversity</td>
<td>FP</td>
</tr>
<tr>
<td>4</td>
<td>Cost of Triangle Initiative (CTI)</td>
<td>Ecosystems and biodiversity</td>
<td>Non-FP</td>
</tr>
<tr>
<td>5</td>
<td>EU INCO Integrated Water Resources Management (INCO IWRM)</td>
<td>Water</td>
<td>FP</td>
</tr>
<tr>
<td>6</td>
<td>International Rice Research Institute (IRRI)</td>
<td>Food</td>
<td>Non-FP</td>
</tr>
<tr>
<td>7</td>
<td>Research to support the management of the avian influenza crisis in poultry (FLUAID)</td>
<td>Health</td>
<td>Non-FP</td>
</tr>
<tr>
<td>8</td>
<td>Worldbank/Thailand Major Overseas Programme</td>
<td>Health</td>
<td>Non-FP</td>
</tr>
<tr>
<td>9</td>
<td>Supporting International Networking and Coop- eration in Educational Research (SINCERE)</td>
<td>Cross-cutting issues</td>
<td>FP</td>
</tr>
<tr>
<td>10</td>
<td>EU-South East Asia Coop eration in ICTs (SEACOOP)</td>
<td>Cross-cutting issues</td>
<td>FP</td>
</tr>
</tbody>
</table>
8.3 Global challenge research collaboration opportunities

Having set out the challenges for global collaboration on climate change in the previous section, we present opportunities for collaboration across themes and introduce the case studies.

8.3.1 Climate change

According to the Intergovernmental Panel on Climate Change (IPCC), the earth is likely to warm by 0.2 °C per decade, and to rise by between 0.6 °C and 4 °C by the end of the century.19 The implications are complex and include impact on the environment, such as changes in temperature20 and precipitation patterns,21 rising sea levels,22 ocean acidification,23 and extreme weather effects such as droughts24, heatwaves25, intense rains and floods26, typhoons, and cyclones.27

Climate change will have major implications for the ASEAN population. The region is already experiencing an average temperature increase of 0.1-0.5 °C per decade. This has been coupled with a decrease in rainfall frequency (yet an increase in rainfall intensity) and a sea level rise of 1-3 mm per year.28 These trends pose a threat to coasts and delta regions due to rising sea levels, increased risk of flooding and reduced freshwater availability through salinisation of groundwater and estuaries. Saline intrusion affects over 10 thousand square kilometres of the Mekong Delta29 and coastal erosion is occurring at a rate of up to 25 metres per year in some areas.30

ASEAN is particularly vulnerable to the impacts of climate change due to the concentration of people and economic activities in coastal areas, its rich biological diversity, resource-based economies, and the increased risk especially presented to the poor.31 It is therefore a key partner for climate change research where mitigation and adaptation may be informed by high quality research collaboration and local know-how.

The ASEAN community is ready for regional action on climate change. This is described in the ‘Dra’i environmental cooperation priorities set out in the ASEAN Socio-cultural Community Blueprint 2009-2015. See table below. These priorities will be taken forward by the ASEAN Climate Change Initiative (ACCI), which was established by the ASEAN member states to promote the implementation of the United Nations Framework Convention on Climate Change agreed to by Thailand and reporting to the ASEAN Senior Officials Meeting on the Environment (ASEO). In addition, a framework for cross-sector efforts on climate change is also in place.

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Mainstream solutions to the challenge of climate change have concentrated on reducing carbon emissions and greenhouse gases from transport and energy sectors. These practical approaches can divert attention away from other solutions such as tropical rainforests, tropical wetlands, and coastal habitats that serve as effective carbon stores and sinks. When healthy, these ecosystems maintain essential water services, reduce vulnerability to climate shocks and natural disasters, and increase local and national resilience to climate change. Conversely, deforested and drained ecosystems are a significant source of carbon emissions; an obstacle to stabilising greenhouse gas emissions. A focus on conservation may therefore serve as an effective approach to abating climate change in Southeast Asia, where rich tropical forest cover plays a major role in carbon dioxide uptake from the atmosphere.

Case Study 1: Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the scientific assessment of climate change and its potential environmental and socio-economic impacts. As a model for collaborative working, it represents a significant social innovation. Since its inception in 1988, the IPCC has involved 194 nations, engaged over 4,500 scientists through largely voluntary participation and cited over 40,000 peer reviewed publications. It has harnessed global research to deliver a landmark series of global assessments, and sustained the interest and support of governments across its 30-year history of issues, contributing also to wider public discourse. Significantly, the IPCC has also committed to building a diverse range of expertise. This is particularly true for regions where domestic scientific research capacity is still limited.

8.5.2 Ecosystems and biodiversity

With only 3% of the world’s total landmass, ASEAN’s rich ecosystems provide economic advantage to the local population through the support of species invasion, land-use change, and climate change all contribute to forest cover decline at a rate of about 1% each year. This equates to losing up to 7% of Southeast Asia’s original forests and up to 42% of its biodiversity by 2010.32

Regarding marine environment, Southeast Asia has a range of sea and coastal ecosystems including sand dunes, estuaries, mangroves, coastal mudflats, algal reefs, and coral reefs. With some 650 kilometres of coastline, it holds one third of the world’s grassy areas, which support economically important fisheries and one third of the world’s coral reefs.33 The region’s rich marine ecosystems bring significant economic advantage to the local population through aquaculture, trade, and tourism.34

The high degree of biodiversity generates high productivity from coastal and marine activities, providing a living for around 20 million people and an estimated

19 Intergovernmental Panel on Climate Change (2007).
28 Manton et al. (2001).
annual income of $2.5 billion.154 Coral reefs provide coastal protection from extreme weather, reducing the need for costly coastal defences. The reefs are also of great value to the scientific community; providing an umbrella for various experiments and studies on the effects of forest fragmentation on species diversity. The work done at Da -

the leading reef conservation centres in the tropical world. As a result, it can provide the evidence-based advice needed by policy makers to manage tropical forests, not just in Malaysia, but throughout the entire tropics. An important legacy of Danum Valley is the people that it trains. These come from all over the world but signifi- cantly many of those from Malaysia now occupy posi- tions of influence locally. SEARRP research has attracted generous funding from Sime Darby, a large Malaysian multinational conglomerate, as well as other interna- tional organisations, and its future is secure for many years to come.

Case Study 3: REEFRES – Developing ubiquitous restoration practices for Indo-Pacific reefs

Coral reefs provide the largest source of subsistence to people in the Indo-Pacific region. The aim of the REE- FRES project,154 was to develop novel methods for ac- tive coral reef restoration, to improve the efficiency of those methods (in terms of physical coral restoration and cost), to strengthen local capacity, and to share expertise and facilities amongst the leading research groups around the world.

Second, the project required some high levels of participation from the Royal Society, the UK’s national academy of science and is the re- search base of the Society’s Southeast Asia Rainforest Programme (SEARRP).

In addition, the project was able to involve local people, such as fishermen on a voluntary basis. The strength of local en- gagement was a key factor in the effective use of the research, for example, Thai officials are reported to have used the findings to inform official reef manage- ment and partners from the Philippines are now work- ing on different village education programmes to train local people in reef restoration techniques that revive the reef, fish populations and local livelihoods. Singa- pore is also investigating ways to transplant corals.

Since the project’s completion, participants have offered the following insights: First, most of the practi- cal work was “low-tech” and did not involve or require highly trained or educated people. This meant the project was able to involve local people, such as fishermen on a voluntary basis. The strength of local en- gagement was a key factor in the effective use of the research, for example, Thai officials are reported to have used the findings to inform official reef manage- ment and partners from the Philippines are now work- ing on different village education programmes to train local people in reef restoration techniques that revive the reef, fish populations and local livelihoods. Singa- pore is also investigating ways to transplant corals.

First, governance structures can be complex, but they work for the region. These include summits for Minis- ters, meetings for senior officials, country co-ordinators, national-level co-ordination groups and participation from millennial-level stakeholders (e.g. Ministries for Science, Agriculture, Fisheries, Environment and Natural Resources). Second, countries have their own responsibilities. They each have their own country-level action plans and each country produces ‘State of the Coral Triangle’ annual reports. Third, the initiative de-
water supply and sanitation, and increase competition for water resources. Several of the ASEAN member states are unlikely to meet the Millennium Development Goals relating to drinking water and sanitation.

The ASEAN member states include Thailand, Vietnam, Indonesia, the Philippines, and Cambodia. The scale of the research effort makes this a valuable case of European Commission-funded international thematic research. Lessons reported by those involved in the IWRM independent review include that the ‘EU-INCO water resources development, EuropeAid and Trade’ indeed the scale of the independent review also advocates constructive engagement with those at the user end of the process e.g. those involved in water resources allocation and management. In addition, the review notes that successful international cooperation requires centres of research excellence in partner countries and trained scientists and professionals in the sector. There may be benefits in supporting the continued development of regional platforms (centres of excellence and training) alongside scientific cooperation.

8.5.4 Food

Agriculture accounts for 70% of global freshwater use. Securing future food security under water-scarce conditions and increasing economic and population pressures will be a major global challenge. The World Bank has estimated that water consumption will increase by 50% by 2050 owing to the growing global population, rising affluence and changes in dietary preferences. It has been estimated that an additional 40 million tonnes of rice will be required by 2050 to meet the dietary needs of this population. World Bank (2008) project that demand for rice will increase by 70% by 2030.

Regional food preferences, export traditions, and geographical conditions combine to make food security a particularly pressing issue in the ASEAN countries. About 35% of the region’s GDP comes directly from agriculture, but beyond economic productivity, farming is part of daily life in the region and remains a strong part of cultural identity. Rice is a principle crop and major export of many ASEAN countries, including Thailand, which is the world’s number 1 exporter of rice and contributes around 10 million tons of the annual 50 million tons of international rice trade. Rice is also a staple food of the ASEAN diet. Worryingly for the ASEAN population, rice is an example of cropland – 1 kg of rice grown in paddies requires 1,900 litres of water whereas the production of 1 kg of potatoes requires just 500 litres of water. Rice is also the most sensitive of the major cereals to salinity, and extreme temperatures and humidity.

The Pacific positioning and level topology of the ASEAN region renders crops vulnerable to variations in typhoons and El Nino Southern Oscillation (ENSO) dynamic, increased flooding, increased salinity, and long droughts which increase the risk of forest fires. Waterlogging and flooding is also exacerbated by the poor soil quality in the region, which has been categorised by UNEP as Degraded or Very Degraded. Global food production and agriculture is also a major contributor to global warming – accounting for up to 52% of man-made greenhouse gas emissions, with a particularly large share of methane (particularly from livestock). Rising affluence is amongst the middle classes in the ASEAN region is associated with changes in food consumption patterns, notably the larger rice intake, and the consumption of meat, dairy, and seafood. To add to these problems postharvest food losses are high at an estimated 10–40%.

Case Study 6: International Rice Research Institute

The International Rice Research Institute (IRRI) in the Philippines is part of the Consultative Group on International Agricultural Research (CGIAR) and a research agency that encourages vector- and water-borne diseases. Major infectious diseases in the area include malaria, dengue fever, bacterial diarrhoea, tuberculosis, Japane-

sia nencephalitis, leptospirosis, hepatitis A, typhoid fe-

ver, and HIV. Infectious diseases are becoming increas-
ingly problematic as climate change has promoted the spread of previously localised diseases – from rural to urban areas, and across country borders.

There is a long tradition of international collabora-
tion to manage food security. Chapter 8.1 shows research strength to be distributed across the region, but notably in Thailand and Singapore. Nonetheless, poor treatment practices have led to the emergence of drug-resistant strains, particularly among country borders. Major obstacles to overcoming global health challenges include the need for deeper scientific understanding of disease pathology and deeper socio-
The Wellcome Trust Southeast Asia Major Overseas Programme began in 1979 as a collaboration in tropical medicine research between scientists at the UK’s University of Oxford and Thailand’s Mahidol University. With half of the world’s population within a 2000 mile radius of Bangkok, research at Mahidol is a major global hub and the bilateral partnership has since forged multilateral links with other institutes in the region including the Hospital for Tropical Diseases in Vietnam and Mahosot Hospital in Laos. The programme is now a firmly established network with operationally independent teams across Southeast Asia and clinical research collaborations with groups in a number of African countries.

The model of collaboration, as described by Nick White, Director of the Southeast Asia Major Overseas Programme has been “a bit different, a low slow burn”. Over the years, the Wellcome Trust have committed significant amounts of money including around £35 million of core funding annually, which has underpinned the programme’s current standing as a global leader in tropical medicine research. The Programme employs around 350 people, over 90% of whom are local staff. Although training is not a primary mandate, the programme supports postgraduate and postdoctoral courses. It also offers an English Language for Science programme.

The teams are committed to delivering practical local benefits and work with Principle Investigators per country. They prioritise building local capacity and expertise to address local situations and experience shape the research agenda. For example, in the case of malaria research, host priorities may be in fieldwork and clinical investigations which translates into the management of models and basic science. Although both approaches may be necessary, it is true that “infectious diseases account for half of all preventable deaths in the developing world and simple research can have big population effects”.

The Programme is strongly integrated with existing academic structures (not necessarily with government involvement) and retains strong bilateral links with the UK and other international networks.

This modest model of working is described as ‘more of a strawberry plant than an oak tree’, and thrives in the collaboration culture. Personal characteristics such as understanding, respect and empathy for local cultures are crucial for building trust with host institutions and lead to harmonious working.

8.5.6 Cross-cutting issues

The impact of global science is underpinned by national infrastructures, which reflect the research priorities, capacity and strengths of individual countries.69 Ideas and solutions, no matter how innovative, cannot be realised without people with the relevant skills and facilities to explore and implement them. A pool of skilled researchers is therefore crucial to boosting international collaboration on global challenges.

8.5.6.1 Education and training

Training new generations of talent can be particularly problematic in some ASEAN countries where education infrastructure is still comparatively poor. ASEAN education enrolment rates are generally lower than in the EU, particularly for tertiary education. Nonetheless, the investment of ASEAN countries in education is significantly higher than the investment in science and technology and national plans for education have become substantially more ambitious in recent years. In 2009, Thailand started the National Research University initiative, part of a 15-year national Plan for Higher Education of the Office of Higher Education Commission (OHEC), which aims for the country to become a world-class regional academic and educational hub. 2009 also saw the national government of Myanmar following a European initiative on bridging Burmese education with European education. Nonetheless, the talent pool for scientific research in ASEAN remains small. One interviewee correspondents described the ASEAN research community as “very elite and very limited”: giving the example of Indonesia in which S&T professionals are seldom recruited from educational institutes outside the top 5 universities.

8.5.6.2 Information and Communication Technologies

Improving capability in Information Communication Technologies has been a shared objective for national and regional development across the ASEAN Member States. In addition, research in these technologies has been identified as an area of comparative strength in the region, with Singapore, Malaysia and Thailand leading the field.

Encouragingly, the EU has a good tradition of working with Southeast Asia, for example through the Trans-Asia Information Network (TEN) project, which has provided a dedicated platform for international cooperation to enhance understanding of how to address the real educational and socio-economic needs and concerns of citizens.

CASE STUDY 10: EU-Southeast Asia cooperation in ICTs (SEACOOP)

The SEACOOP project was set up to promote and support the development of cooperation on ICT research between Europe and ASEAN. It has involved the national agencies in charge of ICT research in all 10 of the ASEAN member states and was conducted in 2 phases.

Phase I ran for 18 months and focused on identifying and analysing opportunities for cooperation. Phase II (known as SEALING), ran for 24 months and focused on support for policy development. The aims were to identify ICT policy and research priorities and develop synergies with other FP projects.

The project structure included an Advisory Committee, formally supported by the ASEAN Secretariat, and €399,800 of EC funding and was coordinated by an Italian partner, with seven partner countries including Malaysia. The project emphasised the need to open the European Research Area in the field of education, training and Lifelong Learning so as to support international networking and cooperation between EU researchers.

The SINCERE project resulted in a Green Paper, which mapped future educational research proposals. It plotted a timetable for international cooperation to enhance understanding of how to address the real educational and socio-economic needs and concerns of citizens.

CASE STUDY 7: FLUAID – Generation of Information and Tools to Support the Management of the Avian Influenza Crisis in Poultry

The FLUAID project was a Specific Targeted Research Project (STREP) under FP6 and received €200,000 of EC funding. 15 partner countries were involved including Indonesia, Thailand, and Vietnam. Coordinated by a research partner in Italy, the project ran for 48 months, starting in 2006. At that time, the Avian Influenza Epidemic had already caused the deaths of over 200 million birds in the preceding 5 years. The losses to the poultry market were substantial and there was a serious concern for food security. Recognising the lack of scientific information on several aspects of the disease, the FLUAID project aimed to increase scientific understanding of the virus and to develop and apply novel diagnostic tools and vaccines to combat avian influenza in poultry. The project turned out to be extremely timely — planning was already underway before the emergence of the new human virus H5N1, leaving the consortium well-placed to support contributions to the global response.

Key lessons shared by those involved highlighted the increased relevance and demand for research and collaboration with those involved. Maintaining the credibility and visibility of projects and institutions with far away partners requires a unique selling point and mutually interesting global public health agenda, and longevity can sometimes be an advantage. In addition, frequent interactions between laboratories, in both directions and in both locations, is essential for building sustainable collaboration platforms. Focussing collaborations on fewer centres of excellence and strengthening the links between them can be beneficial for those involved. This requires effective partner identification and selection—a process which could also be strengthened. One interviewee also noted that they had “no complete overview of how well-connected we [Europe] are”. This suggests there may be merit in sharing more widely analysis which tracks collaboration trends in specific fields to inform future research effort.

CASE STUDY 9: Supporting International Networking and Cooperation in Educational Research (SINCERE)

The Supporting International Networking and Cooperation in Educational Research (SINCERE) project ran from 2006 to 2010. The project received £5.5m from the European Commission, which is matched by national contributions of around £2m from each partner country.

The project team identified key barriers to effective international cooperation across higher education institutions. These included:

- __**Inadequate recognition of the value of international cooperation, leading to a lack of incentives for researchers to engage internationally.**__
- __**Insufficient opportunities and incentives for international collaboration.**__
- __**Insufficient availability of funding for international cooperation initiatives.**__
- __**Lack of detailed understanding of research priorities and infrastructure in other countries.**__
- __**Inadequate information on funding opportunities and national priorities.**__
- __**Lack of international mobility opportunities for researchers.**__
- __**Lack of institutional support for international collaboration.**__
- __**Lack of international - level provision for support and coordination of international collaboration.**__

In response to these barriers, the SINCERE project has developed a range of strategies and tools to support international cooperation in higher education:

- **Policy change and advocacy at EU and national levels to promote international cooperation.**
- **Enhancement of national and institutional capacity for international cooperation.**
- **Development of a shared understanding of research priorities and infrastructures across ASEAN.**
- **Funding initiatives to support international collaboration.**
- **Enhancement of mobility opportunities for researchers.**
- **Support for the development of new partnerships.**

The project has also developed a range of tools and resources to support international collaboration, including:

- **A database of international research collaboration projects.**
- **A guide to international mobility opportunities.**
- **A network of contacts for researchers.**
- **A toolkit for institutional support for international cooperation.**

By addressing these barriers, the SINCERE project aims to improve the capacity of higher education institutions in ASEAN to engage effectively in international cooperation and to enhance the impact of their research on global challenges.
This short review has not permitted a detailed analysis or assessment of the scientific research priorities under global challenge themes. Here we simply hope to make some observations that may be helpful in shaping future research partnerships. We believe that the conclusions presented here are broadly supportive of and consistent with those set out in other chapters in this booklet.

While the sample, genuine bi-regional cooperation, that is EU-wide and ASEAN-wide research collaboration, is an aspiration rather than a reality. This is to be expected. In most cases, projects have at their core, a small number of active partners, and a minority of the Southeast Asian partners. Few of the Framework Programme projects in particular, leverage the growing research capacity of the Southeast Asian region to a significant degree. This suggests that the high potential for bi-regional research collaboration and impact towards global challenges is defined and to some extent constrained by the instruments available to take collaboration further. The Framework Programme and READI (or similar, the ASEAN Science and Technology Plan of Action lists 11 formal dialogue partners). Individual ASEAN Member States have also been sought after for lucrative bilateral partnerships, as well as larger cooperation tools (e.g. the Wellcome Trust Southeast Asia Major Overseas Programme). Each ASEAN member state has its own rich history, differing education legacies, relationships with other regions and instruments, and should build on existing regional frameworks.

Within some case studies, bilateral initiatives, on which wider regional links and platforms have been used for the first time, important, related endeavours (such as the US-ASEAN Partnership which has seen the US commit $136 million over 3 years towards developing an array of environment programmes in Indonesia. Norway have committed $136 million over 3 years towards developing an array of environmental programmes in Indonesia. Norway have committed $136 million over 3 years towards developing an array of environmental programmes in Indonesia). In addition, there have been important efforts to explore the nexus of deforestation and forest degradation. A major challenge for FP success will be to competitively complement existing instruments, whilst recognising that scale and the region are leveraged. European Commission for Research, Innovation and Science, Máire Geoghegan-Quinn, has already acknowledged “European Research funding is currently spread across too many small programmes and different instruments, sometimes with insufficient scale and scope to make real breakthroughs in a visible way.”

Recommendation 5: EU Member States should be encouraged to nurture bilateral research collaboration on global challenges with the ASEAN region. These play an important role in wider bi-regional cooperation. Recommendation 4: The European Commission and Member States should consider actions (such as bibliometric analysis or other on-line social networking tools) to ensure that current research and collaboration trends are visible to interested parties. Recommendations 3 and 4 are perhaps most notably in health (FLUIDA, Wellcome Trust Southeast Asia Major Overseas Research programme) and ecosystems and biodiversity (REEFFRES and CII), the different perceptions, priorities and capacities for research across partners were acknowledged as having an impact on the scope and approach to such bilateral initiatives. Yet a number of international competitors also recognised and be coupled with an assessment of how funding sources and collaborative tools (such as the Framework Programme) can be modified. New forms of global challenge research cooperation beyond the scope of the Framework Programme, through for example READI (or similar) platforms, that permit a multidisciplinary ‘systems approach’ to problem solving are needed.

In some projects, effecting tangible impact and outcomes in the region were primary motives for collaboration (e.g. REEFFRES sought to develop methods for active coral reef restoration, CTI seeks to protect marine biodiversity, andquot;). Projects which have aimed to address deforestation and forest degradation. A major challenge for FP success will be to competitively complement existing instruments, whilst recognising that scale and the region are leveraged. European Commission for Research, Innovation and Science, Máire Geoghegan-Quinn, has already acknowledged “European Research funding is currently spread across too many small programmes and different instruments, sometimes with insufficient scale and scope to make real breakthroughs in a visible way.”

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clude a more diverse range of expertise.

The independent review of EU-INC IWRM recognised the importance of socio-political contexts. The social application of science can only be effected through close and habitual ongoing dialogue with policy-makers and civil society, which would, in turn, enable scientists to understand how to more effectively target their project implementation and dissemination whilst retaining reasonable expectations of the impacts of their research activities. The IPCC stands out as a good example of maintaining effective dialogue between scientists and civil society through engagement with grey literature, and between scientists and policymakers through line-by-line negotiation processes with government officials. Working in this way, the IPCC has stimulated and sustained policy debate over two decades.

The complex nature of global challenges has resulted in a concentration of specialised experts at the top of their field, meaning that S&T research often remains distinct from political and social application. Just as each field of science has its own organised knowledge and explanations for understanding the world, so too does each social culture have its own organised knowledge and explanations for classifying and understanding the world. 116 The STEPS Centre New Manifesto called for scientists to pay attention to social dimensions, emphasising that capacity building for S&T must move beyond a focus on technicalities to support science that works more directly for diverse social and environmental needs. 117 Failure to incorporate local knowledge can lead to a suboptimal implementation of research projects, resulting in tensions between researchers and local knowledge and undermine the legitimacy of scientific findings in the eyes of local communities. The challenge is to both employ and disseminate science within an appropriate cultural framing that complements local understanding. 118

The STEPS Centre New Manifesto also pointed out that innovative S&T initiatives can often founder in the face of local realities, and emphasised the importance of indigenous wisdom that is rooted in local histories and practices. Harnessing this knowledge may significantly shorten the amount of time it would take to survey and map local conditions, enriching the awareness of specialist researchers and broadening the scope for research; yet only a small percentage of local knowledge becomes globalised. 119

Understanding local perceptions is of particular benefit through more subtle channels that might not be immediately apparent to non-natives. CGIAR’s IRRI in the Philippines successfully combines cutting edge global research with practical, local impact through harnessing local knowledge and undermining the legitimacy of scientific findings. 120

Recommendation 1: Developing national and regional strategies for strengthening science-policy dialogue in developing countries.

Recommendation 2: Strengthening science-policy dialogue in developing countries.

Recommendation 3: Developing and implementing suitable strategies for managing global challenges and helping towards effective practical outcomes. This may require more flexibility in the design and approach to specific projects and should take account of policy and local contexts.

Recommendation 4: A diverse range of links to local stakeholders or local networks should be encouraged, and include non-scientists, citizens and civil society. For example, advisory boards which may also help inform the research effort. Consideration should also be given to the important role of grey literature in informing and disseminating research.

Recommendation 5: Consideration should be given to the allocation of follow-on grants (similar to those delayed by the European Research Council) to encourage high quality dissemination and knowledge transfer.

Projects participants used a variety of methods to identify and select their Southeast Asian partners. This included the use of existing contact networks (SINCERE), focusing on institutions with the necessary specialist facilities (REEFRES) or location (SEARRP), official nomination processes (SEACOOP) and recommendations from third parties (FLUIDAID). Some interviewees noted increasing competition for partners in region and indicated that the processes for identifying the best research partners could be strengthened, particularly for new talent and emerging centres of research excellence.

Recommendation 9: There should be sufficient time during calls for project proposals to allow participants to identify suitable collaboration partners. There may be a role for Member States’ Embassy representatives, EU Delegation representatives and National Contact Points.

Recommendation 10: The EU should support ASEAN-COST to continue the development of multidisciplinary centres of excellence, and research platforms across the region.

For some projects (IPCC, IRRI, Wellcome Trust Southeast Asia Major Overseas Research Programme), partnerships take time, sometimes decades to mature. This has been crucial to nurturing the collaboration, build trust and to allow the collaboration to evolve. A tacit recognition that projects are in it for the longer term gives an important signal to those involved, and can influence the approach to joint-working. In addition, a minority of interviewees commented that the personal characteristics of individuals involved were also very important to nurturing good relations. This was particularly true for projects which had more on the ground contact with Southeast Asian partners (SEARRP, Wellcome Trust Southeast Asia Major Overseas Programme). Here, empathy and respect for local cultures are critical to developing collaborations based on mutual trust.

While most projects have built on existing links between the regions, among the non-FP projects in particular (SEARRP, CTI, IRRI, Wellcome Trust Southeast Asia Major Overseas Programme), the quality and extent of engagement with local partners appears to be stronger. This is demonstrated by their permanent location in the region (SEARRP, IRRI, Wellcome Trust Southeast Asia Major Overseas Programme), official or political support (IPCC, CTI), the aptitude to which research agendas had been co-constructed by those involved (CTI, SEARRP, IRRI, Wellcome Trust Southeast Asia Major Overseas Programme), and the range of local partners involved, including the society group in the area and local, institutional or political support (CTI and REEFRES involved fishermen or other locals). This encourages reciprocity and mutual benefits from the collaboration, and ensures the needs of the region can be understood and factored in to the project.

Recommendation 11: Recognising that strong research relations can take years to mature, where appropriate, the personal interest and commitment of those involved in individuals taking part in projects should be taken into consideration. Sustained commitment and time-spent in country, in both regions should be encouraged and should feature as an integral part of projects that includes making use of additional opportunities for language training, to support.

Recommendation 12: Harnessing diaspora more effectively for bi-regional cooperation would also help capitalise on existing resources. 121


The studies presented in this book are inspired by the SEA-EU-NET project’s goal of supporting bi-regional policy dialogue on S&T cooperation, including thematic priority setting and the design of S&T cooperation programmes. We hope that it will help to increase cooperation levels between Southeast Asia and Europe, leading to collaborative solutions for joint problems and mutual social, cultural and economic benefit.

The analyses highlight the strengths of ASEAN research, and the manifold opportunities and potential for greater ASEAN-EU cooperation. Based on different kinds of quantitative analyses, the first part of the book compiles evidence on current research output and cooperation. Thematic areas are identified where ASEAN research is already strong and where Southeast Asia and Europe are most intensely cooperating.

The studies presented in the second part of the book are based on expert interviews, focus groups and site visits. They outline S&T policies of ASEAN countries, indicating areas to which ASEAN public funding and resources are being directed and where future research strengths will likely develop. In addition, these chapters discuss opportunities and pitfalls in S&T cooperation, offering a series of recommendations for the development and implementation of collaborative research and the design of related programmes. The SEA-EU-NET foresight study provides input to further inspire debate on how to define and ensure a successful future S&T cooperation scenario. A detailed account of major ASEAN countries’ internationalisation policies shows what patterns and priorities future cooperation can build upon. The final analysis explores the increasingly important role of research and international cooperation to address global challenges.

The compilation and publication of these analyses seems timely with the ever increasingly internationalised nature of both the scientific community and the research being undertaken, as well as with significant developments in the research landscape currently ongoing in both ASEAN and the EU.

In Southeast Asia, the ASEAN Member States are in the process of establishing an ASEAN Community by 2015. This ASEAN Community will be built on the existing three pillars of ASEAN, including the development of an ASEAN Socio-Cultural Community (ASCC), which aims to increase access to applied S&T. Furthermore, at the 6th Informal ASEAN Ministerial Meeting on Science and Technology in Krabi/Thailand, the ASEAN S&T Ministers agreed to extend the current ASEAN Plan of Action on Science and Technology until 2015 and coordinate activities with the development of the ASEAN Community. The six flagship programmes of the APAST are an important step towards the regional integration of S&T.

In the EU, work is underway to develop the next Framework Programme for Research and Innovation, Horizon 2020, which will run from 2014 until 2020. The European Commission will finalise a proposal for Horizon 2020 by the end of 2011. The end of this decade is also envisaged by the EU’s global strategy for smart, sustainable and inclusive growth, ‘Europe 2020’. The concept of an ‘Innovation Union’ is one of the flagship initiatives of the Europe 2020 Strategy. The Innovation Union commits the EU and its Member States to treat international scientific cooperation as an issue of common concern and to develop common approaches.

Within this wider context, SEA-EU-NET has initiated an ASEAN-EU Year of Science, Technology and Innovation 2012, which is endorsed by ASEAN and the European Commission. This initiative will highlight, promote and extend the reach of scientific cooperation between Southeast Asia and Europe. It will be a year long campaign to stimulate bi-regional scientific collaboration, increase awareness of scientific excellence in both regions and the opportunities to collaborate, as well as communicate the benefits of science to societies. By focusing on topics of strategic importance to both regions as well as being of global relevance, the Year will increase the impact and visibility of S&T cooperation between ASEAN and Europe.

This book is not least conceptualised as an input to the ASEAN-EU Year of Science, Technology and Innovation. It is concluded with four sets of policy recommendations and one set of best practice guidelines produced by SEA-EU-NET. They have been developed in expert- and community-driven participatory processes following SEA-EU-NET’s mandate to support bi-regional S&T cooperation policy dialogue. The recommendations have been through a consultation process with all SEA-EU-NET partners. They do not represent the official view of any individual government.

The first set of recommendations identify the most strategic areas for future Southeast Asian-European research collaboration, which are derived from qualitative research, expert consultation, the outcomes of SEA-EU-NET brokerage events and the quantitative analyses in the first part of this book. Secondly, recommendations are presented for optimising the policy framework for bi-regional collaboration. Subsequently, there are future-oriented recommendations offering ideas how to maximise engagement of researchers in cooperation programmes. The second and third sets of recommendations are supplemented by best practice guidelines for developing and implementing international and national S&T projects. The chapter closes with a summary of the recommendations from the analysis on international S&T cooperation to address global challenges.

**Thematic recommendations**

The analysis considers the national S&T policies, the annual level of output of scientific publications and citations, participation in the European Commission’s seventh framework programme, as well as the unique characteristics of the Southeast Asian region, with the aim of identifying which thematic areas would generate the greatest mutual benefit for Europe-Southeast Asia collaboration. A number of policy recommendations have been produced from this analysis outlining the thematic areas which will give rise to the greatest opportunities for mutual benefit from Europe and Southeast Asia cooperation.

**Health**

Health is a key thematic area for Europe-Southeast Asia cooperation. Within the broad heading, there are specific gains to be realised from directing resources to translational research in infectious diseases, including vector borne diseases (including but not limited to malaria, dengue and infectious diseases, and potentially new and re-emerging infections. Joint research on drug resistance is also extremely important. Research on aging populations and lifestyle diseases are also growth areas for Europe-Southeast Asian partnerships. Evidence-wise, health is also the most important subject area (regarding physical and biological sciences), in academic co-publications of authors from Southeast Asia and the EU. Infectious diseases is the most prominent detailed subject category in EURO-ASEAN co-publications in absolute numbers, followed by physics and engineering, but also several other medicine-related categories. Oncology has been the field with the strongest relative growth in bi-regional co-publications from 2000 until 2010. When comparing the research outputs from Southeast Asia and Europe in this area, a lower percentage than in other areas is observed. Nevertheless, health is among the FP7-themes where participation from Southeast Asia is strongest (together with environment and FAFB).

**Food, Agriculture and Fisheries, and Biotechnology (FAFB)**

Food, Agriculture and Fisheries, and Biotechnology research is a very important area for Europe-Southeast Asia research collaboration. Specifically, the areas of sustainable agriculture, sustainable exploitation of food resources, resilience and adaptation of crops to climatic change, public awareness of food safety, and food security are of global relevance.

FAFB is among the areas where participation from Southeast Asia in FP7 is strongest. The ratio of Southeast Asian to European research output is in the mid range, higher than in the case of health, lower than in the areas of nanotechnology, ICT or energy. Biological sciences are among the most relevant areas in co-publications, as well, with biochemistry and molecular biology showing high numbers of co-publications.

**ICT**

ICT is also a very important area for Europe-Southeast Asia collaboration, and the SEACOOP project (www.eurosoutheastasia-ict.org) is working towards developing deep and sustainable long term collaborations. There are significant opportunities in research on the network of the future, digital libraries and technology-enhanced learning and ICT for the environmental management and energy efficiency. Academic co-publications are not yet that strong in the area of ICT, although the percentage of the overall research output of Southeast Asia compared to European output is among the strongest in this field.

**Growth area: Environment**

There is great potential in Europe-Southeast Asia collaboration in environment research, especially in...
There are substantial benefits from joint research on the evaluation of the social and economic value of biodiversity, coastal and marine management, the reduction of landscape fragmentation and deforestation, as well as sustainable palm oil production. This area is already among the strongest when it comes to Southeast Asian countries’ participation numbers in FP7. The number of co-publications is also rather high in this field, although not as high as in Health or FA&FB (which might have to do mostly with the size of the scientific field itself). However, ASEAN publication output in this area is rather low compared to the number of European publications. Consequently, the share of ASEAN-EU co-publications in ASEAN overall publications is highest in this thematic area. Compared to other areas, a larger part of the ASEAN research output in the field of environment is produced with European partners.

Policy framework recommendations

The following list of recommendations results from the qualitative analysis work on opportunities, pitfalls and drivers of international S&T cooperation between Southeast Asia and Europe. They result from participatory workshops and discussion processes involving policy-makers, programme-owners and members of the scientific community in both regions.

- An enhanced EU-ASEAN dialogue on S&T between political decision makers should develop common strategic priorities. Collaborative R&D should be funded in these priority areas by international programmes between Europe and Southeast Asia.
- Mechanisms for feedback and input from Southeast Asian and European stakeholders (including the scientific community) should be implemented both in the priority setting process and the development of programme procedures for international collaborative research programmes at every stage of the decision-making process. National differences should be taken into account in the development of regional policy.
- Policymakers should ensure all policy directly relating to science, technology and innovation is carefully aligned with all other policy indirectly relating to science, technology and innovation.
- Framework programmes should include substantial dedicated funding calls targeted at scientific collaboration with the Southeast Asian region. Joint calls should further be developed bi-regionally.
- Programme rules should be simple, stable, consistently applied and well communicated, as well as adaptable and able to tolerate risks inherent to scientific endeavours. Rules should be based on common standards and encourage equal project participation and leadership.
- Information on potential partners for Europe-South East Asia collaboration should be easily accessible to all and regular networking and relationship building activities should strengthen relationships between researchers in Europe and Southeast Asia.
- International programmes should support the development of strong national research infrastructures within the Southeast Asian countries by establishing inter-regional centres of research excellence and assisting in the development of a strong base of human research capital.
- Inter-regional mobility should be enhanced through the development of instruments and removal of barriers, resulting in an equal exchange of European and Southeast Asian researchers between both regions.
- Funding programmes for the Southeast Asian region should include science for international development components, where required.
- Programme mechanisms should be cultivated to capitalise on the innovative elements of projects and ensure engagement of the private sector. Mechanisms should, additionally, consider the potential benefits to the economy and the society.
- Easily accessible information on FP7 and the opportunities it provides for Southeast Asian researchers should be broadly disseminated in Southeast Asia, especially using the network of National Contact Points.
- Sufficient time between the release of calls for proposals and the deadline for submission of proposals must enable potential projects to identify partners, form consortia, and draft successful project proposals.

Recommendations to maximise researcher engagement in international S&T cooperation

The following recommendations are aiming at increasing long-term S&T cooperation between Southeast Asia and Europe (circa 2020). Within SEA-EU-NET’s Cooperation Foresight exercise, they have been identified bottom-up by S&T policy-makers and scientists with experience in collaborative research between Southeast Asia and Europe (see also chapter 2).

- It must be taken into account in the design of international funding mechanisms that the most important motivation for scientists to collaborate internationally, is to work on state-of-the-art research with like-minded researchers. Researchers are also motivated by (though to a lesser extent), solving global challenges, contributing to national development, access to a particular field, expertise or equipment, as well as developing friendships or improving international reputation.
- S&T cooperation should be sustained on a longer-term basis.
- A balance should be found between flexible funding of cooperation activities in research projects defined bottom-up and the dedicated funding of S&T cooperation with a thematic focus.
- A balance should be achieved between supporting cooperation in basic and applied research.
- Mechanisms to support mobility must be put in place to enable researchers to develop personal contacts, crucial to the development of long term research collaboration. Mobility support mechanisms must promote equilibrated mobility in both directions by addressing the imbalance of greater flow of researchers from Southeast Asia to Europe.
- Existing human and network resources should be harnessed. Among the many options, established scientific conferences could be invited to convene in Southeast Asia; retired scientists could be offered part-time positions, senior scientists could be willing to engage in cooperation and exchange in the framework of sabbatical themes.
- PhD student exchange, joint PhD programmes and particularly co-supervision of PhD students should be supported to a higher degree.
- Southeast Asian Diaspora academics in Europe should be addressed as possible facilitators of S&T cooperation.
- Return and reintegration support schemes should be considered for Southeast Asian scientists who have spent longer periods of time in Europe.
- Reward schemes for successful cooperation should be considered as potentially increasing the motivation to cooperate.
- Quality metrics for assessing the success of international S&T cooperation projects have to be further developed and adopted.
- Regional training networks, joint research centres and other joint research infrastructure can help to increase cooperation intensity.
- Bridging institutions offering administrative, research management and partnering support should be considered as a means to increase cooperation levels.
- Administrative burdens hampering S&T cooperation like visa issues, material exchange and field access clearance procedures should be simplified.
- Open access to literature and sample databases should be considered as potentially increasing the motivation to cooperate.
- The results of joint research should be made available in the respective regions, not only in international journals.

Best practice guidelines for participation in international scientific collaboration

As it is related to the preceding set of recommendations, we also want to include in this concluding section the best practice guidelines for developing and participating in international S&T projects that has been cited above at the end of chapter 4. These guidelines are the result of previous work within the SEA-EU-NET analysis work package.

- Collaborative projects between the EU and SEA must have sustainable direct benefits to all participants. The benefit to researchers, institutions and society as a whole must be clearly defined and identifiable.
- All partners must understand the scientific objectives of the potential collaboration before the project design is embarked upon.
- All project partners and stakeholders should be included in the planning and design phase of the project as early as possible. Project partners must be fully engaged in the project.
- Collaborative projects should be led by experienced and knowledgeable project managers (either European or Southeast Asian) who act as ‘champions’ for the project.
- Projects should be well designed and both the managerial framework and decision making processes must be established in clear terms of reference. Inductive project costs should be clearly determined.
- Cultural differences and differing socio-economic needs should be given due consideration in collaborative project design.
- The project, including project partners, must be stable and sustainable. The value of continuity should be enforced in all projects.
- Full evaluation of all project outcomes must be included in the project design and mechanisms introduced to prevent any potential negative outcomes. (e.g., “brain drain.”)
- The project terms of reference should determine how the project outcomes will be allocated between partners including clarifying how intellectual property issues will be dealt.
- The participation of industry partners should be positively encouraged within projects.

Recommendations derived from the analysis of science cooperation for global challenges

We close this concluding chapter with the recommendations identified by the study on S&T cooperation in the area of global challenges (see also chapter 8).

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CONCLUSIONS

CONCLUSIONS
Successor(s) to the Framework Programme should continue to remain open to participation from ASEAN Member States. This sends an important signal that the EU remains open and committed to building relations with the ASEAN region. A sustained long-term commitment allows for a more comprehensive approach and is a unique selling point for bi-regional collaboration.

The European Commission should also consider scope for Specific International Cooperation Actions (or similar actions) for global challenge research that permit greater integration of Southeast Asian research effort. The specific themes and aims for such actions should be co-defined by the two regions, and should build on existing regional frameworks.

EU Member States should be encouraged to nurture bilateral research collaboration on global challenges with the ASEAN region. These play an important role in wider bi-regional cooperation.

The European Commission and Member States should consider actions (such as bibliometric analysis or other on-line social networking tools) to ensure that current research and collaboration trends are visible to interested parties.

The potential wider benefits of scientific research collaboration on global challenges (e.g. tangible impact on local communities) should be recognised and be coupled with an assessment of how funding and collaboration approaches (successors of the FP7) can be modified. New forms of global challenge research cooperation beyond the scope of the Framework Programme, through for example READI (the non-trade related political dialogue) or through other cross-Directorate mechanisms (e.g. innovation platforms), that permit a multidisciplinary ‘systems approach’ to problem solving are needed.

A proportion of bi-regional research effort should aim to deliver tangible impacts for managing global challenges and help towards effecting practical outcomes. This may require more flexibility in the design and approach to specific projects and should take account of policy and local contexts.

A diverse range of links to local stakeholders or local networks should be encouraged, and include non-scientists, citizens and civil society groups. These could be engaged through, for example, advisory boards which may also help inform the research effort. Consideration should also be given to the important role of grey literature in informing and disseminating research.

Consideration should be given to the allocation of follow-on grants (similar to those deployed by the European Research Council) to encourage researchers to engage in high quality dissemination and knowledge transfer.

There should be sufficient time during calls for project proposals to allow participants to identify suitable collaboration partners. There may be a role for Member State’s Embassy representatives, EU Delegation representatives and National Contact Points.

The EU should support ASEAN-COST in their continued development of multidisciplinary centres of excellence, and research platforms across the ASEAN region.

Recognising that strong research relations can take years to mature, where appropriate, the personal interest and commitment of those involved in individuals taking part in projects should be taken into consideration. Sustained commitment and time-spent in country, in both regions should be encouraged and should feature as an integral part of projects where appropriate. This may also require additional opportunities for language training.

Harnessing diaspora more effectively for bi-regional cooperation would also help capitalise on existing resources.

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Science and technology cooperation between Southeast Asia and Europe has been steadily increasing in recent years. This trend can be attributed to the global internationalisation of S&T, but also to significant efforts between the two regions to increase cooperation levels and harness the benefits of joint research.

SEA-EU-NET, launched in 2008 and set to run until December 2012, is a European Union Seventh Framework Programme (FP7) funded project supporting these efforts and facilitating joint research. It brings together 22 partner organisations from across Europe and Southeast Asia with the goal of deepening S&T cooperation between the two regions in a strategic manner. SEA-EU-NET addresses this overall goal by identifying opportunities for S&T cooperation, creating a policy dialogue between the countries of Europe and Southeast Asia on S&T cooperation, and increasing the participation of researchers from Southeast Asia in the EC’s FP7.

SEA-EU-NET is also providing the analytical input and evidence base required for the implementation of these activities. The various kinds of analyses undertaken by SEA-EU-NET are presented in this book.

The first part of the book features quantitative analyses of ASEAN countries’ research strengths and S&T cooperation with Europe. The second part presents qualitative studies of ASEAN countries’ S&T policies as well as opportunities, pitfalls, drivers and future scenarios of S&T cooperation between Southeast Asia and Europe. Furthermore, internationalisation priorities and patterns of ASEAN countries’ S&T landscape are explored and global challenge related science cooperation analysed.

The analyses are targeted to inform decision-makers and programme-owners involved in S&T cooperation and policy development between Southeast Asia and Europe, as well as provide useful background information for the broader scientific community engaged in collaborative research and those interested more generally in Southeast Asian innovation systems and research priorities. Furthermore, the analyses offer input for the upcoming ASEAN-EU Year of Science, Technology and Innovation 2012.