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ASEAN Economic Community and intellectual property rights: an assessment of framework conditions for innovation

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partners in science

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Foreword

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Over the past few years, the SEA-EU-NET project has launched a series of reports that informed ASEAN-EU science and innovation cooperation policy and decision-makers. The project's analyses primarily focused on research cooperation patterns, innovation support schemes and selected framework conditions for innovation. The present report takes the work on framework conditions one step further. It asks the question of the prospects of innovation in ASEAN in the context of the ASEAN Economic Community (AEC) process. Following the project's mandate, it specifically concentrates on the impact of AEC on framework conditions for research and innovation in ASEAN and the EU. It also centres on the current and potential role of intellectual property rights in regional and bi-regional innovation processes.

These questions are of crucial relevance for the ASEAN-EU policy dialogue on research and innovation. Cooperation at policy and at research level can support innovation in both regions, provided the right framework conditions are in place.

The AEC has been officially launched at the end of 2015. With the AEC set up, the science and technology portfolio has moved to the economic pillar of ASEAN, putting stronger emphasis on the contribution of research and innovation to social and economic prosperity in the region. Furthermore, the ASEAN Committee of Science and Technology (ASEAN COST) has recently endorsed its new ASEAN Plan of Action on Science, Technology and Innovation (APASTI), articulating regional research and innovation policy for the period up to 2020.

In the EU, research and innovation policy is articulated around the Open Science, Open Innovation and Open to the World dimensions. Openness to the world means seeking STI excellence wherever it is located, engaging other countries and regions to address together global challenges, and creating framework conditions that enable cooperation. This openness is largely implemented by the Horizon 2020 programme, also for the period up to 2020. There are therefore great synergies and potential benefits that could be drawn from research and innovation cooperation and from policy exchanges between ASEAN and the EU: promoting an appropriate intellectual property rights framework to boost cooperation and innovation is a good case in point.

On behalf of the ASEAN Secretariat and the European Commission, we welcome the present report and would like to express our appreciation for the work of the experts who contributed.

1 The views expressed in the text are the sole responsibility of the author and in no way represent the view of the European Commission and its services.

1 Executive summary

The ASEAN Economic Community and the European Union

The launch of the Association of Southeast Asian Nation's (ASEAN) Economic Community (AEC) at the end of 2015 is expected to have an impact on innovation. By facilitating economic integration, it can also forge framework conditions (general macroeconomic conditions, quality of infrastructure, levels of education, product and labour market regulations, tax systems, intellectual property regimes and so on) conducive to innovation performance and a regional knowledge market. The hypothesis is that this might play out in much the same way as economic integration in the Single Market Programme in the European Union (EU). Our argument is that for this to happen, the supranational support structures and innovation incentives at the ASEAN level would need to be strengthened.

In the design of the AEC, the science, technology and innovation (STI) covenant has been shifted from the sociocultural pillar, where it was under the ASEAN framework hitherto, to the economic pillar of ASEAN. This move indicates a more pronounced emphasis on the contribution of research and innovation to social and economic benefits within the region. Both ASEAN and the EU consider STI an engine for growth that is key in any knowledge-based economic development and innovation. The new ASEAN Plan of Action on Science, Technology and Innovation (APASTI), endorsed by the ASEAN Committee of Science and Technology (ASEAN COST), articulates the principles and strategic activities for regional research and innovation policy. APASTI acknowledges the need to enhance public-private partnerships, to engage research and higher education institutions and to support commercialization of R&D and IP policies. This action plan covers the period up to 2025, extending over the EU's Horizon 2020 timetable. Both regions thus have economic integration projects and regional innovation policies in place.

In the present study, we will analyse the interplay of ASEAN's economic integration project and its innovation policies and framework conditions. In doing so, we also present European approaches and experiences that might be of value. Concretely, we have set ourselves three coherent objectives by means of which we hope to create a platform for exchange and learning that supports cooperation between the two regions:

1. We explore the AEC and its potential impact on framework conditions for innovation in ASEAN, within a contrasting framework of related developments of economic integration in the EU.
2. We concentrate on the current environment for generating policies, systems and practices for the protection of intellectual property rights (IPR) as a specific set of dedicated framework condition.
3. We compare the developments in framework conditions in ASEAN in areas related to IPR to the European Single Market Programme.

As to the potential impact of AEC, a first widely acknowledged observation is that the process of economic integration in ASEAN is still a work in progress. AEC has been formally launched, but a variety of particularly non-tariff barriers hamper true regional free trade. Reflecting ASEAN's more intergovernmental and less supranational nature, AEC is designed as a free trade area, whereas the European Union established a single market. AEC further facilitates the growth of regional trade and movement of goods, services, capital and people. However, as to innovation activities, countries are wary of opening their labour markets to other ASEAN nationals. The circulation of scientific and technological knowledge in ASEAN is thus likely to remain limited compared to the occasionally dense networks ASEAN member states have with non-ASEAN countries.

Probably most importantly for innovation and innovation framework conditions, the establishment of AEC is not accompanied by supranational innovation policy incentives in ASEAN. APASTI introduces highly relevant lines of activity for regional cooperation in research and innovation, but beyond a small ASEAN Science, Technology and Innovation Fund (ASTIF), it does not comprise resources to tackle them without outside help. In this

situation, AEC will affect innovation framework conditions through developments in areas that are both trade and innovation related. The most visible case in point is IPR.

We consider IPR dedicated framework conditions for innovation that are of importance for open innovation in the context of globalised innovation processes across countries and regions. The legal protection of IPR can take the form of patents (rights over invention), utility models (similar to patents but with less stringent criteria for novelty etc.), copyrights (rights over artistic work), trademarks (distinguishing signs for products and services), industrial designs (aesthetic aspects), geographical indications (goods having a specific geographic origin), trade secrets (industrial or commercial secrets) and traditional knowledge (knowledge developed by communities over time which needs to be protected against capture by commercial parties outside the community).

In this report, we concentrate on patents as possible outputs of R&D-intensive innovation activity. Various countries in Southeast Asia have intensified their patent regimes, in particular their domestic patenting, with limited or unclear effects on their innovation performance. Copyright and trademarks protection can be challenging forms of intellectual property (IP) in developing and emerging economies, such as in ASEAN. High trademark filing activity is indicative of ASEAN's relevance as a market in the globalised trade regime. Utility models (petty patents or innovation patents, available in Indonesia, Laos, Malaysia and the Philippines) are a downgraded form of IP similar to patents, which potentially foster local innovations particularly suited for emerging economies, with SMEs having limited R&D and investment capacity.

Patent regimes in the EU

European countries have been amongst the first to establish national patent offices, which to this day remain core building blocks of European IP policies and practices, in addition to their willingness to engage in international cooperation and IP standards. European national patent systems still vary widely from country to country. However, a European harmonised layer was introduced with the *European Patent Convention* (EPC) in 1977. It founded the European Patent Office and with it a single integrated application procedure leading to a bundle of national patent rights. The EPC thus provided a significantly simplified and cheaper procedure for seeking patent protection. The EPC-based European patent applications are a significant part of European IP output.

As to the exploitation of IP and patents in particular, European countries again use a variety of measures and support systems. Many European universities employ technology transfer offices or innovation offices, supporting their researchers in commercialising their research results, rather than focussing on patents and generating licence income. Nevertheless, studies show that around 40 % of patents in Europe are not directly commercially valuable but are either used to block competition or are not used at all. Among those that are, the economic value differs greatly, with a few patents resulting in the majority of economic benefits. Figures in other world regions are similar.

At the European level, the European Commission acknowledges the need to support the better valorisation of Europe's patent portfolio. The Commission continues to invest in the technology transfer ecosystem in Europe. It reimburses patent filing costs in projects funded by its Framework Programme for Research and Innovation (Horizon 2020). It strengthens public technology transfer offices and complements technology transfer funding. The European Commission has set up a Technology Transfer Financing Facility Pilot (with an initial budget of € 60 m for 2015) within Horizon 2020.

IPR and patent regimes in ASEAN

The overall situation in ASEAN is one of great diversity and partly less mature systems for IP generation. However, awareness of IP and patents in particular is steadily growing in ASEAN. The region has given IPR a key role in the AEC Blueprint. Southeast Asia's increasingly important role in global value chains and innovation networks also pushes the region towards stronger IPR regimes. International agreements, such as the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) or international protocols in the trademark area, play a crucial role. They set minimum standards to be implemented on the national level and hence serve as a platform on which to develop further harmonisation.

ASEAN has organised its work on IPR policy in various ways since the early 1990s, co-funded by the EU, the European Patent Office and other donors. An ASEAN Framework Agreement was launched in 1995, aiming at broad cooperation to enhance the IP-related institutional environment in the region. An important body in this regard has been the ASEAN Working Group on Intellectual Property Cooperation (AWGIPC), established in 1996, with a mandate to develop, coordinate and implement IP-related measures.

The so-called ASEAN way, through the cooperative efforts of institutions and groups like AWGIPC, takes as a point of departure the fact that the member states have their own IP-related legislation, rules and practices, giving the national IP offices a key role, as laid down in the ASEAN IPR Action Plan. In the implementation of these IPR policies, a "soft-law" approach is taken, by means of which the individual member states of ASEAN and their IP offices implement legislation and regulations in a flexible way and according to their own political and institutional will and capacity. Cooperation and coordination are key processes, rather than formal multilateral or regional agreements. The most vulnerable part of the IP systems may therefore be the enforcement of the rights.

In 2009, AWGIPC established the ASEAN Patent Examination Co-operation (ASPEC), as a *de facto* harmonised system, on the basis of the principle of mutual recognition. The objectives of the ASPEC programme are to reduce work and speed up turnaround time as well as to increase the efficiency of search and examination. However, ASPEC has its limitations, given the weak capacities and competences in some of the national IP offices.

While most ASEAN countries have opted for a system of institutional ownership of patents coming out of publicly funded research (Bayh-Dole-like system of IP), a mismatch between the typically low input to the process in terms of R&D funding and the expectation on the output side in terms of valuable patent portfolios often occurs. A major challenge in the region's patent system is the slow filing and granting process. Another major challenge is the lack of trained personnel in technology transfer offices (TTOs) of universities, in particular in patent examination and evaluation. Fragile implementation and challenges related to enforcement of legal rules abound. There are still too few economically valuable disclosures as a result of this.

The current ASEAN IPR Action Plan for 2016–2020 provides further guidance and support for IPR within the context of the AEC. It will build on the previous plan, with continued ASPEC focus, priority on patent examination guidelines, and access to international treaties and protocols. It will particularly concentrate on further strengthening of IP offices and infrastructure, signing of relevant international treaties, activities to improve the capacities of IP practitioners, regional IP platforms (including TTO platforms), and regional initiatives to promote asset creation and commercialisation.

With such diverse systems, harmonisation of IP systems will more likely than not stretch over a long time. However, there is growing cooperation between the European Patent Office and ASEAN in patenting. This includes a number of activities, such as training of patent examiners, data exchange, search tools and exchange of best practices. Many of the ASEAN countries are lining up to join the Madrid Protocol on trademarks. With international protection similar to what PCT does for patents, the Madrid Protocol will offer protection that is better and easier to obtain. In addition, the Trans-Pacific Partnership (TPP) is also likely to have an impact, as the requirements will be compliant with the Madrid Protocol. Hence, while AEC is providing a necessary path towards a more integrated economic region, innovators and companies will also look towards international treaties and agreements for protection.

Recommendations and conclusions

Considering potential policy lessons coming out from our results, it seems evident that much still needs to be done to remove non-tariff barriers to trade and continue to create a competitive and productive region. We claim that a Southeast Asian knowledge market with strong domestic innovation capacity will only develop when regional supranational support systems are put in place. Economic integration and innovation framework conditions alone will not suffice to move Southeast Asian knowledge producers' focus from a reliance on non-ASEAN partners towards more intraregional inventive activity.

Missing out on this supranational level might lead to further fragmentation. Some countries in the region might occupy and benefit from a variety of hub functions. Multinational companies might use the region's R&D capacities, creating limited knowledge spill-over. It might also be more difficult to regulate transfer pricing (as a way of tax improvement) and defensive filing practices of multinational companies engaged in R&D in Southeast Asia. Based on the study results, we recommend that

1. ASEAN generates better framework conditions for innovation on the back of the AEC by means of programmes and incentives for institutional cooperation. In particular, universities and other stakeholders in research and innovation should be incentivised to build linkages and cooperative arrangements.
2. ASEAN builds upon the many initiatives to develop joint programmes for research and development (e.g. the Krabi Initiative) and works with dialogue partners and international partners to fund such initiatives.
3. EU and European partners expand and direct cooperative measures towards ASEAN to enhance the lasting impact of cooperation. European Joint Programming Initiatives (JPI) as well as the Framework Programme for Research and Innovation (Horizon 2020), have much to offer, in particular if they come with a more targeted approach to the potential that ASEAN offers.

In the area of IP, the following can be recommended:

4. ASEAN raises the awareness of the need to protect background IP for residential users of knowledge, as patents registered later may overrule traditional use.
5. ASEAN balances, and in some cases reduces, the weight given to IP in performance criteria at universities, as the current trend may lead to a high volume of low-quality patents, while commercial values typically hinge on high quality.
6. ASEAN explores available utility models and patents to be used free of charge for local firms, thereby improving the social and economic benefits inherent in IP systems, and to put the available knowledge to better use.

2 Introduction

2.1 Background and objectives

By the end of 2015, ASEAN, the community of Southeast Asian countries, had reached the key milestone of finalising a process leading up to the formal launch of the ASEAN Economic Community (AEC). Among many initiatives involved in developing ASEAN, the AEC stands out as the approach chosen for a comprehensive attempt to integrate the member countries economically. It also represents a concerted effort to modernise the economies of the region and to "climb up the value chain" in order to better benefit from the production of higher-value goods and services and to be better integrated in global value chains.

Economic integration is a crucial element in the shaping of the framework conditions for innovation. The basic argument is that through more open flows of goods, services, capital, and people, competition will intensify, resources will be better allocated, and economic growth will improve. The beneficial relationship between economic integration and framework conditions for innovation is well known from the European case. Integrating economies undergo restructuring, firms innovate more, and welfare increases. The Single Market Programme in Europe has, over the years, helped shape the economic landscape of the region, supported by a supra-national governance system that has developed through treaty changes and institutional adaptations. Different from the EU, ASEAN's chosen path of integration is a system of inter-governmental cooperation. The AEC is therefore likely to be different from the EU Single Market.

The SEA-EU-NET project, funded by the European Commission through the framework programme 7 (FP7), has, since 2009, been actively engaged in providing support to cooperation in science, technology, and innovation (STI). The project team has organised workshops, and has carried out studies and other activities. In the last part of this project, in the context of a greater focus on innovation in FP7 and now in Horizon 2020, the project has also paid more attention to how the cooperative agenda could be expanded to include innovation activities that are quite different from research and development as such. After all, the ASEAN-EU cooperation spans areas that are much broader than STI. To this end, several studies and workshops have been conducted on innovation-related themes, including on the framework conditions for innovation (e.g. Degelsegger et al. 2014; Remøe et al. 2015).

The preparation and launch of the AEC is expected to have an impact on the framework conditions for innovation, as economic integration has had in Europe, both directly and indirectly. Hence, this study is intended to explore the AEC and the possible impact it may have on these framework conditions. Further, while the framework conditions for innovation may be an elusive concept, some of the specific conditions for innovation stand out. Among them are policies, systems and practices related to the protection of intellectual property (IP). Both for investments across borders and for cooperative activities in innovation, intellectual property rights (IPR) are receiving much attention. In many countries in ASEAN, as well as among the European partners, innovation and IP take centre stage in policy development. Therefore, it is also important to address the possible obstacles and challenges for cooperation related to these issues. In addition, Europe has come a long way with the Single Market Programme and the subsequent institutional and cooperative initiatives. As ASEAN still has some way to go, it may also learn from the European experience or develop itself new options relevant for the European context.

Hence, this study has several integrated objectives: First, we explore the development of the AEC and the associated framework conditions for innovation in ASEAN. Second, we analyse the current playing field for the generation and protection of IP in ASEAN as a specific set of framework conditions. Third, we contrast the ASEAN development in these areas with the European Union's experience (namely the Single Market Programme as the key policy for economic integration, as well as the main experiences and lessons in the corresponding fields of IP) to provide a platform for exchange and learning that, in itself, may support cooperation between the two regions and their stakeholders.

The first objective is mainly to set the stage and provide a relevant basis for the next two objectives. Economic integration is seen as the basic and necessary platform for other integrative elements to take shape. It creates a structural impulse for shaping the innovation systems in the regions, a key element of which is IPR systems.

The second objective has a role by itself. IP stands out as a vital component in innovation processes. It is a field which is directly linked to economic integration and related institutional change. It is at the same time a critical component in innovation systems. IP in the ASEAN context has not been studied yet, which is why we regard the focus on understanding IP-related issues as an objective in its own right.

With the latter objective of contrasting ASEAN and EU developments, we do not intend to conduct a strict comparative study. We rather aim at contrasting two regions and develop our argumentation along the following question: How do framework conditions for innovation develop on the basis of a project for economic integration? We try to show that internal markets and trade liberalisation are not enough and that the regional capability to develop and implement viable cooperative processes and institutions is decisive. In this sense, "knowledge markets" become crucial to the innovative capacity of a more or less economically integrated region. Hence, we explore the role of cooperative programmes that have developed in the context of economic integration. In the interplay between public sector support and private investments in international cooperation, IP makes up an increasingly important area, both for intraregional invention and innovation and for trade relationships and foreign direct investments. The links from economic integration to innovation via cooperative arrangements are therefore vital.

2.2 Methodology

The methodology, which provides the empirical basis for the present report, comprises a core set of qualitative methods and quantitative methods making up complementary information. The report builds on a document analysis of national and regional innovation policies (e.g. IP action plans) and a series of studies on the ASEAN Economic Community. This document analysis also confirmed that the present report is the first to systematically analyse both ASEAN's economic integration and its innovation systems.

Building on the results from the document analysis, between May and November 2015, we carried out semi-structured interviews and workshops with around 40 experts in six Southeast Asian countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam). The expert interviews and workshops served to collect information and opinions from key stakeholders engaged in shaping the innovation framework conditions in the region, and they provide the core data for the report chapters focusing on Southeast Asia. The interviewees came from ministries and funding agencies, public and private intermediary institutions, IP offices, as well as from universities and private research organisations. They provided us with information on current policy concerns, as well as approaches to the innovation framework conditions. Moreover, we were able to extract the innovation framework condition-related concerns and expectations. These, in combination with other interviews and material, allow us to discuss the challenges and opportunities for innovation in the region in general and in light of economic integration in particular.

As to the contrasting chapters on the European Union, we have mostly built on secondary data from existing studies. The report also uses the quantitative results of another SEA-EU-NET study on ASEAN patent application output. The patent data helps us to assess the relevance and type of IP produced in the region.

3 Framework conditions for innovation

3.1 Defining the framework conditions

The innovation activities and performance of a country are influenced by a great number of factors. In this report, the framework conditions are understood to be all of the economic, institutional, and social factors that impact firms' innovation behaviour. Hence, the framework conditions may be constituted of the general macroeconomic conditions, the quality of infrastructure, the education levels, the product and labour market regulations, the tax systems, and others. In sum, they make up a country's system of incentives and constraints for innovation. OECD (2014) refers to some key reasons why the framework conditions are important for innovation:

- Weaknesses in the framework conditions result in distorted incentives;
- Innovation activity, not least R&D-based innovation, requires a medium- or long-term horizon and a sufficiently stable environment in which to carry it out;
- The regulatory framework is of crucial importance for the generation of new technologies and their diffusion;
- When the institutions and framework conditions are of insufficient quality, they are likely to reduce the effectiveness of policies designed to foster innovation.

The last point is important in the current analysis. Innovation policies cannot be effective or produce the intended impact without broader framework conditions providing the appropriate incentives and constraints for innovators.

Accordingly, the framework conditions for innovation include macro-economic and market conditions, regulatory issues, trade policies, levels of educational attainment and human resources, and the like. These conditions are typically defined by polices on a national level for each country, and they are often coordinated or determined with others to create a level playing field. Initiatives to advance economic integration between countries will therefore normally have a significant impact on the framework conditions for innovation as firms compete and operate across borders, not least within economic regions. Hence, as the ASEAN Economic Community (AEC) is currently moving ahead, it is likely, as well as intended, that this Southeast Asian "single market" will have an impact on these framework conditions.

A subcategory of the framework conditions makes up the specific institutional conditions for innovation or for certain innovation activities. An important example here is the system or policies put in place to support the generation and protection of intellectual property (IP). We term these as part of the dedicated framework conditions for innovation. As mentioned earlier, "framework conditions" are an elusive concept, and some scholars would argue that IP and related systems for generation and protection are not framework conditions but rather inherent components of innovation systems as such. This is a valid point, and we therefore explicitly refer to the qualification of "dedicated" framework conditions as specific arrangements defined by policy to support and influence the process of innovation. Through these policies and systems, intellectual property rights (IPR) may be granted to inventors for certain periods of time. This will be further expanded upon below. Other examples of such dedicated framework conditions are the system of material transfer agreements (MTAs), which ensure an institutional or contractual basis for sharing or transferring biological material, and public procurement for innovation (PPI), which creates market conditions for innovation that would otherwise not exist.

In this report, we focus specifically on IP and IPR and see them as key dedicated framework conditions that are typically also highly important in the context of economic integration, as well as the increasing globalisation and open innovation processes that are taking place across the countries and regions of the world. This is also the aim of this report: What are the likely impacts of the AEC on the framework conditions for innovation in the ASEAN region, and what are the impacts specifically on the IPR systems in the region? And with the emerging cooperation and linkages between ASEAN and the EU in mind, what lessons can be learned for each region?

3.2 Economic integration and the framework conditions for innovation

As ASEAN is moving through a process of economic integration, expectations are rising that this will have a positive impact on innovation through better and more conducive framework conditions. We look at the AEC in the light of another economic integration process that has taken place in Europe, the Single Market Programme. While the AEC is not necessarily comparable with the Single Market Programme (see figure below and the discussion in chapter 4), certain similar impacts on innovation framework conditions can be expected.

This study will cast light on some of the implications the economic integration programmes have for the framework conditions for innovation and, more concretely, for the role policies and practices related to IP. Three broad perspectives arise from the above:

First, the obvious possible impact will be on competition through the reduction or removal of trade barriers. Competition is a key ingredient for innovation, as it pushes firms to increase productivity through new technology, new production processes and new products. The competitive situation may improve in the different markets in the region, depending on the harmonisation of product regulation and protective measures taken through standards. Capital may flow more easily across borders with fewer restrictions on domestic ownership and investments. Likewise, human resources, including those related to R&D, might move more easily in an economically more integrated region. Thus, in general terms, economic integration is likely to improve the framework conditions for innovation through a more level playing field and competitive pressures.

Second, economic integration may lead to subsequent adaptations and processes in the innovation landscape itself. Building on a more integrated economy, a more integrated "knowledge market" may be envisaged, with a deepening of cooperation in R&D across borders, as well as better cooperation between universities and research institutions. With the opening of borders, firms are in a better position to seek knowledge and information for their innovation processes where they can find it. Better conditions for the movement of highly skilled people may be expected, as well as greater mobility for persons in general. Cooperation across borders between firms may increase, which is associated with better integration in (global) value chains and innovation networks. Hence, overall innovation performance should be set to rise. Knowledge markets may be more integrated and viable as a result of the economic integration process.

Third, as both European and most of the Southeast Asian countries are proponents of a new pro-patent era, better protection of patents and other innovation-relevant types of intellectual property may be expected. This is again a key ingredient in knowledge markets, and it constitutes, as mentioned above, an important dedicated framework condition for innovation. In fact, both the AEC and the Single Market Programme have defined IP as a key ingredient in the integration process. The protection of IP becomes more important with a globally more integrated economy as well as with the production of goods and services with higher investments and value added. When firms invest in and establish operations in foreign countries, they consider good protection of their IP as a precondition. The theory is that this is also true for domestic innovations. If IP and patent protection in particular is strengthened, domestic firms are expected to innovate more. Commercialisation and technology transfer, typically stimulated by government policies, are expected to improve with deal flows spanning countries. This will possibly increase the demand for IP protection by domestic companies. The IP institutions, such as national IP offices, are likely to invest more in regional cooperation to ease IP development and protection, with a unified IP (e.g. patent) for the region in question as the ultimate possible objective, but with more harmonisation and easier procedures as the likely second bests.

The integration process in the two regions is, as said, very different. Adding that to the likewise very different framework conditions at the outset, a point-to-point comparative analysis is not necessary or even fruitful. Rather, this study will, across these three broad categories of framework conditions for innovation, highlight the developments and impacts in ASEAN with a contrasting view on Europe. Our intention is to provide innovators and stakeholders in the two regions alike with insights into the framework conditions as they evolve, with possible mutual benefits for the innovation actors' cooperation, investments, and innovation.

Before we describe the links between the regional economic integration processes and the innovation

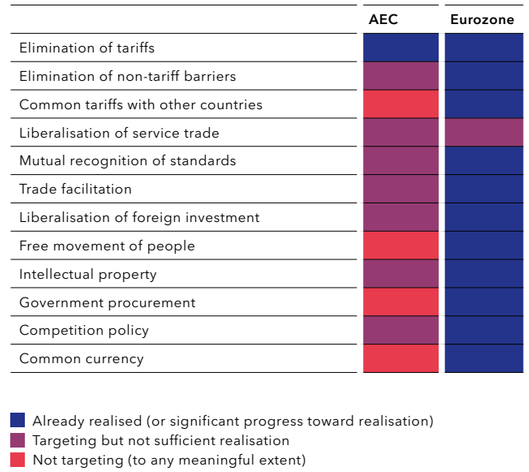


Figure 1: Economic integration in comparison.
Source: Woetzel et al. (2014), authors' modification

framework conditions and dynamics in Southeast Asia and Europe, we shall give a more detailed overview of the current discussion on the role of IPR in innovation.

3.3 The role of IP in innovation

3.3.1 Intellectual property rights

Any creation by the human intellect resulting from ingenuity, creativity, and inventiveness can be seen as intellectual output. If the ownership of this output is ascribed to a person or entity as its creator, we speak about intellectual property. IPRs[2], then, are legally guaranteed by a state or another authority and give the creator an exclusive right over the use of his/her creation for a certain amount of time.

The protection of intellectual property through law can take various forms:

- Patents: a right granted for an invention
- Copyrights: right of creators over their artistic work
- Trademarks: signs distinguishing certain products and services
- Industrial designs: aesthetic aspects of an article (including machines)
- Geographical indications: used for goods that have a specific geographic origin and related qualities
- Trade secrets: industrial or commercial secrets providing enterprises with a competitive edge; sometimes also dealt with as a separate form of IPR
- Traditional knowledge: knowledge that has been used and developed by communities over time and which needs protection from being captured by commercial interests outside the specific community.

With regard to innovation, several of these IPRs can gain importance depending on the stage of the innovative process: At an early stage in the development of commercially viable ideas, it can be important to treat them as trade secrets. Technical drawings can be protected as copyrights. A successful innovation can be marketed using trademarks and industrial designs, often in combination with patents. It becomes clear, then, that several types of IP can have a role in innovation. When we speak about intellectual property and innovation in the context of this report, we will mainly focus on patents as the possible outputs of R&D intensive innovation activity. The boxed text defines typical steps in the process of obtaining patent protection in current international legal frameworks. The process of obtaining and especially enforcing patent protection has developed over centuries. Although a certain degree of international standardisation has been achieved, patents are still territorial rights tied to nation states. Their design and particularly their enforcement depend on the respective national framework.

The patenting process

The following steps are typical in a patenting procedure (the description applies to national filings in countries that signed the Paris Convention):

1. **Innovation disclosure:** An internal document in companies or universities typically written by the researchers involved in the inventive work and reviewed by a university's technology transfer office or a company's patent department.
2. **Patent application:** Filing of an application at a national IP Office or international bodies like the EPO or the WIPO. If the specific invention is filed for the first time, the date of application is also what is called the 'priority date'. Within 12 months after this date, an applicant can seek protection (i.e. file the patent application) in another country and is still considered the "first-to-file" in this country (if the priority date is before any other parties' filing date).
3. **Preliminary search report:** The patent examiners at the IP authority receiving the application check whether there is so-called 'prior art', i.e. whether the criterion of the novelty of the invention is met. The preliminary search report includes information on existing similar inventions that were published earlier (as a patent, a publication, etc.). The search report often includes an opinion on the patentability of the invention.
4. **Publication:** The publication (together with the search report, as soon as it is available) is published after a maximum of 18 months from the application date. From this moment on, it will count as 'prior art' against any future applications from other inventors.
5. **Substantive examination:** The publication of a patent does not automatically mean that a granting of the patent follows. Sometimes, there is prior art, which disallows a granting. Sometimes, the applicant itself might not be interested in paying the fees and pursuing a granted patent (which would allow licensing or selling). She/he might be happy with having published the application, thus establishing prior art and blocking others from patenting.
6. **Granting:** This will occur if patentability is confirmed and fees have been paid. Further steps might follow (in the case of an international patent according to the Patent Cooperation Treaty or of an EPO-filed patent, the patent now must be validated by the national offices in the countries in which protection is sought).

Box 1: The patenting process (modified from the EPO's description at http://www.epo.org/learning-events/materials/inventors-handbook/protection/patents.html)

2 Cf. also: http://www.wipo.int/about-ip/en/ or http://www.wipo.int/sme/en/documents/ip_innovation_development_fulltext.html#inv

3.3.2 The evolution of the global patent system

The history of the patent system goes back to 15th century Venice, when the city-state issued the first formal patent code (Granstrand 2006, p. 267). During the 16th century, the practice of granting patents spread in England and France as part of mercantilist policies[3]. Since then, patents have consistently and controversially been linked to trade policies. These mercantilist policies and related monopoly privileges led to a strong anti-patent movement in 19th century Europe (especially in Germany, the Netherlands, and Switzerland). However, emerging economies and nations with a strong patent tradition created pro-patent lobbying groups. The depression of the 1870s also revived protectionism.

In 1883, a community of 11 countries signed the Paris Convention for the Protection of Industrial Property, which was reorganised in 1967 as the World Intellectual Property Organization (WIPO; a UN agency since 1974). As of 2014, 176 countries have signed the Paris Convention, which is based on two major principles (Granstrand 2006, p. 270): the same treatment of domestic and foreign patent applications, and the recognition of a priority claim established in one country by all of the others (within a twelve month time window).

The 20th century saw a shift of inventive activity away from the individual inventor towards industrial research and development. The differences between countries regarding their inventive capacities increased, which led to tensions between the so-called developed and the developing world. Nevertheless, the IP system spread internationally. When the WIPO joined the UN system, it came under a stronger influence of developing countries. The WIPO administers IP treaties such as the Paris Convention, but also has become involved in teaching, arbitration, and consultancy. It furthermore processes patent applications within the framework of the Patent Cooperation Treaty (PCT), which was signed in 1970 and has been effective since 1978. It allows for international harmonisation through the establishment of a procedure enabling a patent application to take effect in some or all of the PCT signatory states. More concretely, the PCT assists applicants in seeking patent protection internationally for their inventions, helps patent offices with their granting decisions, and facilitates public access to technical information relating to those inventions. It simplifies the process of filing and protection, as the applicants simultaneously seek protection for an invention in potentially all of the currently 148 member countries globally.

The 1970s also saw the development and ratification of the 'Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure'. The Treaty has 79 signatories and is thus not global in scope. It provides a legal framework for inventions involving microorganisms. Given that the description of the invention would not allow third parties to carry out the invention, thus violating the requirement of sufficiency of disclosure, the Treaty allows for the depositing of the microorganisms involved. As the PCT, it is administered by WIPO.

Parallel to the development of these international Treaties, the patent regimes in Europe were also put on different and more harmonised grounds. On the basis of the European Patent Convention, the European Patent Office (EPO) was established in 1977. It offers a cheaper (less translation costs, etc.) and simplified procedure for seeking patent protection in the EPC signatory states[4]. Europe thus opted for a deeper integration and harmonisation of its patent regimes. However, as said above, IP in general and patents in particular remain territorial rights tied to national legislation, also within Europe. The venues available for obtaining these rights have been complemented by approaches that are harmonised supranationally.

Another interesting example of integration in the global patent regimes is Japan (cf. Granstrand 2006, pp. 273ff). Before it signed the Paris Convention in 1899, it was not possible for foreigners to obtain patents in Japan. After signing the Convention, Japan established a patent system with the goal of facilitating the technological "catch-up" process. The idea of enabling catch up has been present in international debates on patent regimes ever since.

In 1994, the US-inspired TRIPS agreement on the trade-related aspects of intellectual property rights was signed. TRIPS was the first major IP-related international legislation that was negotiated and is enforced under the umbrella of the World Trade Organization (and not WIPO). It includes minimum standards with regard

3 The right of the state to secure for inventors (for a limited amount of time) the exclusive right to their discoveries is also included in the American Constitution.

4 It is important to highlight that this is not what is referred to as a European unitary patent (a patent that would allow for protection in the EU Member States without national phases and translations). The related legal initiative has been negotiated for decades. There is agreement in all major points, but the unitary patent can only become reality when the signatory states also agree on two details that are still debated: one is the official languages relevant for the unitary patent (Italy and Spain claim their respective languages to be recognised as well), the second the location of the Unified Patent Court, which is important for the enforcement of the unitary patent.

to all kinds of IP (including patents, trademarks, copyrights, etc). Its purpose with regard to patents is the further international harmonisation of patent systems (e.g., regarding the patentability criteria, the extension of patent protection to additional sectors like pharmaceuticals, or the equal treatment of foreign and domestic inventions). It was criticised by developing countries as impeding them from entering catch-up processes. The TRIPS agreement exemplifies a new pro-patent era, which started in the late 20th century. Patent portfolios have become increasingly valuable business assets. Multinational corporations have pressed for stronger patent protection and enforcement. Litigation by companies (especially multinationals) has increased (with the related costs skyrocketing).

At the level of public research and innovation, a national legal act has also become important from the 1980s onwards for a specific aspect of patent regimes. In the US, the so-called Bayh-Dole Act of 1980 has allowed universities to own and license patents developed with public money. The ownership of patents thus moves from either funding agencies or researcher-inventors to research institutions. Bayh-Dole-like legislation has been introduced in a number of countries, including in emerging economies, without becoming international law.

TRIPS and Bayh-Dole were effective in pushing forward global standards in patenting. However, even within the so-called developed countries, there is considerable diversity in patent regimes, for instance, with regard to the possibility of filing software patents or the relationship between public research and patenting. In Sweden, for instance, a country usually considered successful in public research-driven innovation, there is no Bayh-Dole-like legislation. Instead, university researchers own the property rights related to their inventive activity. Similarly, not all developing countries and emerging economies have adopted Bayh-Dole legislation. Some of them have pushed for the recognition and protection of their traditional knowledge, have different views on what kinds of inventions are patentable, have experimented with exceptions to patent protection as foreseen in TRIPS, or have decided to resist international pressure towards strengthening patent enforcement. This international pressure often also comes through free trade agreements where economically stronger parties push for stronger IP regulation in developing economies.

The landscape of patent regimes thus remains diverse and fragmented. "Despite long-standing efforts to coordinate and harmonize the national patent laws, many important differences remain, and a global patent system, with international or global patents, seems far away" (Granstrand 2006, p. 273). Instead of a global patent system, we find a variety of patent regimes within a renewed global pro-patent (or, more broadly, pro-IP) era. We will now discuss the economic and, in particular, innovation-related impact of these patent regimes, a question that is of particular relevance in times of more collaborative forms of knowledge production and internationalising innovation networks.

3.3.3 Patents and innovation

After this short overview of the development of global patent regimes, we will continue the focus on patents and present a variety of arguments regarding their relevance for innovation. As of today, economic and innovation studies offer ambiguous findings regarding the systemic relevance of patent regimes for innovation. A patent regime provides innovators with a temporary monopoly as a reward for an invention and its disclosure. The underlying idea of the regime is first to provide a substitute for socially costly trade secrecy, and second, to correct for underinvestment in innovation. Arrow (1962) argued that private firms will underinvest, from society's point of view, because of their inability to appropriate returns. As innovation produces and relies on knowledge, it potentially suffers from the fact that knowledge is non-rival (cf. Encaoua et al. 2006). Furthermore, the aspect of patent disclosure is a substitute for socially costly trade secrecy. Disclosure potentially reduces the duplication of R&D investments, hence avoiding unnecessary overinvestment.

However, the economics literature has indicated that patent laws "do not appear to be a necessary or sufficient condition for higher rates of innovation" (Moser 2013, p. 33). For instance, the IT sector developed without patent protection (not without IP though, as it relies heavily on copyrights). Patent regimes sometimes create additional social costs, e.g. in the case of patented technologies of high social relevance[5]. When companies 'race' towards obtaining monopoly protection, patent regimes might lead to a certain duplication of investments: Firms compete to finish similar R&D projects first (thus gaining the monopoly granted through patents). This competition can be healthy, but it can, on occasion, unnecessarily increase costs related to an innovation. In addition, as patents can increase the entry barriers to a new sector, they might also block further innovation. This is especially the case when applied to young industries and early generations of inventors (ibid., p. 40). Patents might hinder innovation further downstream, especially when upstream companies apply for broad patent protection. The downstream companies have to deal with license fees and legal insecurity, which increase their costs.

5 Compulsory licensing has emerged as a solution to balance this: The TRIPS Agreement allows national governments to issue compulsory licenses of foreign-owned patents in the case of national emergencies. India and Thailand, for instance, have referred to this procedure to procure vaccines against the swine flu or to provide HIV/AIDS medication. Critics argue that India's positive stance towards the generic pharmaceuticals industry has led to underinvestment in the private sector's health and pharma research, causing patients more harm than good. In Thailand, which has also referred to the procedure, similar discussions are ongoing.

Depending on the sector, their position in the value chain and their innovation strategies, companies opt for or against patent protection. Studies have shown that, in many sectors, trade secrecy and the so-called 'lead-time' (or first mover advantage) and trade secrecy are still the dominant choice among R&D managers when it comes to ensuring returns on innovation (Boldrin, Levine 2013). Thus, not all technically patentable inventions are actually patented because companies do not want to disclose what they are working on. They might also opt against patents because of the limited timeframe of monopoly protection. Furthermore, as we have seen, not all inventions are technically patentable, either because the subject matter is excluded (as is the case with software or some biotechnology related subject matter) or because of the patenting criteria (of novelty, etc).

In terms of ensuring returns on patented inventions, studies have shown that around 40 % of granted patents are not commercially used: 20 % are only used to block competition and an additional 20 % have no use at all. These numbers are higher in the case of multinationals' patent portfolios (cf. Gambardella et al. 2012). Among the patents that are commercially used, there is a significant difference in their economic impact, as Pakes and Griliches (1984) or Scherer and Harhoff (2000) have already pointed out. A very small number of patents are responsible for the largest part of the economic value in a firm's or a country's patent portfolio.

The skewed distribution of patents' economic returns does not turn them into a barrier for innovation per se. Commercially unused patents (including those where protection ended) are part of a stock of knowledge that is accessible and can be used. However, the data point to the phenomenon of an abuse of the monopoly rights granted through patents. Patent owners might file patents to prevent competitors from entering a market. They create 'patent thickets' that are difficult to handle for market newcomers. They patent without the motivation of ever actually using the inventions. In sum, depending on the sector and the maturity of an industry, patents can encourage investments in innovation, innovation itself, as well as its diffusion, while on other occasions and in other contexts, they might be detrimental to innovation.

Developing economies are among the innovation systems where the potential benefits or detrimental effects of patent regimes are particularly relevant and contentiously discussed. As specified above, the developing countries initially opposed TRIPS because it was feared that it would impede catch-up processes (enabled through the protection of local knowledge production and inventive activity against foreign economic actors). Ultimately, most developing countries signed TRIPS (there are currently 162 signatories). The agreement also led to an increased number of bilateral free trade agreements with these countries (cf. Hassan et al. 2010, p. xiii).

As to the question of the effects of the IP systems in developing economies, the literature suggests, among other things, that stronger patent protection and IPRs in general 'may positively affect the volume of FDI and exports, particularly in countries with strong technical absorptive capabilities where the risk of imitation is high' (ibid., p. xiv). It is implied that manufacturing and R&D-oriented foreign direct investment (FDI) will only flow into these countries if the investors do not need to fear immediate imitation[6]. Similarly, technology transfer through licensing is reportedly more frequent in developing countries with stronger patent regimes and sufficient absorptive capacities, whereas those countries with weaker patent and IP regimes see multinationals exporting through foreign affiliates and intra-firm trade (not allowing other economic actors' learning processes in the recipient country). Other studies point out that the absorptive capacity in the private sector, together with the scientific quality in public research, is actually also a prerequisite for a country to have its public research sector benefit from the IP system (Montobbio 2009, p. 199). Otherwise, there is a risk of public research producing low quality and/or unused patents.

The private sector's technical absorptive capacity is one of a number of preconditions that need to be in place for a developing economy to benefit from a stronger patent regime. Public research capacities, innovation financing and access to foreign markets are some of the others. Most of the developing and emerging economies in Southeast Asia have embraced the global pro-patent era. Against this background, our work focuses on situating patent-related policy developments in the innovation systems and economic integration processes in the region. We see various countries in Southeast Asia strengthening their patent regimes. According to the literature (Granstrand 2006), this particularly increases inward patenting because foreign companies expect to be able to enforce protection. However, Southeast Asian countries have also stepped up efforts to increase domestic patenting. Some countries have substantially increased national and international patent application output. This has happened, as we shall see later, with limited or unclear effects on innovation performance.

Apart from patents, we have indicated above that other types of IP can also play a role in innovation. In the following, we will briefly discuss their potential contributions to innovation in general and to ASEAN in more detail.

3.3.4 Other types of IP and their relevance for innovation

Patents are not the only form of intellectual property that can play a role in innovation processes. Companies

6 China seems to be a contrasting case as R&D-oriented FDI inflows were strong despite the risk of imitation. If the market is big enough, the argument made by Hassan et al. (2010) might not hold true.

might opt for trade secrets instead of patenting in order to exploit their ideas. Copyrights are traditionally connected with the arts. However, they play an important role in the knowledge-intensive software development sector (Filippetti, Archibugi 2015). Depending on their legal frameworks, many countries (e.g. in the EU) do not allow the patenting of software (although others do, interpreting the TRIPS agreement's specifications accordingly). In light of this, copyrights are another means to protect intellectual property related to software.

Broadly speaking, copyrights describe the rights of creators over their authored works (literary, artistic, architecture, etc). According to the Berne Convention, ratified in 170 countries, copyright protection encompasses moral and economic rights of the author. Copyright is obtained automatically without the need for registration or other formalities[7]. TRIPS and the WIPO Copyrights Treaty stipulate that computer programs are protected by the Berne Convention. This makes copyrights particularly important in the software sector. It is a crucial element in the open source development of software. Depending on the innovation model, copyrights on software can also be an important part of firms' commercial innovation strategies (together with or instead of speed and trade secrets).

Different from copyrights, trademarks play a role in innovative activities in practically all sectors. Trademarks are crucial when it comes to building a firm's relation with its customers. The product or brand protected by a trademark does not have to be new. Nevertheless, trademarks can be linked to innovation performance, particularly in knowledge-intensive services and high-technology manufacturing. They play a role in the marketing of new products, in pointing out product improvements, as well as in protecting innovations, either in combination with trade secrets or as a way of continuing protection after the relevant patents have expired (cf. Malmberg 2005; Mendonça et al. 2004; Millot 2009). By very similar means, however, firms can also use trademarks in ways that counteract innovation: Trademarks create entry barriers for competitor firms. After the formal expiry of patent protection, some companies make strategic use of trademarks to suggest a continued protection, preventing innovative competitors from entering a market[8].

In a regional context of developing and emerging economies, as in the case of ASEAN, copyright and trademark protection are contentious forms of IP. Trademark filing activity, for instance, is high and still rising in most ASEAN countries[9]. This reflects its relevance as a market and its inclusion in the global trade regime. Infringements are heavily criticised and lobbied against by MNEs. At the same time, strong protection in favour of foreign companies might run counter to domestic economic interests. Nevertheless, most ASEAN countries are working on stronger protection regimes, partly in order to continue to attract foreign direct investment, and partly because their own company landscape is increasingly relying on these forms of IP (in a regional and global context).

Utility models are a different, but not necessarily less disputed case of innovation-related IP. Utility models (or, as they are also called, 'petty patents' or 'innovation patents') are a form of IP that is similar to patents. Inventions to be protected through utility models also have to be novel, but the requirements with regard to an inventive step and non-obviousness are less strict.

Utility model protection can be faster because of the less strict criteria. This makes them interesting for industries with short product life cycles (cf. Radauer et al. 2015). WIPO sees utility models as potentially fostering local innovations and incremental innovations by allowing SMEs to protect minor inventions, which improve and adapt existing products[10]. Utility model systems are considered as particularly suitable for emerging countries, which are typically characterised by SMEs with limited R&D and investment capacity. These firms can benefit from the possibility of obtaining IPRs for incremental changes or adaptations to existing products (Kim et al. 2012; Suthersanen 2006). Large companies, by contrast, might abuse utility model protection, which requires less substantive examination, for anti-competitive behaviour (cf. Grosse Ruse-Khan 2012)[11].

Utility models are an internationally hardly harmonised form of IP. Even in the EU, utility model systems differ greatly among those countries that have one (Radauer et al. 2015). Among the group of ASEAN member states, utility model protection is currently available in Indonesia, Laos, Malaysia, the Philippines and Thailand. Studies of the types of inventions protected through utility models as well as of their relevance for these countries' innovation performance are still missing. In our discussion of intellectual property and the innovation framework conditions in ASEAN, we will keep utility models and their potential role in innovation (particularly in SMEs) in mind. The focus will nevertheless be on patents as the major type of IP in knowledge-intensive, research-based innovation.

Before we turn to a discussion of the European and Southeast Asian patent regimes in more detail, we will take a step back and look at the regions' respective economic integration processes and how they are linked to the innovation framework conditions and the patent systems as a part of them.

7 Most countries allow for the voluntary registration.
8 See also the respective site on the Innovation Policy Platform: https://www.innovationpolicyplatform.org/content/trademarks (accessed 6 February 2016)
9 See WIPO's trademark application statistics: http://ipstats.wipo.int/ipstatv2/index.htm?tab=trademark
10 See: http://www.wipo.int/sme/en/ip_business/utility_models/utility_models.htm
11 See also: https://www.innovationpolicyplatform.org/content/utility-models

4 Economic integration and the framework conditions for innovation

As mentioned already, we see the link between economic integration and innovation as including a set of cooperative measures and institutions, which reinforce the regional innovation systems and processes in general. Economic integration increases the likelihood or capacities to develop such cooperative measures. For both the EU and ASEAN, we therefore include a discussion of the main innovation-relevant arrangements that have developed on the backdrop of integration processes.

4.1 Economic integration in Europe: Some highlights

4.1.1 The policy and framework for European economic integration: The Single Market Programme

Economic integration in political unions or economic blocks is normally a difficult and complex process. This has also been the case with economic integration in Europe. It has been a process plagued by diverging interests and set-backs, although it also has made big leaps forward. The early years of the European Community, to use a generic phrase, were indeed much about economic integration, and the "European Economic Community" managed to launch a customs union among the six members in the 1960s. The customs union served as the platform for further integration, in particular in energy policy, which was a cornerstone of European cooperation in those days, but also for the longer term aim: free flows of the key factors of production. Lowering tariffs among the six early members did not provide the level playing field that was hoped for, as some countries retained other protective measures, such as subsidies for firms in trouble or restrictive practices for public procurement.

This situation, along with additional tensions arising from the oil price crisis of the 1970s and 1980s, generated greater concern, often with reference to the widespread pessimism or Euro-sclerosis perceived to be persistent. The need for further reforms of the treaties governing European cooperation burgeoned, and industrial interests as well as political priorities pushed for further economic integration to create a European industry. The process led to the approval of the "Single European Act" in 1986, which was implemented in 1987. It included a number of institutional reforms which will not be dealt with here, but provided a further commitment among the members to realise the single market. The Cecchini Report (Cecchini 1988) even estimated that the Single Market Programme would boost the region's GDP by 6.5 %.

This treaty also included provisions related to the enlargement and inclusion of southern European countries (Spain, Portugal, and Greece), which had relatively weak economic structures. These provisions were directed at social and economic cohesion and were implemented through new structural funds to support economic and social development in lagging countries. But more importantly in this context, the Single European Act also added a commitment to undertake research and technological development and to increase cooperation between companies and research institutions. In fact, the successful series of European framework programmes for research and development[12] were increasingly driven by the Single Market Programme and the Single European Act. The link between economic and technological development became a centrepiece in boosting competitiveness (Guzetti 1995).

The Single Market Programme continued through different initiatives, but aimed primarily to open the European markets for greater competition through ensuring free flows of goods, capital, persons, and services. Deregulation and tariff reductions were key to this process, as were measures to reign in unfair state aid and other non-tariff protective measures. The Single Market Programme has therefore gone through a number of steps over time, including further changes in the European treaties that cannot be discussed here. However,

12 See later for details.

the economic, or market, integration that was set in motion triggered some important developments and impacts that will be briefly discussed below:

- Impacts on competition and growth;
- Impacts on the R&D landscape.

4.1.2 Impacts on competition and growth

The Single Market Programme induced significant changes in the framework conditions for innovation. It should also be noted that a key objective behind it was the improvement of Europe's competitiveness in the global economy, whereby a bigger and more unified market in Europe was seen as a necessary platform or condition for this to happen.

Market integration is, in particular, directed at product market reforms, and in a recent study, the link between product market reform, innovation, and EU macro-economic performance was investigated (Griffith et al. 2006).

An immediate impact of the competition induced by market integration policies is likely to be on the "mark-up", that is, the price for a product that a company may take above the cost to produce it. Lower mark-ups from increased competition, Griffith et al. argued, lead to greater incentives for innovation and development to boost profitability and competitiveness. This may take place to protect positions in existing markets or to take bets in new ones. Their study was on the manufacturing sector in Europe, a sector in which product market integration has had a great impact and where R&D is a normal activity, including patenting. Their most relevant findings supported the notion that competition leads to more innovative activity:

- The Single Market Programme's market reforms have led to a reduction in the average mark-up/increased competition in the studied countries and industries;
- Increased competition has led to increased R&D investments in the manufacturing industries;
- Competition has increased innovative activity by incumbents, but has tended to decrease incentives for new entrants to enter the innovation process (meaning that entry barriers have increased);
- The increasing impact of competition on innovation has been larger in countries that are closer to the technology frontier (as measured by R&D and patenting);
- Increased R&D investments have led to faster total factor productivity growth in the manufacturing industries.

Another study by Belderbos et al. (2010) achieved results much in line with the above. With reference to the major structural changes coming from the market integration efforts in Europe through the Single Market Programme, Belderbos et al. traced the changes in firm and industry structure "by focusing on the interrelationships between production strengths, product diversification, multi-nationality and technology strengths of leading firms in EU manufacturing industries" (ibid., p. 2). They included data for the period 2000–2007 for 250 leading firms.

Among the findings, they concluded that producer concentration has increased, which was partly due to increasing tendencies for merger and acquisition activities. They also made a point of the fact that the global dimension has increased through the increasing presence of non-EU firms among the technological leaders. Further, product diversification declined as a consequence of greater competition. Incumbent firms, i.e. firms originally present in Europe, managed to maintain a significantly higher share of production compared to new entrants, which is also in line with the findings above. Then, the study concluded that there was a strong positive relationship between technological and market leadership, and that new entrants need strong technological leadership in order to build a sizable production share in the European market. Increasing competition has led to an increasing importance of R&D, as well as an increasing role of innovation policy instruments to ensure that market and systems failures (e.g. failure to invest in R&D or lack of appropriate networking) do not inhibit optimal investments in R&D.

The results from these two studies are fully in line with what has been expected from the Single Market Programme over the years. A rationale for this programme has been, on the one hand, boosting the competitive position of European industry vis-à-vis global competitors, and on the other hand, ensuring an effective use of resources and flexible allocation of them to activities with high social returns. The efforts to enhance and improve the single market through further integration have been continuing through step-wise reforms, as well as enlargements to include more member countries. The recent programme of Europe 2020 is just another step in this direction, illustrating the long-term ambition of the Single Market Programme. It reinforced the economic growth agenda after the financial crisis of 2008, but with a broader and more comprehensive set of objectives. It was termed "a strategy for smart, sustainable and inclusive growth" (European Commission 2010), and it reiterated the former objective of investing 3% of Europe's GDP in R&D, and among other things, gave priority to actions such as the Innovation Union (a concerted initiative to boost innovation-led economic growth), an industrial policy for green growth, a new agenda for skills and jobs, and more. In particular, the Innovation Union can be seen as a more ambitious link between a progressed Single Market Programme and an innovation and R&D-based growth agenda. For example, the Innovation Union agenda is highly integrated in the current framework programme for research and innovation, Horizon 2020.

4.1.3 Impacts on the R&D landscape

The Single Market Programme for economic or market integration in Europe has developed hand-in-hand with new initiatives for research and innovation. When the first framework programme was put in place in 1984, it was a response to the increasing complexity and disorder of the disparate R&D activities to that date. There was, in fact, no Community policy on science and technology, and the R&D activities themselves were less than optimally co-ordinated with other Community activities.

At that time, there were already increasing doubts as to the relevance of the linear model of the process of technological innovation, and the Commission wanted to set up the new activities within a system that corresponded to their perceived complexity. The Framework Programme (FP) resembled a multidimensional matrix in which all of the single programmes found different linkages with each other and with other Community activities and policies. The importance in the FP lay in the interaction between the programme activities and the aims of Community policy in various sectoral areas (Guzzetti 1995). However, as the national level had the competence in R&D policy, the Community could not expand activities in this area beyond what could be seen and agreed as adding value to what national governments were doing already. Therefore, 'European Added Value' (EAV) emerged as a concept legitimising Community level action. During the first FPs, EAV was used to define the limits of what the Community could do.

In an attempt to operationalise the idea of EAV at the start-up of the 1st FP, the "Riesenhuber criteria" were formulated to guide or justify Community involvement in R&D:

- Research conducted on so vast a scale that single member countries either could not provide the necessary financial means and personnel, or could only do so with difficulty;
- Research which would obviously benefit from being carried out jointly, after taking account of the additional costs inherent in all actions involving international co-operation;
- Research which, owing to the complementary nature of work carried out at the national level in a given sector, would achieve significant results in the whole of the Community for problems to which solutions call for research conducted on a vast scale, particularly in a geographic sense;
- Research which contributes to the cohesion of the common market, and which promotes the unification of European science and technology; as well as research which leads, where necessary, to the establishment of uniform laws and standards.

Later, two additional criteria were formulated: one on social and economic cohesion in 1987, and one on the mobility of researchers and the co-ordination of national policies (Guzzetti 1995).

In these early stages of the FP system, stimulus programmes were developed with the aim of underpinning and enhancing the development of the European scientific potential. Moreover, the mobility of researchers was encouraged to support networking and the development of a European research community. Horizontal activities were put in place to improve the forecasting and evaluation of European scientific efforts.

With the Single Market Programme, technological progress was seen as essential in the new economic landscape. The 2nd and 3rd FPs (1987–1994) thus became the engines for a gradual shift to include R&D efforts also in other Community policies, notably in regional policies. The cohesion problem was seen mostly in terms of disparate economic development in various regions in Europe. The hope was that collaborative research could help mitigate economic disparities. The hope was justified, as an evaluation panel wrote: "The Panel finds that the Framework Programme is contributing substantially to the establishment of an integrated, transnational research community of academic, industry and government researchers. … What has also impressed us greatly, is the apparent cultural change and modernisation which is affecting the RTD system of the Less Favoured Regions, under the influence of participation in the Framework Programme, as well as the stimulus it has provided for the emergence of new protagonists in the RTD area" (Caraça et al. 1991, p. V)

The Maastricht Treaty of 1992 intensified political co-operation, and in particular, created a more demanding framework for the European dimension for R&D. Furthermore, the treaty brought more policy areas within the competency of the Commission. Economic and social cohesion, on the one hand, and social affairs, on the other, were given more prominence than they had had before. The principle of subsidiarity was given a key role in setting out a clearer picture of what the European dimension was, including a clearer borderline between Community responsibilities and those of the member states.

The Maastricht Treaty affected research in some notable ways. For the first time, policy areas other than science and technology policy became explicitly relevant for the overall R&D policy: "It [the treaty] re-emphasised, at the highest juridical and institutional level, the idea which originally gave rise to the framework programme: the Community's S&T policy should be, first and foremost, at the service of other Community policies" (Guzzetti 1995, p. 153). Among other things, this gave more legitimacy to research activities that were not directly linked to the Single Market idea of competitiveness.

Correspondingly, in the 4th FP, three other activities were introduced in addition to the specific research programmes: cooperation with non-EU countries and international organisations, dissemination and exploitation of results and training and mobility of researchers. FP5

(1996–1999) further increased the emphasis on horizontal themes, including the participation of SMEs, international collaboration beyond Europe and socio-economic research. The concept of EAV was no longer the only justification for Community action in R&D. FP5 also represented a renewed effort to move towards a less technologically driven policy. Social objectives and wider Community concerns became even more important. Research policy should serve European society, not only industrial development. The European Commission saw European industry and competitiveness as a rather bleak picture during the 1990s, in particular vis-à-vis Japan and the USA. The focus of the 6th FP on scale and the concentration of research resources is a reaction to this.

Until the 2000s, there was no formal innovation policy at the European level. However, there were the combined policies of market deregulation and integration through the Single Market Programme, on the one hand, and support for research and technological cooperation through the Framework Programmes, on the other (Guzetti 1995). Despite the absence of a formal innovation policy, the focus on collaborative research corresponded well with new insights from innovation research: Cooperation is the key building block in innovation.

The Framework Programmes continued in this way, staying formally out of innovation policy, but supporting Community policies, in particular, the Single Market Programme and its variations, as well as other sectorial policies. New cooperative platforms came into being, such as EUREKA, a pan-European cooperation mainly for small and medium-sized companies, and later, European Technology Platforms, Joint Technology Initiatives, Knowledge and Innovation Communities (KICs), etc. After the financial crisis in 2008, renewed efforts were focused on a broad Europe 2020 agenda. However, the increasing need for cooperation, as well as coordination, also led to discussions on the lack of coordination of R&D investments in Europe in the context of ever increasing economic integration. This led to an attempt to establish the European Research Area (ERA) in 2000, a first formal initiative to initiate a European knowledge market.

4.1.4 The development of an ERA: A single market for knowledge and innovation

The impact of economic integration on research and development in Europe took shape early in the integration process in Europe. The early form of integration was built upon three "communities": the Coal and Steel Union, Euratom (the basis for nuclear energy research), and the economic community called EEC. The latter stimulated, in particular, research and development in the field of agriculture. However, and not least because of the perceived technological gap with the US, a broader priority for research came into being with the integration of the three communities into one. The new commissioner for research, technology, and development, Altiero Spinelli, took office in 1970 and launched a research policy for industrial development with a heavy priority towards technological areas deemed important in the context of competition with the US and the emerging Single Market. As a federalist, he argued for the Community to spearhead modern industrial development and advanced technological areas such as ICT, telecommunications, electronics, and transport, and took a clear stance against concerted initiatives by the member states. Hence, while the Single Market was supposed to be the economic platform for the member states in Europe, he saw the EU of that time as the institution of competence for technological and competitive upgrading.

However, the next commissioner, Ralph Dahrendorf, took an opposite view, and saw the scientific basis throughout Europe as the main European resource for social development and welfare. He proposed a European Scientific Area which was supposed to pave the way for stronger coordination between the European member states to achieve an internal market for knowledge. In particular, he argued, it was important to coordinate the member countries' research policies. Thus, Dahrendorf became the early protagonist for the later European Research Area (ERA).

The first formal ERA initiative in 2000 had a relatively small impact, but a renewed attempt in 2008 generated a more solid base for a European "single market for knowledge and innovation", the ERA, often coined ERIA to include the innovation dimension. It included several broad initiatives to tackle perceived bottlenecks for a more unified knowledge market in Europe. To speed up the process, the EU Council called on all stakeholders to complete the ERA by 2014. ERA is anchored in the 2007 Lisbon Treaty, which also defined an EU mandate in research and innovation. The ERA is defined as being made up of five priorities for action (European Commission 2014 a):

- More effective research systems, leading to new efforts on the national level to develop policies and priorities in line with ERA priorities;
- Optimal transnational cooperation and competition, in particular, through Joint Programming Initiatives (JPIs) to tackle global challenges and align national programmes in such collective efforts, as well as cooperation on research infrastructures and linking national roadmaps with the European Strategic Forum for Research Infrastructures (ESFRI);
- Open labour markets for research, with a focus on better doctoral training, better recruitment processes for researchers, and attention to issues such as pension systems;
- Gender equality and gender mainstreaming in research, including targeting women researchers in the research system, as well as institutional changes in the research organisations;
- Optimal circulation, access to, and transfer of scientific knowledge, including via digital ERA, with active promotion of open access policies, improved knowledge transfer activities, and commercialisation of R&D results.

Further, ERA is seen as an open knowledge market and also an open space internationally, taking into consideration that ERA is in a strong symbiosis with global R&D systems. Hence, an important cross-cutting priority is that of international cooperation with non-ERA countries. The continuous monitoring of ERA shows a broad but uneven development that is too extensive to discuss in detail here[13]. However, we want to highlight one aspect: The link between an open knowledge market and innovation, illustrated in figure 2, is clear and positive, and provides further support for stimulating innovation and growth through openness and high quality research systems.

While ERA has been a comprehensive initiative in recent years, built on Dahrendorf's vision, it should also be noted that many likewise important developments took place over several decades. There are significant R&D budgets in the Structural Funds (regional policy). The European Science Foundation was established in 1974 and is an association between 79 member organizations in Europe. Its activities have been tightly linked with the FPs. EUREKA was established as an intergovernmental initiative in 1985 with a view to stimulate industry-led R&D projects. EUREKA established EUREKA Clusters and EUROSTARS as specific initiatives to stimulate cooperation and networking between firms as well as better funding conditions for R&D-intensive firms. The COSME programme with its forerunners like the Competitiveness and Innovation Framework Programme, led by DG Enterprise, has created a framework programme system particularly for SMEs. FP-related measures like Joint Technology Initiatives and the Knowledge Innovation Programme (KIP) are also members of the family of cooperative measures, programmes and institutions that over the years have been important for knowledge-based cooperation and innovation Europe.[14]

As Arnold et al. (2010) also emphasise, the European schemes were largely networking instruments to support more effective linkages between R&D and innovation performers in Europe. The recent ERA development reinforces a deeper cooperation in Europe in which the member states take a more active role in the integration efforts through better alignment between resources and activities in Europe.

These recent developments have also confirmed the overall trend: While the Single Market Programme has pushed economic and market integration, increased competition, and stimulated structural change, there has been a steady flow of initiatives to spur cooperation and collaboration through a series of Framework Programmes (the current one is termed Horizon 2020) and dedicated platforms and coordination measures for technological development, standards, risk financing, synergies, alignment of policies, etc. As such, it seems clear that economic integration goes hand in hand with more cooperation and interaction, which are the cornerstones of innovation, and that open and excellent research systems are strongly correlated with innovation performance.

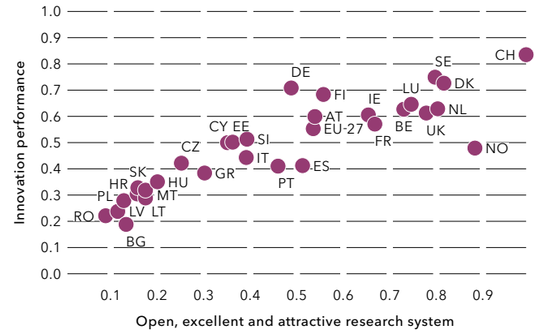


Figure 2: Innovation performance and openness of research systems
Source: European Commission (2014 c)

4.1.5 Innovation patterns in the Single Market

The discussion above was centred on the link between economic integration through the Single Market Programme and the framework conditions for innovation through the intervening factor of competition. Further, a link between the emerging European knowledge market and innovation was established, with open research systems (facilitated through European-level research funding and IP regimes) as the intervening variable. It was shown, for instance, that European-level research funding attracts highly innovative companies. It produces commercial output and has an added value on the innovative sales of participating organisations (Fisher et al. 2009). Integrated European-level research funding also had a structuring effect on research activities in the EU in general. The significance of geographical distance and country borders within European research has decreased (Scherngell, Lata 2013), especially for public, but also for private research (Scherngell, Barber 2011). This points to a connection between integration and innovative activities across Europe. Apart from the European-level research funding, integration measures regarding the free movement of people (including mobility support schemes) and capital, etc. have played a facilitating role in these processes.

Of course, it is difficult to establish direct causal links between integration, competition, and innovation, or even between open, cross-border research systems

13 http://ec.europa.eu/research/era/pdf/era_progress_report2014/era_facts&figures_2014.pdf
14 For a useful overview of this development, see Arnold et al. (2010).

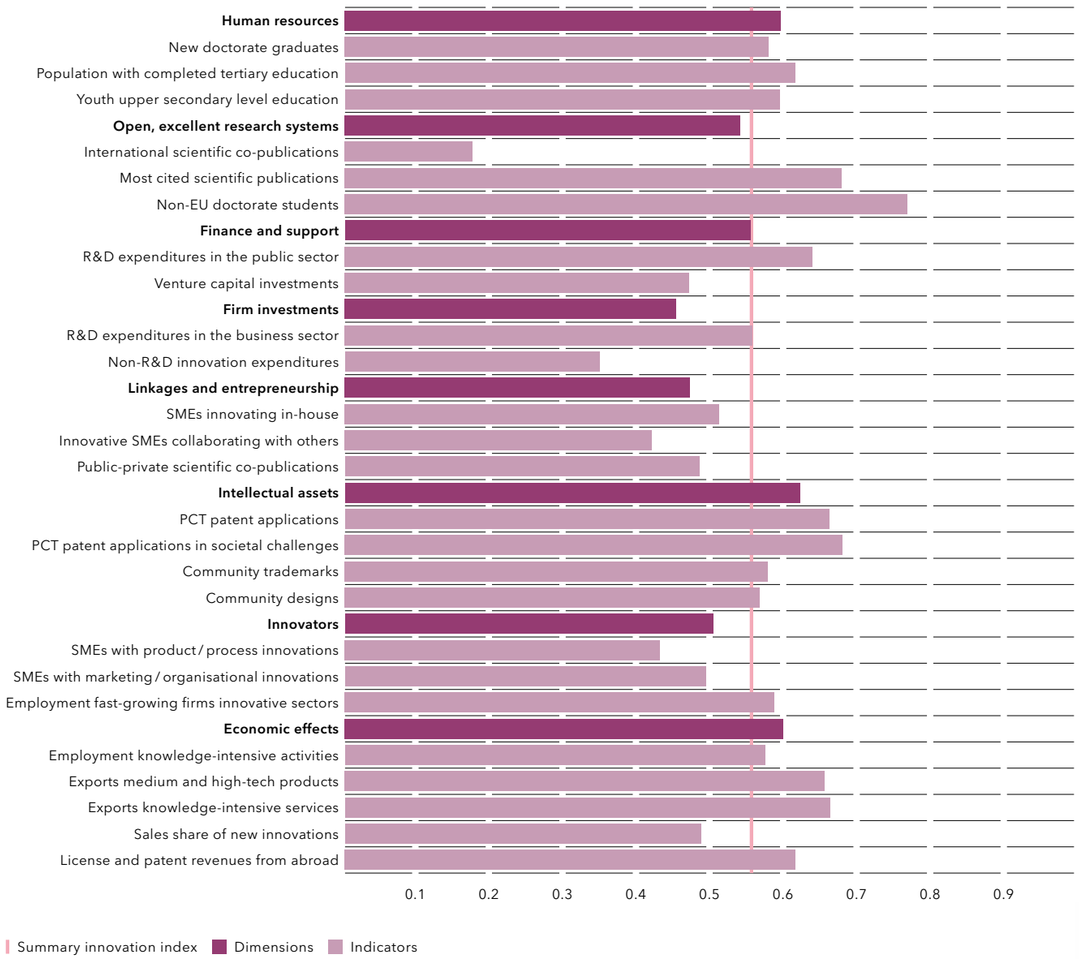


Figure 3: EU innovation performance. Source: European Commission (2015 a)

and innovation. However, it is obvious that the inter-related development of the Single Market Programme and other policies, programmes, and institutions has had a combined impact on innovation that is likely to be significant, even though there are still a number of inconsistent rules and practices within the Single Market that continue to hamper innovation and growth.

In this context, the Europe 2020 strategy was a renewed effort to boost innovation-based growth in Europe in 2010, and the so-called Innovation Union flagship programme was placed at the very heart of the Europe 2020 strategy. The very foundation of this is the Single Market Programme, with its integration through free flows of people, capital, goods, and services. The Innovation Union has helped to reinforce efforts to strengthen the knowledge and innovation base in Europe through several means. For example, public-private and public-public partnerships for innovation have been further stimulated in the new framework programme for research and innovation (H2020), and the private sector has committed to invest some 20 billion € since 2010 in Joint Technology Initiatives in areas such as the aeronautics, medicine, electronics, transport, and bio-based industries. Further, starting in the former framework programme (FP7), a risk-sharing finance facility was established through a collaboration between the EU Commission and the European Investment Bank (EIB), ensuring that, for every billion Euro spent from the framework programme budget, the EIB will mobilise 12 billion € in loans and more than 30 billion € in final investments in research and innovation[15]. Economic integration spurs collaboration on many levels.

The Innovation Union initiative also led to the development of better and more consolidated indicators for monitoring the development in innovation performance. Included in this was the innovation index based on four

15 European Commission (2014 a)

Figure 4: Average annual innovation growth rates 2007–2014. Source: European Commission (2015 a)

broad dimensions and a number of selected indicators for each of them. For this report, these indicators serve as a useful basis on which to discuss the overall innovation performance and patterns in Europe (meaning the Single Market). In figure 3, the European innovation performance is depicted, with the vertical line illustrating the consolidated index and the various dimensions with their indicators.

The strengths emerging from this figure are intellectual assets (in particular, PCT patents, which are discussed below in this report), economic impacts, in particular, through exports of medium- and high-tech products, as well as human resources. Weaknesses can be found in firm investments in non-R&D innovation expenditures and the low performance of SMEs in innovation.

In figure 4, the average annual growth rates of these indicators are shown for the period 2007–2014. The innovation performance has been growing annually on an average basis by 1 %, but with significant differences. The key element of knowledge markets, open research systems, has been growing with strong contributions from international co-publications. Growth in human resources has also been strong, while finance and related support has seen strong negative growth in the context of the financial crisis. The same picture, for the same reason, is seen for innovators, with considerable problems for SMEs in this period, while the economic effects are still acceptable. The growth in community trademarks (under intellectual assets) and not least the licence and patent revenues from abroad are noticeable.

Summing up this part, human resources and intellectual assets are driving innovation performance, with the overall economic impacts remaining positive, while innovation among SMEs is still a weak spot. Further, the Single Market's "organizational and institutional surplus", that is, the cooperative layers stemming from programmes and initiatives in Europe over the years, seems

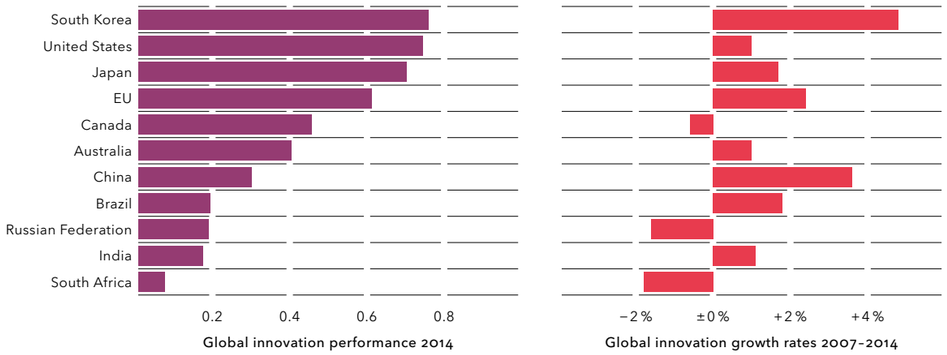


Figure 5: Comparative innovation performance. Source: European Commission (2015 a)

to play a significant role, in particular, in times of financial challenges.

Seen in a global context, the innovation performance of Europe has been seen as below its potential. Figure 5 illustrates that this view is too negative. While the global front runners are still Korea, the USA, and Japan, with the EU trailing in 4th place, its innovation growth performance in the same period as above is quite positive, below only Korea and China. This means that the EU and the innovation pattern in the Single Market are holding up, most likely due to a combination of factors, such as competitive pressures, framework conditions, cooperative institutions, and basic resources for innovation, such as R&D and human capital.

4.2 Economic integration and innovation in Southeast Asia: Some highlights

4.2.1 The policy and framework for ASEAN economic integration (AEC)

The Association of Southeast Asian Nations (ASEAN) was established in 1967 with the underlying objective of regional peace and security. It has a market of over 600 million people. This exceeds the population size of the countries of the North American Free Trade Agreement (NAFTA, established in 1994) and the EU. The ASEAN countries, however, represent only a fraction of the economic size of these other regional free trade and integration areas. ASEAN's combined nominal GDP amounted to $2.4 trillion in 2013, which would make it the seventh largest economy worldwide. NAFTA has a combined nominal GDP of $19.9 trillion (2013) and the EU $18.4 trillion (2014).

As early as 1977, the ASEAN member countries sought economic cooperation to spur economic growth by establishing the ASEAN Preferential Trading Arrangement (PTA). Individual ASEAN member states and their economies were considered too small and needed to cooperate to enhance their economic competitiveness and to improve their position in the global economy. Economic integration was expected to improve market efficiency and innovation. This included an enlarged market with economies of scale and scope, improved resource allocation across the member countries, and improved resource pools with an inflow of capital and labour. ASEAN responded to the European Single Market with serious efforts at economic integration in 1992 through initiatives such as the ASEAN Free Trade Area (AFTA), the ASEAN Investment Area (AIA), and the ASEAN Framework Agreement on Services (AFAS)[16].

The pressure to keep a competitive edge has always been a major driving force to foster a deeper regional economic integration amongst the ASEAN economies. They have also developed in the context of the wider Asian development, with the early inclusion in the international economy of the Asian Tigers (Korea, Taiwan, and Singapore), and later, with fierce competition from low-cost China. As China has lost some of its low-cost advantage recently, the ASEAN countries have regained some of their competitive edge and have been more integrated in global value chains. Bilateral and regional trade agreements in East Asia, to some extent biased against ASEAN, have created stiff competition for ASEAN's export markets and sources of foreign direct investment.

The region is still one of the largest recipients of foreign direct investment. The ASEAN countries received 11 % of global FDI inflows in 2014 (its share in global GDP is 5 %). Global FDI inflows decreased in 2014. In ASEAN, they rose by 5 % compared to 2013 (to $133 billion; see UNCTAD 2015). According to UNCTAD (2015, p. 4), ASEAN is also among the regional groupings which have had an impact in increasing intra-regional FDI. However, ASEAN's position as the preferred partner to establish free trade agreements or comprehensive economic partnerships in East Asia has been challenged. Negotiations for an ASEAN-EU FTA have been discontinued. The Trans-Pacific Partnership (TPP), for instance, pushed

16 For an overview, see e.g. Chia (2011).

by the US and signed by 12 countries, only involves four of the ten ASEAN countries. Factors such as these have prompted the ASEAN member states to at least sustain, if not strengthen, the competitiveness of the region (Austria 2012).

A more integrated and overall approach to economic integration seemed to be called for. More outward-oriented development strategies, with trade and foreign direct investment liberalisation, open regionalism, support of the WTO, and free trade agreements with ASEAN's major trade and investment partners, are the key issues. ASEAN's pace in building an economic community has been significantly slowed down. Unlike the EU, where the European Commission coordinates a supranational policy, ASEAN is devoid of a single regulatory body to develop and implement policies to adapt to changes within the region itself and to the external global environment, or to harmonise national policies and regulatory systems (Brennan 2015). The 'ASEAN-Way of doing things' involves meetings at all levels involving heads of governments, ministers, committees, policy-makers, CEOs of companies, scientists, and so on. There was a perceived need to establish an institutional framework for building and supporting the much-coveted economic community. The ASEAN way is inter-governmental, rather than supra-national.

The endeavours to remain globally competitive by removing barriers to the free flow of goods, investment, labour, and capital, were stepped up during the ASEAN Summit in 2003. The members of ASEAN resolved to establish an ASEAN Economic Community (AEC) with a target launch date in 2020. This occurred in the wider framework of the ASEAN Vision 2020, which envisaged an integrated Southeast Asian region with equitable economic development and reduced socio-economic disparities. The timetable for completion was later brought forward to 2015, which was perhaps over-ambitious, given the differences between the member states in terms of economic development and political frameworks. The AEC is one of three pillars of the Declaration of the ASEAN Concord II (also referred to as the Bali Concord II), the other pillars being the ASEAN Security Community, and the ASEAN Socio-cultural Community.

During the 13th ASEAN summit in 2007, the Declaration on the ASEAN Economic Community Blueprint[17] (AEC) was signed. The AEC is an ambitious effort to enhance ASEAN's global competitiveness through the free flow of goods, services, and skilled labour. The AEC is comparable in scale and complexity to the European Union, but it is different in the depth of integration. Nevertheless, it is the most ambitious regional economic integration initiative in the world outside of Europe. The AEC aims to create a single market and production base across its ten member states, encompassing the nearly 600 million people and US$ 2 trillion in production, and an economic community that is fully integrated into the global economy. Through the AEC, ASEAN is to develop into a fully integrated production base for transnational capital primarily by eliminating or minimising intra-regional barriers to trade and investment, and by creating a trans-boundary infrastructure to connect national markets amongst each other and to link them to the global market.

Following this declaration, the AEC can be briefly characterised as a:

- Single Market and Production Base with a free flow of goods (under AFTA and ATIGA), services (AFAS), investment (AIA and ACIA), skilled labour, and a freer flow of capital, Integration of Priority Sectors, and enhancement of intra- and extra-ASEAN trade of food, agriculture, forestry products, and commodities (ASEAN Integrated Food Security Framework);
- Competitive Economic Region with a fair competition policy, consumer protection, intellectual property rights, infrastructure development, bilateral agreements taxation, and infrastructure for e-commerce;
- Region of Equitable Economic Development with a blueprint for SME development, an initiative for ASEAN integration;
- Region integrated into the Global Economy with a coherent approach towards external economic relations and an enhanced participation in global supply networks.

The AEC blueprint provides the impetus for necessary joint objectives, such as lower transaction costs, the progressive elimination of rules of origin requirements (ROO), good infrastructure and logistics catering to the world-wide value chain, reduced barriers to trade and investment, increased capital, and labour mobility. This would have been next to impossible for the individual member states to implement unilaterally.

In addition to the AEC, region-wide agreements, comprehensive economic agreements, and partnerships with countries such as China, Japan, India, Australia, and New Zealand were established, and bilateral and regional free trade agreements (FTAs) are being entered into by a growing number of individual member economies[18]. ASEAN has entered into ASEAN+1 agreements with China, Japan, South Korea, India, Australia, and New Zealand, into ASEAN+3 (EAFTA) with China, Japan, and South Korea, and ASEAN+6 (CEPEA) with China, Japan, South Korea, India, Australia, and New Zealand, and the Trans-Pacific Partnership.

Although it seems natural to assess the benefits of the AEC in comparison to the EU's Single Market Programme, this comparison should be hedged in with caveats. The European Single Market Programme provided

17 ASEAN Secretariat (2008)

18 Excessively strict Rules of Origin requirements are often used by FTA partners as protectionist instruments. Most FTAs now adopt a combination of ROOs, rather than rely on a single rule, the 'noodle bowl effect.' (cf. Chia 2013)

measures that go well beyond those incorporated in the AEC, and the AEC includes steps that were not required in Europe (Petri et al. 2012).

The economic integration in ASEAN has often been subject to the criticism of having failed to live up to expectations. The commitments on paper are impressive, but the devil is in the details, in its exclusions, exceptions, and implementation record. One of the most important potential pitfalls is protectionist sentiment. In Indonesia, ASEAN's largest and arguably most important economy, and one of the founding members of ASEAN, there is governmental support for economic nationalism, indicating that progress towards economic integration will be an uphill struggle. President Joko Widodo, during the 25th ASEAN Summit in Myanmar in November 2014, declared his support for protectionist policies, particularly in the area of mining, aviation, and the financial service sectors, ensuring that no harm comes to Indonesia's national interest. This stand-off between national and regional interests is, however, not exclusive to Indonesia, and other ASEAN member states show similar protectionist concerns.

These concerns hamper activities even at the level of free trade as the first level of economic integration. According to Dosch (2015, p. 4), the often quoted figure that 99 % of AEC trade (between the six major ASEAN economies) has been liberalised is misleading. It refers to the share of the number of goods included in the ASEAN Trade in Goods Agreement and has nothing to do with trade volume. Several important commodities with great trade volumes are on temporary exclusion lists (including rice, for instance). Another potential weakness in the AEC is a reluctance to liberalise the member states' investment markets in some key sectors. The liberalisation of investment flows has not kept pace with the liberalisation of goods (Dosch 2013, p. 6). Among some ASEAN members, there is fear that national companies will not be able to adopt a regional strategy and will not be able to compete with companies from ASEAN's more developed economies, particularly Singapore, Thailand, and Malaysia.

The implementation of the AEC is challenging under the best of circumstances, but in ASEAN, it takes place in the framework of rapidly transforming national policy structures, wide regional gaps in socio-economic development and capacity, and a range of substantial political transformations. The AEC is a highly complex project involving many substantive structural adjustments that will require political commitment to complete, consistently maintained over a longer period. In addition, the ASEAN Secretariat, the main coordinating institution, has to work with a small operating budget (of around US$ 20 million[19]).

Overall, a recent study stated that "… ASEAN lacks the institutions and processes that help governments and societies to recognise the benefits that the AEC represents" (Severino, Menon 2013, p. 2). Indicators[20] suggest that the AEC, formally launched in Malaysia in November 2015, is still a work in progress. This especially applies to the areas of creating a single market and production base (including free trade and investment flows), a competitive economic region, and equitable economic development, and integrating into the global economy. The AEC Blueprint 2025, adopted on the occasion of the AEC launch event in November 2015, among other things, calls for strategic measures to strengthen free trade (through the ASEAN Trade in Goods Agreement), to eliminate investment restrictions (through the implementation of the ASEAN Comprehensive Investment Agreement), and the completion of other measures initiated under the AEC Blueprint 2015.

The main reason for the delays in the AEC's implementation is, as indicated, the various underlying national interests of the various member states. Economic liberalisation agreements will have an effect on economic governance and will have an impact on the redistribution of political power and resources, despite the commitments that have been launched, reflecting the value and long-term importance of the AEC for the member countries of ASEAN. There seems to be a lack of political willingness of several member states to 'walk the talk' (Dosch 2013). The impact of controversy between coalitions of social and political forces is best seen in the constrained integration of ASEAN's energy markets and the limited deregulation of skilled labour migration (Jones 2015). The problem seems to be one of striking a balance between political imperatives for *some* economic openness, generated by socio-political coalitions in ASEAN, and the constraints against full neo-liberalisation of the regional economies. The outcome is a constrained, partial, and uneven liberalisation (Rodan et al. 2006).

4.2.2 Impacts on competition and growth

With the gradual development of the AEC itself, including measures on the national level that often counteract the AEC, its impact on competition and innovation is likely to be lower than envisaged. At the outset, intra-regional trade has, over the years, remained relatively low, compared to the region's external trade (Remøe et al. 2014). However, bringing the AEC into full life will imply that intra-regional tariffs on trade will be lowered to enhance competition, productivity, and resource allocation. In fact, ASEAN has indeed achieved great strides ahead on this important indicator of economic integration (Intal et al. 2014, see figure 6).

Productivity development in the region is another matter. The figure below illustrates very well the challenges facing Southeast Asia. While labour productivity growth has been quite robust over the years, in particular, in Cambodia and Vietnam, with significant development in Indonesia and the Philippines in the recent period as well, it is still low compared to e.g. China. However, the main weakness is the total factor productivity growth (TFP). This indicator shows modest gains in most countries and stands in sharp contrast to other Asian countries such as China, India, Korea, and Taiwan (Intal et al. 2014). This means that the overall positive development in economic growth is not linked to greater competitive pressure and innovation, but to e.g. population growth and labour productivity growth. With greater competitive pressure and innovation-led growth, including the associated structural changes, one should see a boost in TFP growth. This has not been the case. Indeed, this puts pressure on the ASEAN countries to stimulate structural change, innovation, and knowledge-based growth.

An important point made by the McKinsey Institute (2014) is the fact that even if the Southeast Asian countries have low and competitive labour costs, their productivity levels, as illustrated above, are also low. Over many years, these countries have seen high growth rates. But their productivity levels are so low that most of the countries will have to make significant improvements in productivity to maintain these growth levels. In fact, most of the countries must increase their labour productivity over the next 15 years or so by between 10 %, and in Singapore's case, 170 % (most of them require increases of 30–100 %).

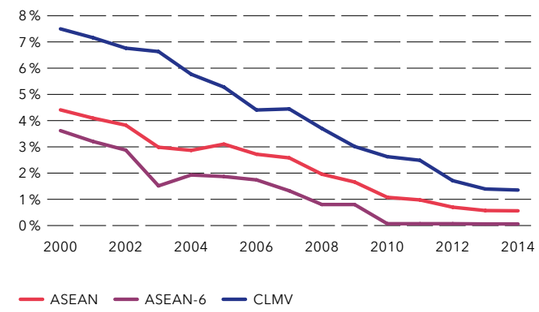


Figure 6: ASEAN has reduced intra-regional tariffs
Source: OECD (2015), based on ASEAN data

The business community reported through a survey that the main barriers to greater intra-ASEAN trade were different regulatory standards, excessive regulation, and a lack of information (Hu 2013) or problems in customs clearance. The latter also relates to the fact that the business community has little knowledge of the AEC and its objectives. Hu (2013) stated that the lack of awareness in the business community is linked to the lack of economic integration in the first place. Pursuant to Hu's survey, the response to the question of the main barriers to conducting business across borders in the region is shown in table 1, illustrating the main points above.

In sum, non-tariff barriers to trade (NTBs) dominate the picture, implying that even if the AEC should be able to implement lower or no tariffs (which is, to some extent, the case), these NTBs represent a major impediment to economic integration. In other words, greater competition through integration is not being achieved, and the innovation impacts that may be expected as a

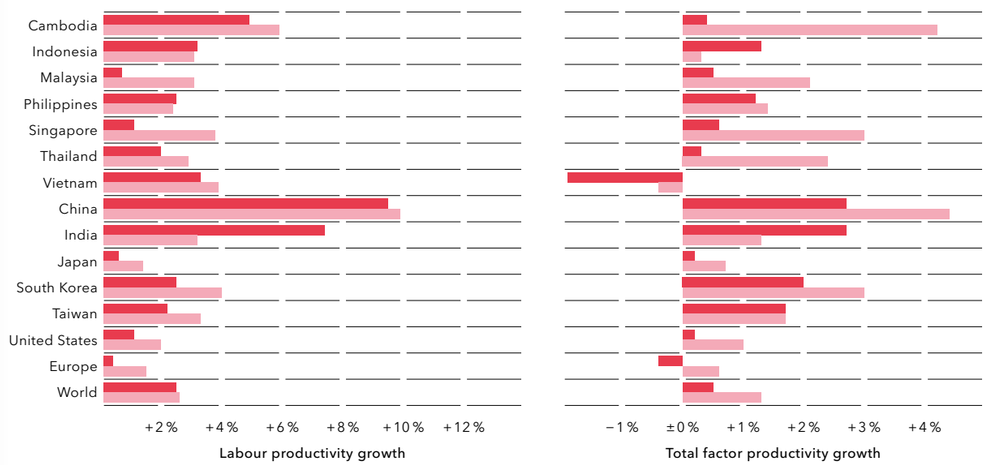


Figure 7: Productivity growth in ASEAN and selected partners. Source: The Conference Board (2015), authors' illustration

19 By means of comparison, the costs for the EU's administration in 2013 were around € 8.5 billion, around half of this amount was for staff (a reported 6 % of its annual budget of € 144 billion), see: http://ec.europa.eu/budget/explained/myths/myths_en.cfm

20 See e.g. the ASEAN Secretariat's latest AEC Scorecard. These scorecards are based entirely on member states' self-reporting, which causes some scepticism amongst academic observers of even the limited progress voiced in these scorecard reports. They have been superseded by the independent ERIA publications (Economic Research Institute for ASEAN and East Asia).

result of this will not materialise. Austria (2013) stated that NTBs have replaced tariffs as protective measures, a fact that was confirmed in the interviews conducted for the study. As also mentioned in the preceding section, governments take active counter-measures to protect their domestic business communities against competition, a tendency that is also likely to be linked with the high level of corruption in many ASEAN member states. Austria (2013) also pointed out that one particular factor is the difficulty in identifying which among the NTBs are effective barriers to trade.

Barriers	Share
Tariff barriers	33 %*
Different regulatory standards	41 %*
Discrimination against foreign investors	9 %
Excessive government regulations and bureaucracy	38 %*
Language barriers	24 %
Lack of information about the business environment in other ASEAN states	35 %*
Inadequate infrastructure	22 %
Double taxation	23 %
Lack of competition policy	16 %
Weak IPR	19 %

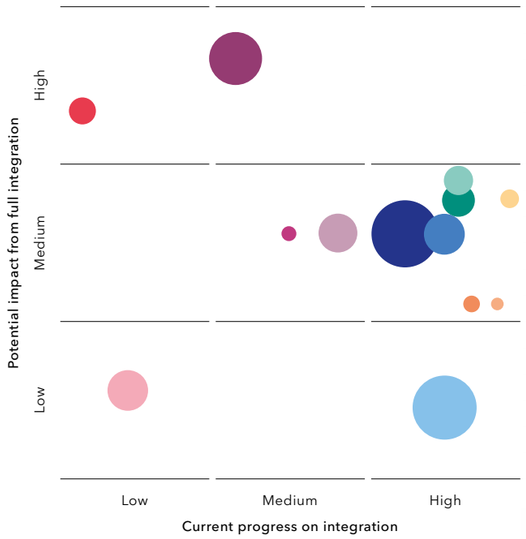
**Top barriers significantly different from the rest at 1 % significance level*

Table 1: Barriers to conducting business in other ASEAN countries
Source: Austria (2013)

Still, the AEC is likely to have some impact, albeit different across various industrial sectors. Woetzel et al. (2014) illustrated this in figure 8, showing that, in particular, health care and financial services will be the most impacted, with several typical manufacturing sectors scoring on a medium level.

This last point is underpinned by the growing importance of services both for growth and employment. However, the productivity levels in services are likely to be lower than in e.g. manufacturing. Hence, liberalisation in services is very important in the AEC context. But as Nikomboriak and Jitdumrong (2013) noted, the commitments under the AEC Blueprint are not sufficient to make any headway, nor do the negotiations under the ASEAN Framework Agreement on Services (AFAS) provide any major steps forward. Hence, the AEC will not have much impact on competition and productivity in services in general in ASEAN.

As the AEC and ASEAN member states are currently only slowly driving liberalisation and competition, productivity development will have to come from other structuring impulses. Innovation is key to this development, and while innovation is often stimulated by competition arising from cross-border liberalisation, but, as mentioned, does not represent a significant stimulus, such stimulus will have to come from national policies, as well as firms and sectors engaging in value chains and technological upgrading. ASEAN countries are increasingly linking into global value chains and knowledge flows, including via recapturing production that has been relocated from China. This in itself will require continuous upgrading in investments, skills, and technologies to sustain the growing importance of the region in the global economy. Further, urbanisation is continuing to be a major factor for restructuring and productivity, but also for innovation and technological development. The skills issue is particularly important and relates to the above discussion on services. Seeing Southeast Asia as a regional innovation system, the mobility and quality of human resources are key to innovation-driven growth. However, in line with the lack of liberalisation in services, there are still considerable restrictions on mobility and recognition of qualifications across the countries in the region. Nikomboriak and Jitdumrong (2013) concluded in their study on services that the seven Mutual Recognition Agreements for selected professions are full of loopholes and do not provide much impact on the mobility of highly skilled personnel.



Note: Tourism and e-ASEAN not included due to lack of available data. Agriculture-based sectors include fisheries.

Figure 8: Impacts of AEC by sector. Size represents cumulative sector GDP 2013 for Indonesia, Malaysia, the Philippines, Thailand, and Vietnam
Source: Woetzel et al. (2014)

The same can be said about investments. Bhaskaran (2013) held that the AEC itself provides a useful context for increasing investments. But on the other hand, foreign direct investments (FDI) have been declining over

the years since the Asian crisis in the 1990s. Domestic investments have also been shrinking, at least up to 2010. Even though the AEC and its investment agreement serves as a constructive platform, national barriers play out with a number of country-specific regulatory and other barriers to increasing investment flows. This also confirms the importance of non-tariff barriers in general that the AEC is not sufficiently addressing.

The difficulties of completing the AEC notwithstanding, the region stands to gain a lot from the process. On top of activities such as the removal of tariff and non-tariff barriers, wider-ranging measures such as regional liberalisation and trade with third countries, aligning standards, lowering transactions costs, integration into global markets, creating more efficient production systems, and developing a stronger manufacturing sector, are all worth pursuing in order to become a more attractive partner for trade agreements. It has even been estimated that the full implementation of the AEC will boost the real incomes in the region by some 5.3 % over the 2004 baseline and will result in 8 % gains in GDP towards 2025, in truth a significant gain, but with significant variations between the countries (Plummer et al. 2014). Such gains should be sufficient incentives for the region's policy makers to address the barriers to the AEC's implementation. If ASEAN succeeds in turning the regional AEC integration into a springboard for establishing stronger ties with the global economy, this achievement in today's global environment would increase the value of the AEC.

4.2.3 Impacts on the R&D landscape: The new role of science, technology, and innovation

Developing a single market, or in ASEAN's case, initiating the process towards it, also typically leads to a series of institutional developments as has been demonstrated in the case of the EU above. Economic integration is based on, and stimulates, further cooperative arrangements in areas vital to economic growth and competitiveness. A first sign of the new importance given to STI is already visible: Science, technology, and innovation has, up until recently, been subsumed under the Socio-cultural Pillar of ASEAN, the other two being the Political-Security Pillar and the Economic Pillar. This allocation was reflected in science and knowledge-related activities being first and foremost linked to the cultural development of the region and its member countries[21]. However, recognising the above, and learning from other, not least Asian, countries such as China, ASEAN decided to move STI from the Socio-cultural Pillar to the Economic. STI is increasingly seen as an engine for growth, playing a key role in knowledge-based economic development and innovation. This has immediate implications for the R&D landscape. For example, universities in many of the countries have been mandated to prioritise the commercialisation of R&D and engagements with industry, more attention is being given to IP and the funding of R&D, and innovation is at the heart of policy attention (Degelsegger et al. 2014). With the gradual implementation of the AEC, it is likely that a gradual increase in cooperative efforts for STI development in the region will take place, giving the ASEAN COST a key role.

ASEAN's member states have, from its very inception, been keen to integrate their relatively autonomous STI systems with strong national characteristics at an inter-governmental STI governance level[22]. The efforts have been shaped by a number of steps in ASEAN community building over the years, triggering the launch of similar S&T policies in the region. This integration was initially driven by an Ad-hoc Committee meeting on S&T in 1970. Then, a Permanent Committee on S&T (PCOST) was set up in 1971. Finally, the Committee on S&T (COST) was established in 1978. The mandate of COST was broad and comprehensive:

> *ASEAN shall promote active collaboration and mutual assistance on matters of common interest in the economic, social, cultural, technical, scientific and administrative fields and provide assistance to each other in the form of training and research facilities in the educational, professional technical and administrative spheres*[23].

COST remains an inter-governmental, cooperative platform for developing the S&T landscape in the ASEAN region. The annual meetings of the ASEAN Ministers for STI provide the general policy framework for regional STI cooperation, whereas COST, in its six-monthly meetings, then includes guiding the implementation of the projects and programmes of its subsidiary groups, monitoring and supporting ongoing regional collaborative progress, assessing their impact and effectiveness in terms of enhancing ASEAN's STI capabilities, and so on. COST's subcommittees cover nine major priority areas, ranging from biotechnology, food S&T, S&T infrastructure and resources development, meteorology and geophysics, microelectronics and information technology, marine S&T, nonconventional energy research, and space technology and applications. At the intergovernmental level, COST receives coordination assistance from the ASEAN Secretariat.

COST now drives ASEAN S&T policy, trying to implement the objectives outlined in the goals of ASEAN's Plans of Actions on S&T (APAST). APAST has, since 2007, been the guiding document for regional, inter-governmental cooperation in S&T, and it contains six strategic thrusts for COST:

21 For an impact of the AEC in terms of the socio-cultural issues in Indonesia, see e.g. Narjoko and Wicaksono (2009, pp. 16–24).

22 See e.g. Rodriguez and Soeparwata (2015).

23 See: http://astnet.asean.org/index.php?option=com_content&view=article&id=97&Itemid=247 (accessed 16 March 2016)

- Intensify R&D collaboration and technology commercialisation;
- Develop S&T human resources;
- Network S&T Centres of Excellence and programmes;
- Promote S&T awareness and utilisation;
- Strengthen S&T infrastructure and support systems;
- Forge closer cooperation with dialogue partners.

APAST was updated in 2011, with four additional years to run until 2015. In this period, COST also launched a select number of flagship programmes as an approach to prioritise the themes that needed more strategic attention and better allocation of resources, with objectives set for the end of the APAST period:

- Early warning system for disaster risk reduction;
- Biofuels;
- Applications and development of open source systems;
- Functional foods;
- Climate change;
- Health.

To further reinforce a more organised inter-governmental strategy, COST adopted the Krabi Initiative in December 2010. Its rationale was built upon the political visions of ASEAN leaders, a new understanding of the importance of STI (now with the 'I' meaning a greater awareness of Innovation) and its role in developing competitiveness and human development, as well as the perceived need for re-inventing the ASEAN Scientific Community for a "meaningful delivery" of an STI agenda in ASEAN. The Krabi Initiative launched several thematic priorities that partly overlapped with the APAST:

- ASEAN innovation for the global market;
- Digital economy, new media and social network;
- Green technology;
- Food security;
- Energy security;
- Water management;
- Biodiversity for health and wealth;
- Science and innovation for life.

Hence, the Krabi Initiative represented a shift in the awareness of the role to be played by STI, with a greater focus on innovation and economic growth, as well as a focus on the need to embed STI in the overall development of the ASEAN countries. As APAST came to an end in 2015, the new APASTI came to life for the period covering 2016–2025, confirming the greater focus on innovation, as well as the need for inclusive economic development, and an acknowledgement of the need to enhance the cooperation between state and non-state players (e.g. through public-private partnerships). More specifically, APASTI will be more aligned with the AEC, while prioritising in strategic thrusts:

- Strengthening and supporting strategic collaboration between academia and the private sector for capacity building, technology transfer, and commercialisation;
- Enhancing talent mobility and people-to-people interaction, especially for women and youth in STI;
- Establishing smart partnerships with dialogue partners to nurture STI enterprises to support micro, medium, and small enterprises;
- Raising public awareness and strengthening STI enculturation to enhance ASEAN science and technology cooperation[24].

The development and relevance of these plans and strategies notwithstanding, promoting STI in the region faces several obstacles and challenges. First among these is the lack of resources to implement the foreseen actions in any meaningful way. Most of the ASEAN countries have very small public investments in R&D, with gross expenditures in R&D (GERD) as a share of GDP typically in the range of 0.04 % to 0.20 %, with Singapore, and to some extent, Malaysia as exceptions). Therefore, a true commitment is difficult to achieve. Further, as an intergovernmental approach, COST and the member countries still lack effective coordination mechanisms, and the ownership among key stakeholders is still too weak. Lastly, even though the thematic priorities are highly relevant, small resources lead to small projects with correspondingly low impact, including the impact on the very development of cooperation.

To further integrate STI policies on an intergovernmental level, COST has inaugurated the Advisory Body of the ASEAN Science Fund, responsible for the management of the regional science fund and the Advisory Body on the ASEAN Plan of Action on S&T, which is in charge of providing policy advice on S&T related to internal ASEAN issues. The ASEAN Science Fund was established in 1989 with seed contributions from each member state, with additional contributions from the New Zealand government. It has grown to more than 11 million USD (2013), and represents, together with the recently established ASEAN Innovation Fund (2014), a useful attempt to boost the regional approach through a "common pot" mechanism.

In many European countries, it has been found that a national fund that awards grants for scientific research on a competitive basis is the most effective way to encourage the best science. A number of individual ASEAN member states have acknowledged the importance of having an infrastructure in place to allocate and distribute funds to researchers, provide research facilities, or maintain a state budgeting system that would allow the flexibility needed for scientific research. Indonesia is a case in point: The country is in the process of establishing an Indonesian Science Fund (ISF) supported by the World Bank and Australian Aid, to be established

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under the auspices of the Indonesian Academy of Sciences (Brodjonegoro, Greene 2015).

Such national autonomous professional granting agencies, with an independent expert review process to support research grants and development projects, could then also be integrated and supplemented on a regional level. Parallels could be drawn to the process by which the European member states are trying to bring their national granting systems into alignment with the European framework programmes.

STI policies contribute to the integration of the economies in the AEC, and vice versa. In general terms, STI policies cluster around certain key elements to deal with increasingly competitive and knowledge-based issues, and they typically involve activities concentrating around research and higher education institutions, the commercialisation of R&D and IP policies, the funding of research, support to SMEs, and the like. However, without supra-governmental institutions and with a weak resource base, STI is likely to play a smaller role in the AEC than foreseen in the plans and strategies.

4.2.4 Innovation performance in Southeast Asia

Given the challenges for ASEAN related to boosting internal trade, increasing productivity, and upgrading capacities to enhance competitiveness, much will hinge on the innovative capabilities of the region and its member states. A useful entry to this issue is the Global Innovation Index (GII) developed by the Institut Européen d'Administration des Affaires (INSEAD), WIPO and others (see: Dutta, Lanvin, Wunsch-Vincent 2015). The composite index is made up of two sub-indices: the input sub-index and the output sub-index. These are again made up of well-known indicators:

The input sub-index:
- Institutions (political, regulatory, and business environment);
- Human capital and research (education, tertiary education, research, and development);
- Infrastructure (ICT, general infrastructure, and ecological sustainability);
- Market sophistication (credit, investment and trade, and competition);
- Business sophistication (knowledge workers, innovation linkages, and knowledge absorption).

The output sub-index:
- Knowledge and technology outputs;
- Creative outputs.

On the basis of the input and output indicators, the authors also offer an innovation efficiency ratio. The results shed light on the diversity of Southeast Asian innovation performance. Table 2 reveals a wide gap in performance according to the Global Innovation Index. As expected, Singapore has the highest rank, with Myanmar the lowest among the eight ASEAN countries covered in the 2015 edition. In general, the ASEAN countries score relatively low. By means of comparison: European countries occupy the four highest ranks (Switzerland followed by the UK, Sweden and the Netherlands). Many other European countries are highly ranked too, with Romania being the European Union's lowest ranking member state (54th).

An interesting point is the differences between the input and output scores. In the innovation input ranking, Singapore, Hong Kong and the US feature strongly (Singapore highest ranked). In the innovation output ranking, the eight highest ranked countries are European. Some of the ASEAN countries are actually more efficient than European countries in translating input resources into outputs. This especially concerns Vietnam (also China scores well here). In contrast, Singapore has the highest score on the input indicators, ranking no. 1, but is only 20th on the output indicators, with an efficiency ranking of 100. This should be of some concern

	Global innovation index		Innovation input sub-index		Innovation output sub-index		Innovation efficiency ratio	
Country	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Cambodia	30.35	91	35.98	96	24.72	91	0.69	80
Indonesia	29.79	97	33.74	114	25.83	85	0.77	42
Malaysia	45.98	32	52.78	31	39.18	34	0.74	56
Myanmar	20.27	138	23.92	139	16.62	130	0.69	75
Philippines	31.05	83	35.24	101	26.86	77	0.76	44
Singapore	59.36	7	72.12	1	46.60	20	0.65	100
Thailand	38.10	55	43.17	62	33.02	50	0.76	43
Vietnam	38.35	52	40.04	78	36.65	39	0.92	9
China	47.47	29	48.36	41	46.57	21	0.96	6
India	31.74	81	35.51	100	27.97	69	0.79	31
Japan	53.97	19	63.83	12	44.10	26	0.69	78
South Korea	56.26	14	62.37	15	50.15	11	0.80	27

Table 2: Overall innovation performance. Source: Dutta et al. (2015)

for Singapore, as it indicates a less effective innovation system than could be expected and indirectly confirms the productivity challenge illustrated earlier. Still, as Intal et al. (2014) also noted, the scores and the rankings reflect the fact that the ASEAN member countries are in different stages of development, with different technological capabilities.

Table 3 below (from the 2013 version of the Global Innovation Index) indicates further that many countries have significant weaknesses in highly skilled human resources, higher education in general, and notably also in the linkages between higher education institutions. The latter is also important in the context of an ASEAN "single market for knowledge", and these data suggest that ASEAN has not come far in cross-border cooperation between such institutions or in research cooperation, as has been seen in the European case, although a strict comparison here is not warranted. Further, the well-known weakness in R&D funding is visible for all countries except Singapore.

Looking more closely at the pattern of funding, with the role of research performers in mind, there is a great difference between the countries in terms of the performance of higher education institutions and research organisations. In the more advanced countries, such as Thailand, Malaysia, and Singapore, higher education institutions play a greater role in the system, compared with the less advanced, where public research organisations are more dominant. This pattern suggests two things: First, that in the former group, human capital and universities are recognised as key to overall performance, and secondly, that higher education-based systems are more open to engagement with business, whereas public research institutes are more closed.

4.2.5 Contrasting single markets

Comparing the two projects for economic integration may not be productive, as they are, in many respects, not comparable. This is also why we have suggested contrasting the two, rather than comparing them according to a more strict approach. A very specific reason for the great difference between the two regions in this respect, is the fact that while the EU, as a tightly knitted system with supra-national governance, i.e. a political union, on top of various other integrative measures, ASEAN is basically inter-governmental, supported only by a small ASEAN Secretariat in Djakarta and built upon a number of cooperative institutions and processes in various policy areas. The latter model is time-consuming and much is left to the discretion of the member states.

The stronger institutions in the EU case, including competition policy and enforcement, are not mirrored in ASEAN. Rather, in the latter case, the non-tariff protective measures in many countries run counter to the economic integration project as such. While competition has been seen as contributing to innovation in the European Single Market, the non-tariff measures and other nationally grounded tactics, as well as corruption, still hinder the development of a competitive environment that is capable of triggering innovation in a similar way in Southeast Asia. Of course, there is a great gap in the level of development between the two cases, but the lack of an ASEAN system to deal with the various obstacles to integration, such as a common competition policy and the associated legal institutions, as well as a common way to deal with e.g. non-tariff measures, is a significant drawback for ASEAN.

Even so, the AEC is moving ahead, tariff barriers are being reduced, and several sub-projects and chapters

Code	Pillar / Sub-pillar / Indicator name	BN	KH	ID	MY	PH	SG	TH	VN	CN	IN	JP	KR
2	Human capital and research	31.9	12.5	24.3	39.7	18.1	63.2	37.2	24.7	40.6	21.7	57.2	64.8
2.1	Education	45.9	26.3	40.0	47.8	21.3	55.7	42.7	56.8	68.7	27.6	66.7	59.0
2.2	Tertiary education	48.0	11.2	21.0	49.9	23.0	81.4	53.1	17.4	11.7	6.5	35.0	56.0
2.2.1	Tertiary enrolment, gross	19.6 %	14.5 %	23.1 %	42.3 %	28.2 %		47.7 %	24.4 %	26.8 %	17.9 %	59.7 %	103.1 %
2.2.2	Graduates in science and engineering	20.7 %	12.5 %	22.8 %	36.7 %	24.3 %		53.2 %	16.8 %			20.5 %	30.9 %
2.2.3	Tertiary inbound mobility	5.6 %	0.1 %	0.1 %	6.1 %	0.1 %	20.2 %	0.8 %	0.2 %	0.3 %	0.1 %	3.7 %	1.8 %
2.2.4	Gross tertiary outbound enrolment	9.6 %	0.3 %	0.2 %	2.2 %	0.1 %		0.5 %	0.5 %	0.5 %	0.2 %	0.6 %	4.0 %
2.3	Research and development (R&D)	1.9		11.8	21.3	9.9	52.4	15.7		41.5	30.9	69.9	79.3
2.3.1	Researchers, headcounts / mn pop	685.5		173.3	715.4	129.6	7,188	575		1,303		7,066	
2.3.2	Gross expenditure on R&D (GERD), % GDP	0 %		0.1 %	0.6 %	0.1 %	2.1 %	0.2 %		1.8 %	0.8 %	3.3 %	3.7 %
2.3.3	QS univ. ranking average score of top 3 univ., index	0	0	32.6	44.2	26.5	55.0	38.2	0	74.9	44.8	81.7	73.6
5.2	Innovation linkages	29.6	36.3	29.5	30.9	21.4	49.8	22.3	27.4	27.9	30.9	42.0	38.0
5.2.1	University / industry research collaboration, index	47.8	42.0	53.0	66.4	40.9	76.5	50.2	37.3	56.2	47.5	67.1	61.7
5.2.2	State of cluster development, index	48.9	50.4	54.4	66.1	50.4	69.1	52.4	54.5	59.7	54.9	69.4	58.0
5.2.3	GERD financed by abroad	6.6 %			0.2 %	4.1 %	4.9 %	1.8 %		1.3 %		0.4 %	0.2 %
5.2.4	Joint venture / strategic alliance deals / tr PPP$ GDP	0.1	0	0	0.1	0	0.2	0.1	0	0	0	0	0

Table 3: Country scores on innovation pillars and indicators. Source: Dutta and Lanvin (2013)

in the AEC programme are being pursued to the extent that capacity allows. But if there is an area where ASEAN could learn more from the EU, it is the subsequent developments of knowledge markets, i.e. institutions and programmes to push research and innovation, as well as cooperation in these areas across borders. In fact, in the EU, the Single Market Programme has spurred a number of initiatives for competitiveness through research, technological development and innovation that have helped to create a more integrated European knowledge market, mostly through networking. In other words, the EU has developed an "institutional thickness" as a regional system of incentives for innovation and research from which ASEAN could learn more. The lack of funding resources and human capital notwithstanding, appropriate institutions and collaborative programmes may create momentum in the direction that ASEAN itself has envisaged.

The limited regional incentives for research and innovation in Southeast Asia affect the ways in which economic integration processes relate to innovation framework conditions. ASEAN's economic and innovation policy processes are not streamlined at the moment. AEC thus becomes relevant for innovation processes and framework conditions through more indirect ways, e.g., by gradually allowing capital (which might be invested in R&D) or people (which might work in R&D) to move through the region more freely. One aspect where both the economic and innovation policy worlds meet is intellectual property rights. They typically play a major role in free trade agreement discussions and in knowledge exploitation oriented innovation policy. We introduced IP as a dedicated framework condition for innovation. It is not merely a phenomenon affecting innovation performance. Innovation policy often also explicitly addresses IP as a crucial element in innovation processes. In the following, we will discuss IP and specifically patent regimes in the EU and ASEAN, considering them as mediating between competitiveness-oriented economic integration and innovation processes.

5 Dedicated framework conditions for innovation: The case of intellectual property

5.1 Patent regimes in Europe

5.1.1 Institutional set-up and development

The history of harmonisation and current institutional setup is different in the case of the various forms of IP. As stated earlier, we will focus our discussions on patents. European countries have been at the forefront of the development of patent regimes (see also chapter 3). They were among the earliest to establish national patent offices[25]. Despite their commitment to international cooperation and standards in IP and patent regimes[26], these national systems are still the core building blocks of European patent-related policies and practices. This particularly concerns enforcement and litigation of patent rights, which is achieved through national courts with nationally educated judges and legal experts. European national patent systems are also diverse with regard to the role of various innovation system agents in the creation of patentable knowledge (various types of ownership of publicly funded research results; different cultures in the private sector) or IP support services and markets (a publicly backed patent pool exists in France, for instance, and different sets of IP market intermediaries exist in countries such as the Netherlands). The European level of harmonisation and integration is well advanced regarding the process of filing patent applications (including the related costs and timelines).

Most important for European harmonisation and for the current institutional set up of a European-level patent regime is the *European Patent Convention* (EPC[27]), which, among other things, established the European Patent Office in 1977. The EPC regulates what kinds of inventions are patentable in the signatory states:

> *"European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application."*
> (Article 52.1)

It subsequently describes the patentability criteria (e.g. novelty) in detail and defines the exceptions to the patentability rule: Scientific theories, mathematic models, but also "programs for computers" (i.e. software), plant or animal varieties or methods for medical treatment are not considered patentable under European patent law.

Neither the Paris Convention (which 'only' regulates equal treatment of national and foreign patent applicants, as well as priority dates) nor the Patent Cooperation Treaty (which focuses on international filing procedure, examination, and publication standards) define what can be patented. Europe opted for a patent regime that goes further in harmonisation than the international treaties, particularly with regard to the patent application procedure (with one examination leading to a bundle of national rights). To some extent, this situation changed with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which all ASEAN and EU countries have signed. TRIPS (article 27.1) includes a definition of patents and patentability, which is similar to the one in the EPC (it also defines the criteria

25 The English patent system is considered to be the oldest, starting the awarding of patents to inventors in the 1620s. The UK Patent Office was established in 1852, more than 30 years before the Paris Convention was signed. The US office was already established in 1836, and the French one was established in 1900.

26 European countries were among the signatories of the 1883 Paris Convention for the Protection of Industrial Property, which later turned into the WIPO. Likewise, many European countries joined the Patent Cooperation Treaty (PCT) when or shortly after it became effective in 1978.

27 https://www.epo.org/law-practice/legal-texts/html/epc/2013/e/ma1.html

of novelty, an inventive step, and the capability of industrial application), but it extends patent protection to "all fields of technology". The only exceptions relate to public order and morality, "diagnostic, therapeutic and surgical methods", as well as "plants and animals other than micro-organisms". This definition has led to much debate about software patents within Europe and internationally. While the European Patent Convention holds that software as such is not patentable (it is covered by copyright law), it is patentable as part of other devices. Currently, the debate has not been resolved, with one side pointing to the patentability of inventions in all fields of technology and the other pointing to the fact that software is sufficiently covered by granting authorship rights (i.e., copyrights, article 10.1 of TRIPS). Similar debates have emerged among the TRIPS signatories around patents for genetic material.

With the EPC, the signatory countries of the EPC also gave themselves a significantly *simplified procedure for seeking patent protection*. The EPO defined three official languages (English, French, and German) as those in which an application can be filed. The applications are then prosecuted very similarly to national patent applications: A search report is provided, and the application is published 18 months after the filing date. If the applicant decides to follow up, he/she decides in which of the EPC member states the patent should be protected. A substantive examination report is compiled (by three EPO examiners) and the granting decision is taken. This results in a bundle of national patents, which must be subsequently validated in each designated EPC member state within a specific time limit (in this case, translations may become necessary).

The specifications of the EPC regulations on application and enforcement show that EPO-filed European patents are characterised by a peculiar combination of harmonised European-level procedures and national regulations. The EPO procedure is thus not to be confused with an actual unitary European patent. Such a unitary patent has been discussed among the EU member states under the title of a *"European patent with unitary effect"* (EPUE, also 'unitary patent' or 'EU patent'). In such a unitary patent, validation in national phases would not be necessary. There would be a single renewal fee (instead of the EPO and then the national renewal fees), a single object of property, single ownership, no national translation requirements, and a single Unified Patent Court.

While the legislation necessary for the creation of an EPUE is well advanced (with 26 EU member states forming part of the enhanced cooperation for the EPUE), the ratification of the agreement is still pending.

The discussion of European patent regimes has shed light on the peculiar current combination of a harmonised patent application procedure leading to territorial rights enforced via national legislation. The following chapter will introduce some key figures on European patenting activity.

5.1.2 Patent statistics: key patterns

In Europe's patent application output, it is apparent that the EPC-based European patenting process has been well accepted. In the years since 2010, around 60,000 European patent applications have been filed annually by the EPO according to the EPC procedure[28]. The total number of filings is much higher (over 274,000 in 2014) because of PCT filings channelled through EPO.

In addition to the direct European patent applications, the EPO received around 33,000 PCT filings in 2014 (WIPO 2015, p. 33). Of the 274,000 overall EPO and PCT patent filings registered in 2014, 152,000 were seeking protection in Europe (either European patent applications or PCT applications entering the European phase). Most applicants came from the EPC member states (49 % overall), followed by the US, Japan, Korea, and China.

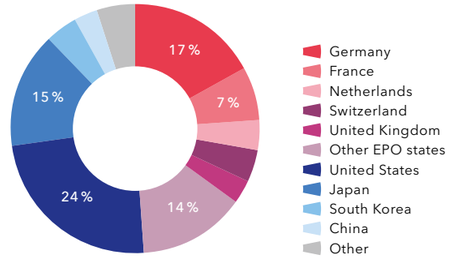

Figure 9: European patent applications per country of origin
Source: European Patent Office (2015)

In order to better assess the relevance of EPO and the EPC filing route, we can compare the filings at EPO with filings at national intellectual property institutes. According to PATSTAT (version 2015 autumn), the German IP office processed 71,500 filings in 2013 (63,000 of which sought protection in Germany), the UK 26,000 (23,000) and France 19,000 (16,000 for protection in FR)[29].

These numbers show that the EPO has established itself as a major player in the formalisation of intellectual property rights protection, and that it is by far the most important regional patent office. It receives more PCT applications than the WIPO International Bureau. Only the US and Japan received more PCT applications in 2014.

The patent figures also confirm patent applicants' interest in Europe as a market (which they want to exploit

28 http://www.epo.org/about-us/annual-reports-statistics/annual-report/2014/statistics/patent-filings.html (accessed 30 November 2015)

29 All types of applications (national patents, PCT applications, etc.) are counted. The counts for national and PCT applications per office filed for protection in the territory of this office (and not as PCT applications seeking protection outside of the country) are from WIPO: http://ipstats.wipo.int/ipstatv2/keysearch.htm?keyId=221

with their protected IP). According to the WIPO figures for 2014[30], 13 % of global patent applications (national and PCT applications) were filed to seek protection in European countries. Almost half of these applications are filed with the EPO (either directly or seeking a European phase through the PCT process). An interesting fact in the context of this study: Patents filed for protection in Asian countries make up 60 % of the world application output. In 2004, this number was at only 49 % (and at 21 % for Europe).

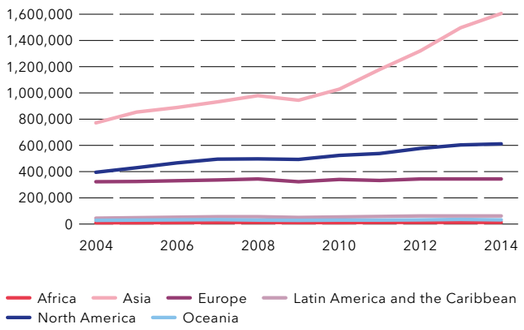

Figure 10: Patent filings by region of receiving office. Source: WIPO (2015)

As the figure shows, the last few years have seen a surge in patent filings in patent offices in Asian countries. This reflects the relevance of Asia as a market, as a production site and possibly as a knowledge production centre. However, the higher numbers for Asia are also partially caused by the fact that filing cultures between national systems can differ substantially. For instance, while in Japan, several applications might be filed for the same invention, applications in Europe or the US often contain several inventive steps (expressed in claims)[31].

In dealing with patent statistics, it is important to distinguish the location of the filing office (the data we dealt with above focused on this), the inventor and the applicant. The latter is the owner of the patent that is filed.

If we look at the applicant's origin as an indicator for the geographical ownership patterns of inventive activity, WIPO data show that applicants in EU member states own around 15 % of the patent application output in 2013. This makes EU-based owners of intellectual property the fourth largest group of IP owners worldwide, ranking behind China (28 %), Japan (18 %), and the US (19 %). Among PCT applications, 59,000 PCT applications in 2014 were filed with the first applicant being based in a European country. Applicants in Asian countries filed 87,000 PCT applications in 2014 (with Japan contributing 42,500 applications, China 25,500 applications, and South Korea 13,000 applications), and US applicants numbered 61,500 (WIPO 2015, p. 38).

If we compare the above numbers on the filings by office with the data on the filings per origin of applicant, we see a certain lag: As seen, 60 % of patent applications in 2014 were filed in Asian countries. At the same time, 41 % of PCT applications in 2014 had a lead applicant from Asian countries. This is still the largest share, but the relevance of Asia as a market is even more pronounced.

An interesting specificity of European PCT patent output is the comparatively high shares of foreign co-applicants (WIPO 2015, p. 42). With the exception of Canada, which also features a high share of international co-ownership of its PCT patents, European countries, such as the Netherlands, Belgium, or Finland have significantly higher shares of international co-ownership than the global average (3 %). Whether applicants opt for a formal co-ownership or not is largely a strategic decision. Frequently, legal counsellors and patent attorneys advise against co-ownership, and companies tend to avoid it (as it complicates decision-making, especially in the case of mergers and acquisitions).

If we want to learn about the geographic localisation and international linkages in inventive activities, data on international co-inventions is thus more conclusive than data on co-ownership. The OECD offers data on PCT patent applications (2012) with foreign co-inventors[32]. While individual shares of international co-inventorship range from 13.8 % for Slovenia (see table 4 for details) to 57.4 % for Luxembourg, if we treat the European Union as one unit, the share of EU-based patent applications with non-EU co-inventors is 11.4 %. The share for US-based inventors is 12.8 %, for China 8.6 %, for Korea 3.4 %, and for Japan 2 %. The OECD also presents figures for two Southeast Asian countries' co-invention shares in PCT patent applications: 54.3 % for Indonesia and 31.3 % for Singapore.

Given the size of its patent application output, the EU appears as a fairly internationalised innovation environment, similar to the US in regard to the co-inventorship indicator. Indonesia's share of internationalisation is high, but the evidence is not conclusive because of the low overall number of patents with inventors from Indonesia. Patents with Singapore-based innovators are frequently international, more often than the patents with inventors based in European countries of similar size and R&D expenditure (such as Austria, Denmark, or Finland). Ireland's internationalisation share is higher than Singapore's[33].

30 Indicator: Shares by region, http://ipstats.wipo.int/ipstatv2/keysearch.htm?keyId=203

31 This is why the OECD Patent Statistics Manual (OECD 2009) recommends comparing data on the basis of PCT applications only. However, the acceptance and relevance of the PCT procedure again varies from country to country. Both indicators have thus to be treated with caution.

32 http://stats.oecd.org (accessed 30 November 2015)

33 When interpreting a finding like this, one needs to keep in mind that international co-inventions are often networks that actually operate within one and the same international company (e.g., with R&D facilities in different countries). The data on Ireland (with relatively many headquarters of multinational enterprises) is a case in point. Nevertheless, in our understanding of international inventive activity, cross-country networks are interesting regardless of whether they are part of one multinational enterprise or different knowledge producing constellations.

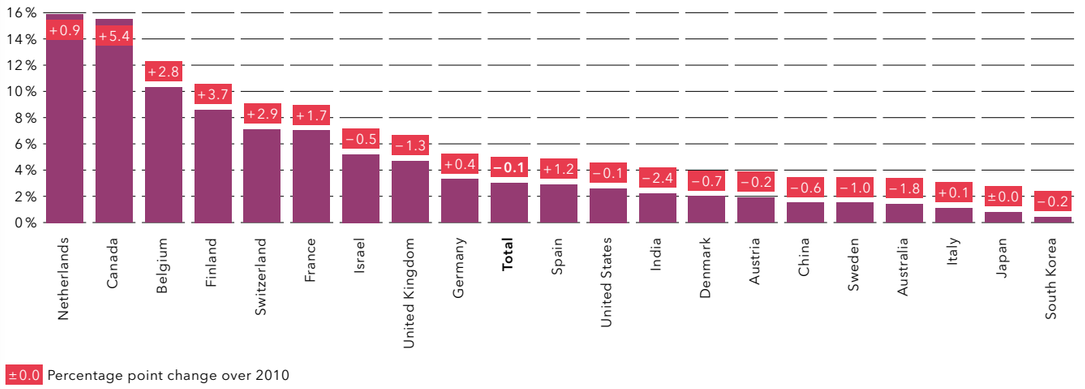

Figure 11: Share of PCT applications with foreign co-applicants 2014. Source: WIPO (2015)

PATSTAT data (April 2014 version) on PCT patent applications with inventors in Singapore show similar shares of internationalisation: In the period 2003–2013, 30 % were international co-inventions. The figures are similar for Malaysia and the Philippines, but higher in the case of Thailand, Indonesia, and Vietnam (see chapter 5.2 for details).

A related indicator of the internationalisation of patent output is foreign ownership. According to OECD figures for 2012, 14.4 % of PCT patent applications by EU-based inventors are owned by foreign applicants. For the US, this figure is at 12.5 % and for Japan, only at 2.8 %. This can be interpreted in different ways: Foreign ownership can be seen as an indicator of the attractiveness of the knowledge produced in a certain region. It is more attractive for foreign investors to acquire EU- or US-produced inventive knowledge than Japanese inventions. The other reading is that countries like Japan are more able to exploit domestic knowledge, whereas Europe relies more on foreign investors to exploit its domestically produced inventions.

In terms of inward knowledge flows (ownership of patent applications invented abroad), Europe appears as slightly less internationalised than the US: 16 % of US-owned PCT applications are invented abroad, compared to 13.9 % of EU-owned applications and 2.8 % of Japan-owned applications.

The data presented above illustrates the significant patenting activity in Europe and by European applicants. This (and the history of the patent regime in Europe as outlined above) also suggests a significant and well-developed IP service industry (including private patent agents, lawyers, and consultancies) and related public institutions (IP courts and patent examiner education). The following section will focus on the various research-performing actors behind the patenting activity.

5.1.3 Patent applications in the EU

Representative samples of EPO-handled patent applications show that in 2013 and 2014, 6 % of applications came from the universities and public research sector[34], whereas around 30 % came from SMEs or individuals, and around 65 % from large enterprises.

The WIPO (2015, p. 41) uses a slightly different categorisation, separating PCT applications from businesses, individuals, universities, and government research. Over 80 % of 2014 PCT applications owned by applicants in the major European countries (Germany, France, UK) came from the business sector, in Germany (also the Netherlands, Sweden, and Finland) more than 90 %. France is the only country in Europe where the government research sector plays a major role as a patent owner (around 10 % of PCT applications are owned by government research applicants). University ownership of PCT applications is negligible in many European countries. It is comparatively high, however, in the case of Denmark, the UK, Ireland (with slightly under 10 % held by universities), and Spain, with 20 % owned by universities. Spain is one of the bigger European countries with the lowest share of business in PCT application ownership. Around 55 % of PCT applications in 2014 were owned by business, 25 % by individuals, and 20 %, as mentioned, by universities. In Singapore, the business share was slightly over 50 % (with almost 40 % coming from university and public research), and in Malaysia, the business share was 30 % (with over 50 % coming from universities and public research).

In Japan, 96 % of PCT applications in 2014 were owned by businesses, and in the US, 85 %. The share of university ownership in the US is at around 5 %, and

34 https://www.epo.org/about-us/annual-reports-statistics/annual-report/2014/statistics/applicants.html (accessed 30 November 2015)

Country	Patents (2012) with innov. from	International co-inventions	Share
Indonesia	46	25	54.3 %
Singapore	857	268	31.3 %
Austria	1,635	472	28.9 %
Belgium	1,624	734	45.2 %
Croatia	48	7	14.6 %
Cyprus	8	2	25.0 %
Czech Republic	266	101	38.0 %
Denmark	1,312	305	23.2 %
Finland	1,878	428	22.8 %
France	8,537	1,634	19.1 %
Germany	19,042	3,115	16.4 %
Greece	136	38	27.9 %
Hungary	280	99	35.4 %
Iceland	37	8	21.6 %
Ireland	461	180	39.0 %
Italy	3,553	523	14.7 %
Latvia	32	3	9.4 %
Lithuania	50	14	28.0 %
Luxembourg	94	54	57.4 %
Malta	7	3	42.9 %
Netherlands	3,853	719	18.7 %
Norway	799	187	23.4 %
Poland	429	121	28.2 %
Portugal	159	36	22.6 %
Romania	82	39	47.6 %
Slovak Republic	67	34	50.7 %
Slovenia	130	18	13.8 %
Spain	1,876	329	17.5 %
Sweden	3,523	836	23.7 %
United Kingdom	6,550	1,695	25.9 %
European Union (28)	52,514	6,001	11.4 %
World	194,094	12,874	6.6 %
Australia	1,892	325	17.2 %
Brazil	790	146	18.5 %
Canada	3,655	1,141	31.2 %
China	19,518	1,683	8.6 %
India	2,210	713	32.3 %
Japan	42,570	864	2.0 %
Mexico	274	79	28.8 %
New Zealand	364	69	19.0 %
Russian Federation	1,175	249	21.2 %
South Africa	399	56	14.0 %
South Korea	11,404	386	3.4 %
Switzerland	3,271	1,338	40.9 %
Taiwan	672	228	33.9 %
Turkey	661	58	8.8 %
United States	53,896	6,912	12.8 %

Table 4: International co-inventorship

thus, it is higher than in most European countries, but lower than in Denmark, the UK, Ireland, or Spain. In terms of absolute numbers, the patent application output of US universities is still above the output in European countries.

The relatively low share of universities in European patent application ownership has been discussed in the literature. It has long been considered that US universities outperform EU universities in patent output, as well as its exploitation (see e.g. Schmiemann, Durvy 2003). This widely held view has been discussed as the 'European paradox' of simultaneous excellent research and poor commercial exploitation (cf. European Commission 1995; European Commission 2007). Recent studies have criticised this view in several ways. One line of literature (e.g. Dosi et al. 2006) has argued that Europe is, in fact, not outperforming the US in terms of research excellence. The challenges for Europe lie, thus, not only in commercialisation, but also in academic research. Other studies indicate that the gap between the US and Europe is indeed not so wide if we consider that many university-invented patent applications in Europe are not university, but business-owned. After controlling for this fact, European universities only marginally lag behind their US counterparts (Crespi et al. 2010). Nevertheless, a gap in commercialisation is identified: On average, European and US university TTOs perform similarly in terms of the number of licenses they execute. However, although they put the same emphasis on revenue generation, European TTOs' licensing incomes are lower than those of their US counterparts' (Conti, Gaule 2011). The authors present no concluding evidence for why this is the case. There also seems to be no clear answer in the literature on the question of the extent to which the higher share of business-owned university (co-)invented patents is an indicator of either successful or unsuccessful European technology transfer[35].

A point that is still discussed, in this regard, is the necessity of further (or less) Bayh-Dole-like legislation[36] in the European Union member states. Although many EU countries have passed laws enabling institutional ownership and favouring it over ownership by professors, the situation is still fragmented. Research is not yet conclusive on the impact of Bayh-Dole legislation on patenting and particularly licensing. Evidence from a study on US universities suggests that Bayh-Dole was only one of several factors behind the increasing patenting and licensing activity in the US in the 1980s and

35 One interpretation could be that companies are involved in university research from an early stage (they do not only acquire licenses) and take care of commercialisation themselves (with no market failure). Another would be that universities either contribute only marginally to the joint research (with the firms therefore owning the IP) or suffer from low bargaining power in view of the companies (cf. Crespi et al. 2010).

36 The Bayh-Dole Act was a US legislative act allowing public research institutions to own IP generated with public funds. It is different from models where the IP ownership is with the individual researcher, or conversely, the funding agency.

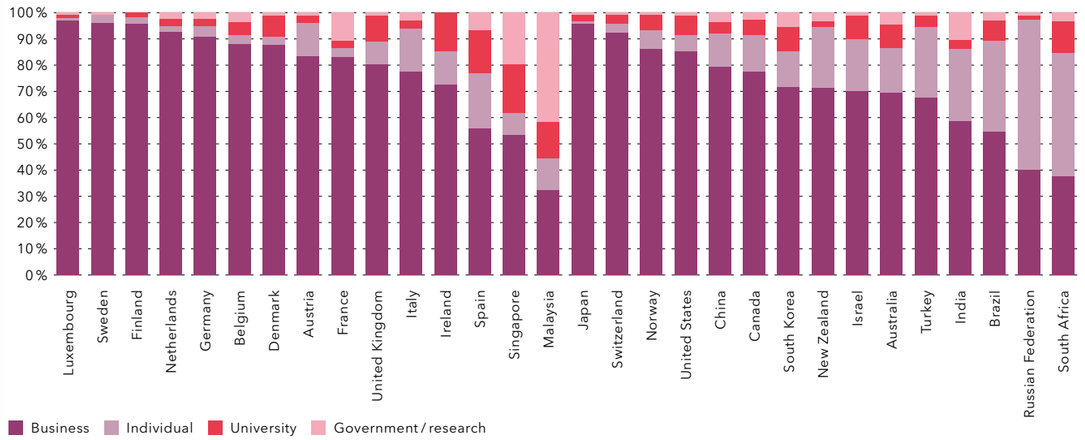

Figure 12: Distribution of PCT applications by type of applicant. Source: WIPO (2015)

1990s (Mowery et al. 2001). Crespi et al. (2010) concluded that no Bayh-Dole legislation is needed in Europe because the market takes care of the uptake of university research. Others have argued in favour of new and strengthened Bayh-Dole-like legislation (Bereuter, Heimerl 2010). Regardless of the outcomes of this debate, practically all research universities (and public research organisations[37]) in Europe have technology transfer offices (cf. Conti, Gaule 2008).

The focus of the technology transfer efforts varies, however, between licensing, start-up generation, contract research, or community engagement. Instead of focusing on holding patents and generating license income, some universities have followed the model of innovation offices, which offer support to researchers to facilitate commercialisation and industry collaboration. This is also the case for some of the universities that are considered the most successful in technology transfer and commercialisation, such as the Karolinska Institute in Sweden. Interestingly enough, Sweden still follows the 'professor's privilege' model, which entitles researchers (instead of universities) to patent their inventions and which is contrary to the Bayh-Dole model. Germany abolished the professor's privilege model in 2002 and is currently consolidating its landscape of newly created technology transfer offices and patent and valorisation agencies.

Despite this strengthening and consolidation of the TTO landscape in Europe, the literature (e.g. Leydesdorff, Meyer 2010) points to a stagnation or even decline in university patenting activity. The authors contested the interpretation that this is due to institutional learning (i.e. universities realising that patenting is costly and not often rewarding), as the institutional lessons were already available in the 1990s. They argued instead that one reason for the decline in university patenting is structural: university rankings, which put an increased emphasis on issues like international co-authorship and less focus on patenting output. Another reported reason is that the relationship between universities and their (economic) environment are less institutional and more functional, with patenting as only one of several possible ways of engaging in technology transfer.

At the European level, the European Commission continues to invest in the protection of exploitable IP. It aims to facilitate technology transfer and research commercialisation eco-systems in Europe. It also aims to strengthen public technology transfer offices (e.g., through the exchange of best practices), and to complement technology transfer funding. Trying to fill the gaps at the (pre-)seed financing stages for the commercialisation of public research, as well as making up for a still underdeveloped European business angel community, the European Commission has, among other things, set up a Technology Transfer Financing Facility Pilot (with an initial budget of € 60m for 2015) within the latest Research and Innovation Framework Programme (FP), Horizon 2020 (H2020).

At first sight, the discussion on technology transfer and the commercial exploitation of European-level research seems to conflict with the significant European-level focus on open access to research results and on open innovation. However, the European Commission's understanding is that open access to research results precisely facilitates technology transfer and commercialisation. Intellectual property rights and patents in particular are a central component of the open and excellent research system envisaged and implemented by the European Union.

The European Commission's view of IP and patents as key to European research becomes clear, for instance,

37 The European Commission's Joint Research Centre hosts a network of the technology transfer offices of major European public research organisations (e.g. Fraunhofer Society, Helmholtz Association, INRIA, TNO, VTT, etc.).

in the rules and regulations related to H2020. H2020 participants are invited to explicitly deal with IP issues at the outset of the collaborative research. Guidelines and templates are available for participants. The approach is to separate IP that partners bring into the collaborative research ('background') from IP generated through the collaborative research ('foreground'). The European Commission as the funder of the research does not claim any ownership of the IP. Instead, the collaborating players are invited to find co-ownership and usage agreements. Costs for filing patent applications or paying royalty fees can be claimed as part of the project budget. Another principle is the combination of these clear IP protection guidelines with the idea of also making research results openly accessible (publishing in open access journals, establishing open data procedures, etc).

The underlying idea here is that open access and open research systems do not contradict the idea of exploiting research commercially through intellectual property protection. For instance, research results can be published after a patent application is filed. Even if no patent application is filed, authors retain the copyright over their open access published results. The European Commission hopes that this combination of IP protection and open access will serve societal goals as well as the economic returns to innovation investments.

Protection is not enough to achieve these societal and economic goals. We have shown above that a substantial share, around 20–40 % of patents (depending on firm size, country, etc), are not commercially valorised (cf. Gambardella et al. 2012). Among the patents that are commercially used, there are significant differences in their economic impact (Pakes, Griliches 1984; Scherer, Harhoff 2000). The European Commission sees the protection of intellectual property as a necessary, but insufficient condition for the exploitation of project results. Funded participants have a general obligation to protect results (for an appropriate period and with an appropriate territorial coverage) and then also to exploit them. While the exploitation of publicly funded research will remain a challenge, there are promising developments in private sector research and innovation: more and more firms turn to more open forms of innovation.

As far as the private sector is concerned, open innovation is characterised by companies that realise that they cannot afford to rely entirely on their own research. Instead, they collaborate with public research, buy patented processes or inventions from other companies, and, in turn, take internal innovations outside the company through licensing, joint ventures, or spin-offs (European Commission 2014 b, p. 100). The open innovation paradigm is, thus, not seen as contradictory to the propatent regime in place in Europe. While so far only limited evidence is available, a recent study by Radauer and Dudenbostel (2013) indeed points to an increase in firm-level licensing activities.

Whether in an open or a closed mode, the commercial exploitation and thus economic relevance of intellectual property in Europe is impressive. At an aggregate level, IP-intensive industries (in sectors where patents, trademarks, industrial designs, copyrights and geographical indications play a role) contributed 38.6 % of the EU's GDP in the period of 2010–2012 (European Patent Office and Office for Harmonization in the Internal Market 2015). Considering patent-intensive industries alone, this figure is 13.9 %.

A major driver behind the European Union's strategy for a single market for intellectual property rights is to ease IP-related procedures for companies in respective industries. This includes the initiative of a unitary patent protection, which would make patent filing with European coverage and the litigation of patent protection much cheaper. The European Commission (2011) also proposed to establish a European framework for online copyright licensing, contributing to the establishment of a digital single market in Europe. It also continues working on the European trademark system. While the trademark systems have been harmonised for around 20 years already, with the Community Trademark existing for around 15 years, there is room to make the system more efficient and effective.

At a more general level, the European Commission works to improve the enforcement of IP, encourages non-European trading partners to strengthen their IP regimes and supports companies, especially SMEs, to take advantage of IP (e.g., through the IPR Helpdesk). In spite of these efforts, the European Commission has identified a number of challenges for managing and exploiting IP in the EU.

5.1.4 Patent portfolios in the EU and emerging issues

Patents are an indicator of inventive activity, and relatedly, of innovations with economic potential. What actually happens with patents is, however, difficult to estimate[38]. The patent offices do not track information on the actual use and commercialisation of patents, nor on mergers and company (and, thus, patent portfolio) acquisitions. Studies using survey methodology to get information on the usage and commercialisation of a limited set of patents estimate that around 40 % of patents reach the market launch stage (Webster, Jensen 2011) or that around 65 % of inventions involving academics are commercially used (Meyer 2006)[39]. In the early 2000s, the European PatVal-EU 1 Survey questioned the inventors of 9017 patents granted by the European Patent Office (EPO) between 1993 and 1997 and found, among other

38 Unless one can rely on institution-level surveys like the above-mentioned TTO licensing income survey carried out by Conti and Gaule (2008)

39 Mostly if they are already produced in collaboration with industry; of the purely academic inventions, only between 10 and 40 % are commercially utilised.

things, that around 36 % of the patents are not used in any economic activities (Giuri et al. 2007). About half of them are so-called 'blocking patents' that are neither internally used nor licensed, but block competitors. The other half is 'sleeping patents' with no use, not even in blocking competition. Another finding of the PatVal-EU 1 Survey is that large companies have higher shares of unused patents than SMEs (around 40 % blocking and sleeping patents vs. around 20 % in SMEs). Around 40 % of the patents of public research institutions and universities were also found to be unused. In a second wave of the PatVal-EU Survey, carried out from 2009 to 2011 for over 20,000 patents granted by the EPO between 2003 and 2005, this share was higher: 43 % were unused patents, and over 50 % of patents of public research institutions and large companies were unused (Gambardella et al. 2012).

The activities of the European Commission in regard to these findings build on the broader basis of a 2011 Communication on a Single Market for IPRs (European Commission 2011). This Communication states that IPRs are the cornerstones of knowledge economies, but considers, at the same time, that a single market for IPRs is still missing in Europe. European companies' success in the future will rely on their intangible assets, which is why Europe needs to make better use of its IP portfolios by means of licensing and commercial exploitation. Among the more directly innovation-relevant initiatives envisaged is a reform of the patent system, with a unitary patent protection and litigation system (see above) and an IPR valorisation instrument. In view of the latter, the European Commission established an Expert Group on IPR valorisation.

In 2012, the group came forward with a report on 'Options for an EU instrument for patent valorisation' (Expert Group on IPR Valorisation 2012). In this report, the group recommended patent valorisation through technology development and commercialisation as a relevant long-term activity. They advised against encouraging short-term forms of valorisation through enforcement and litigation, as this would have detrimental effects on innovation. The authors furthermore pointed to the particular challenges of SMEs due to transaction costs and market failures. It is not easy for SMEs to find potential buyers or sellers of patents, to carry out a valuation, or to negotiate a transfer.

To mitigate the transaction costs, the authors discussed IPR Exchange Platforms that could provide seller/acquirer matching, but concluded that existing commercial platforms obtain better results than what a separate public platform could achieve. They recommended supporting SMEs in using these platforms. The EPO Patent Register was also considered as a potential key instrument in providing companies with easy access to patent information. As a second SME-oriented support activity, the group proposed consulting and financial support for technology development (well coordinated with existing support mechanisms and networks such as the Enterprise Europe Network, the PATLIB network, and the national IP offices). Finally, the group discussed whether patent funds would be an option that it is worthwhile to consider at the European level. Patent funds invest in the acquisition of patents or patent pools, either for short-term enforcement (resulting in the phenomenon of 'patent trolls', which are detrimental to and not interested in innovation) or for long-term technology development (through specialisation and economies of scale). The authors reviewed a French proposal for a public patent licensing fund. However, they doubted that such a fund would be able to succeed at the commercialisation stage and saw no added value from the public investment. The authors recommended that the EU might provide limited and targeted support for the creation of patent pools for selected technologies. The issue of patent aggregation and pooling was taken up by a separate expert group on patent aggregation. The group's report (European Commission 2015 b) provided some useful conceptual clarification (e.g. differentiating patent pools and patent funds) and reiterated the previous group's opinion that the creation of a publicly supported patent fund was not recommendable.

Building on the expert group's work, the Commission issued a staff working document (European Commission 2012), which identified four main obstacles for efficient patent valorisation in Europe: low transparency in the patent market; insufficient awareness of business opportunities; high transaction costs of trading patents; and difficult access to funding to commercialise patents. The measures proposed to counter these obstacles are listed in the figure 13.

In this expert group report, as well as in other literature, the issue of valuing a patent was identified as a challenge, particularly for SMEs or other actors with little bargaining power. The European Commission also established an expert group on IP valuation. In its report (European Commission 2013), the group acknowledged the clear need to increase market actors' confidence and certainty in IP valuation. However, the group concluded that there is no lack of valuation methods or standards per se. By contrast, the challenge is the case-by-case nature of valuation. Each case requires investigation, and each valuation is an opinion at a given point in time. Comparisons are therefore difficult. The group argued in favour of national and European-level efforts to increase the acceptance of IP assets as collateral for commercialisation investments. They also pointed to the fact that investors typically invest in companies, not IP assets as such. It is therefore difficult to establish IP as widely accepted collateral. In terms of policy action, the group recommended the establishment of a data source containing information to be used by valuation professionals; the creation of an organisation overseeing IP valuation practice; the introduction of risk sharing schemes for banks to facilitate IP secured lending; and an increase in the transparency of IP value in company accounts.

Improving the transparency of the EU's patent market	Increasing awareness	Lowering transaction costs	Improving access to funding
Better identification of patents on offer	Making patent exchange platforms more accessible	Making patent data more accessible	Incentivising early-stage investment in SMEs
	Conducting pilot projects on valorising unused patents	Reviewing current approaches to patent valuation	Valorising patents that are the result of R&I projects
		Fostering pro-competitive forms of patent aggreg.	
		Improving patent valorisation services	

Figure 13: Measures identified. Source: European Commission (2012)

The preceding section aimed at outlining of the some general features of the IP landscape and eco-system in Europe. We will now turn to the situation of economic integration and intellectual property in Southeast Asia.

5.2 Patent regimes in ASEAN

5.2.1 The general situation: IP in context

The AEC Blueprint strives towards a more integrated ASEAN economy by 2015. It recognises the fact that a fully integrated single market is hardly conceivable. The supranational type of integration practiced by the EU is not comparable to the more intergovernmental integration model of ASEAN. Therefore, an EU-type single market is not the appropriate benchmark of integration for the AEC. The AEC builds upon, as has been described above, four pillars, of which the second, enhancing a competitive economic environment, includes policies or strategies for competition and IPR, two highly associated areas of policy. This association notwithstanding, the present chapter will be limited to IPR, in particular, as far as it is related to our core area of interest: innovation.

We have seen that innovation policy, in major parts of the world, is aligned with an increasingly global pro-patent regime. At the same time, the link between IPR, on the one hand, and economic growth and FDI, on the other, is still not altogether clear. There is a subtle difference in interests between industrialised and developing countries because of the fact that the latter may be better off with weak IP protection, while the former seek stronger protection of their technology and knowledge (Lall, McEwin 2013). This is also reflected in the different approaches of ASEAN member states to balancing the two fundamental challenges relating to IP: generating IP and managing/protecting/enforcing it. The diversity between the ASEAN member states (as regards institutional systems, legal standards, etc.) is also reflected in the variety in the competitiveness-related rankings of the countries as illustrated in table 5.

While several of the ASEAN member states have made efforts to improve their legal framework related to global competitiveness and the foreign direct investment climate, including making use of international treaties, the path is riddled with challenges. One aspect is that:

> *"… the problems of harmonizing procedural rules in developing Asia are much more severe than those experienced in Europe and North America, with law in Asia drawn not only from different traditions, but also from different colonial periods, and with a judiciary that is often struggling to free itself from political influence and from a negative image of being corrupt to some degree."*
>
> (Antons 2011, p. 2, cited in Lall, McEwin 2013)

Even so, ASEAN has given IPR a key role in the AEC Blueprint. The region's increasingly important role in global value chains and innovation networks also makes a stronger IPR regime a must. The assumption is that growing domestic innovation capacity and activity will increase the region's drive to protect its own IP, thus driving them to improve related IP systems and framework conditions. This view is held by ASEAN's international dialogue partners, but also has broad support among ASEAN member states. Apart from ASEAN's own regional efforts, which will be addressed below, the international agreements discussed above (TRIPS, etc) play a relevant role in this regard. They set minimum standards to be implemented on the national level, and hence, serve as a platform on which to develop further harmonisation.

TRIPS includes a waiver for developing countries. They can delay adapting their IP regimes until 2021.

	Brunei	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
IP protection	28	97	46	21	75	2	39	65
Judicial independence	42	96	76	43	102	20	55	78
Efficiency in legal framework	52	48	61	14	118	8	54	73
Strength in investor protection	100	60	36	4	111	2	12	137

Table 5: ASEAN selected competitiveness indicators 2011–12 (rank out of 142 countries). Sources: Schwaab (2012), Lall and McEwin (2013)

Many countries (like Myanmar) will need to improve their IP protection systems with the end of this waiver in sight. This might revive debates between developing and more mature economies on the effects of agreements like TRIPS beyond the facilitation of foreign direct investment.

Apart from TRIPS, bilateral or bi-regional free trade agreements (FTAs; with the Trans-Pacific Partnership, TPP, as the most recent and visible example) also include IP provisions affecting a number of ASEAN member states and contributing to harmonisation. Box 2 compares the IP provisions of TRIPS with regulations of free trade agreements.

IP regulations in TRIPS: Among other things, its signatories agree to treat legal entities from all partner countries equally in seeking and enforcing IP protection and to allow for patents in all areas of technology. As to the potential negative effects of protection and enforcement, a clause allows for 'compulsory licenses', enabling signatories to circumvent patent protection in areas of significant societal relevance (e.g. in order to provide a population with specific drugs; while not widely used, Thailand has made use of this clause).

IP regulations in other international treaties: Apart from specific international IP legislation (like the Patent Cooperation Treaty) and TRIPS, a number of regional free trade agreements also include IP-related regulation. Most of these are oriented towards the protection/enforcement aspect of IP, not so much the domestic value-generation aspects.

The recent Trans-Pacific Partnership (TPP), signed by the US and 11 other signatories (four of which are in Southeast Asia: Brunei, Malaysia, Singapore, and Vietnam), features a chapter on intellectual property. Its Article 18.37 defines patentable subject matter in a similar fashion to TRIPS (including possible exceptions from patentability for diagnostic, therapeutic, and surgical methods, as well as animals 'other than microorganisms'). However, the signatories at the same time confirm that 'new uses of a known product' or 'new methods of using a known product' are patentable. This has potential implications, especially with regard to the pharma sector.

The EU's FTAs with Singapore and Vietnam also include chapters on intellectual property. Regarding patent protection, both refer to the rules and obligations under the Patent Cooperation Treaty and also to TRIPS and its provisions on patents and public health. In the EU-Singapore Agreement, however, an additional article establishes the extension of the protection period for patents on pharmaceutical products. The goal is to account for the delays due to administrative marketing approval processes, which decrease the de facto length of patent protection.

Box 2: IP-related regulation in TRIPS and free trade agreements

As with TRIPS, the FTAs focus, first and foremost, on the protection and enforcement of global IP, not so much on the local generation and exploitation of IP. The issue at stake is whether a more consistent protection framework can sustainably inspire economically and socially relevant domestic inventive activity. Meanwhile, regarding the framework conditions for generating and protecting IP, our results suggest that the international agreements beyond ASEAN have a higher impact on IPR harmonisation than regional projects like the AEC have.

At the same time, IPR law is still mostly national, and the great political and institutional diversity between the member countries makes integration and harmonisation a challenge. The diversity in the region has made integration in a realistic time span unlikely.

When assessing the IP policies and practices in ASEAN, it is therefore useful to be reminded of the implication of the lack of integration so far in the region. Full economic integration would mean integrated IP laws and regulations. As mentioned, ASEAN has not chosen this path. A unitary regional EU patent is still being discussed. It is currently not discussed in ASEAN. An alternative is harmonisation towards a level playing field, reaching similar laws and regulations within a certain time span. ASEAN member states have not chosen this model either, for the time being. The next alternative would be mutual recognition, that is, the recognition of the protection given in one country as valid in another (Lall, McEwin 2013). As will be seen below, the current dynamic in ASEAN is close to the latter, building on the system of MRAs (Mutual Recognition Agreements) as an institutionalised approach to ensure a more effective IPR environment in ASEAN.

5.2.2 Policies, institutions and initiatives

Policy development in ASEAN

The AEC Blueprint serves today as the policy platform for developing the region's IP policy. It aims at fostering cooperation and development in the area of patents, as well as other areas of IP, such as copyrights, traditional knowledge, genetic resources, and GIs (geographical indications).

ASEAN has organised its work on IPR policy in various ways since the early 1990s, through subsequent projects co-funded by the EU, the European Patent Office, and other donors. An ASEAN Framework Agreement was launched in 1995, aiming at broad cooperation to

enhance the IP-related institutional environment in the region. An important body in this regard has been the ASEAN Working Group on Intellectual Property Cooperation (AWGIPC), established in 1996, with a mandate to develop, coordinate, and implement IP-related measures in the region. These activities are then closely associated with the development of ASEAN IPR Action Plans, the last one covering the period of 2011–2015. This plan "…is designed to meet the goals of the AEC by transforming ASEAN into an innovative and competitive region through the use of IP for their nationals and ensuring that the region remains an active player in the international IP community" (ASEAN IPR Action Plan 2011–2015, p. 2).

The ASEAN way, through the cooperative efforts of AWGIPC, takes, as a point of departure, the fact that the member states have their own IP-related legislation, rules, and practices, giving the national IP offices a key role:

> *"Developing the IP system in the region necessitates improving the capacity of AMS and the national IP offices to enable them to build a higher level of confidence in the integrity and transparency of their processes. Each national office in ASEAN will provide higher quality, efficient, and cost-effective systems to protect IPRs. Each IP office in the ASEAN will be stakeholder-centric, continuously improving the quality and timeliness of the services they provide."*
> (ASEAN IPR Action Plan 2011–2015, p. 3)

This action plan encompasses five strategic goals that illustrate the priorities of the ASEAN IP policy (simplified from ASEAN IPR Action Plan 2011–2015, p. 4):

- A balanced IP system that takes into account the varying levels of development and differences in institutional capacity;
- National and regional legal and policy infrastructures that address evolving demands in the IP landscape and AMSs participation in global IP systems;
- Ensure that IP becomes a tool for innovation and development, support for technology transfer, with a view to advancing the interests of the region;
- Active regional participation in the international IP community and closer relationships with dialogue partners and institutions;
- Intensified cooperation among AMSs to enhance the human and institutional capacity of IP offices in the region.

In the implementation of these priorities, a "soft-law" approach is taken, whereby the individual member states of ASEAN and their IP offices implement legislation and regulations flexibly and according to their own political and institutional will and capacity. Singapore stands out as the most mature and developed country, with a modern legal system and practices. The downside to this is, of course, progress at variable speeds, but on the other hand, it is based on legitimacy and respect for the very variable capacity and competences in each case. This is also ensured by the fact that the AWGIPC itself is made up of delegates from each national IP office. Cooperation and coordination are the key processes, rather than multilateral/regional formal agreements. The most vulnerable part of the IP systems may therefore also be enforcement, as this is more related to trade, and more dependent on the state of the art of the national legal systems, court competencies, and in some cases, the degree of corruption.

As mentioned above, this also hinges on the logic of MRAs, the mutual recognition agreements that are widely used in different policy areas, such as the mutual recognition of professional skills. In 2009, AWGIPC established the ASPEC (ASEAN Patent Examination Co-operation), building on the principle of mutual recognition. The objectives of the ASPEC programme are to reduce the work and speed up the turnaround time, as well as to increase the efficiency of search and examination. A further aim is to circumvent the big challenge of the diverse languages used in the region, a fact that represents a serious bottleneck to the harmonisation of the IP systems in ASEAN.

Through the ASPEC process, patent examination in one ASEAN member state may build upon work that has been done in another, reducing the time and effort involved, and creating an easier route to understanding the IP in question. For example, a patent examiner in one country receiving an application from an applicant in another may build his/her examination on the documents already produced for the initial application from another jurisdiction. In effect, this is a work and information sharing process, a light-footed example of the cooperation initiated by the AWGIPC. It circumvents the need for harmonised rules and gains direct benefits in the examination process.

However, the ASPEC process also has its limitations. They are linked to the sometimes weak capacities in the national IP offices, as well as to a lack of overall trust in these capacities and competences. ASPEC is a kind of replacement for a harmonised system, offering simplified procedures: examination reports from one country can be used in another jurisdiction. In practice, it is not so easy, as the level of trust accorded to the IP offices is very different. This is also to the advantage of countries with an existing strong examination system, such as that in Singapore. In this sense, the ASPEC process reinforces Singapore as the regional hub. While Cambodia fast-tracks patent applications with available search reports from Singapore, a patent application from Myanmar will not be fast-tracked according to ASPEC rules in Indonesia, as there is a lack of trust. A possible uncertainty in the ASPEC process relates to the different rules and procedures for examination in different areas, as well as government changes or lack of stability. This is also linked to different laws in other areas, such as different laws on drugs.

A major challenge in the region's patent systems is the sometimes slow filing and granting process. It may take up to 12 years to obtain a patent in Thailand. In Singapore, it may take 2–4 years[40]. ASPEC can help in speeding up the granting process. In fact, other countries in Southeast Asia can rely on Singapore's well-trained examiners to some extent. However, this is the exception. In most of the other countries, the examiners are few, poorly trained, and not well paid. This is the case e.g. in Indonesia, where 82 registered, poorly equipped examiners are in charge of the entire patent application portfolio. Hence, Singapore's position is reinforced, as inventors and applicants in other countries have more trust in its legal basis, as well as its competence and capacity.

The next ASEAN IPR Action Plan for 2016–2020, launched in 2016, provides further guidance and support for the work ahead within the context of the AEC. It will build on the previous plan, with a continued ASPEC focus, priority on examination guidelines, and accession to international treaties and protocols. The next plan, however, will particularly focus on the further strengthening of IP offices and infrastructure, the signing of relevant international treaties, activities to improve the capacities of IP practitioners (advisors, lawyers, patent agents, etc.), regional IP platforms (including TTO platforms), and regional initiatives to promote asset creation and commercialisation. The latter point also includes capacity building in terms of IP valuation. While it particularly includes geographical indications and traditional knowledge (as potential IP providing assets), there is also much emphasis on the challenge of turning other forms of IP into actual social and economic benefits.

The national IP offices

The core of IP systems is made up of national intellectual property offices, often termed patent offices. The country's ability to serve inventors and other actors in protecting their IP rests, in particular, on the capacity and capability of these offices. Further, a group of countries may cooperate to enhance these capacities and capabilities, which, in the ASEAN case, takes place through the ASEAN Working Group on Intellectual Property Cooperation (AWGIPC).

As discussed above, patenting activity and IP activity in general is still low in the region. It is on the rise, however, with dedicated policy support from national governments (e.g. financial support for patenting in the public research sector). This is also reflected in the greater importance being given to national patent offices. But if there is one message coming out of the interviews conducted for this study, it is that there is still a significant lack of expertise and trained personnel at these offices. This is particularly true for patent examiners, who often have poor training and are far too few. As already mentioned, Indonesia, by far the largest country in the region, currently has only 82 trained patent examiners. Vietnam currently has some 80 patent examiners, but according to the national IP offices, the optimal number would be 200. Singapore stands out as being well equipped with capacity and capability, while Malaysia is giving significant priority to this component of the innovation policy. Most ASEAN member states are investing in upgrading their IP offices, but the level of capacity is still extremely diverse.

There are several resources required by patent offices to make them perform effectively and efficiently. In their study of patent and trademark offices in Southeast Asia, Bernard and Wedel (2011) discussed the resources needed to ensure effective patent and trademark processing. Training is the key, not least because of the immense rise of patenting activity in general. Further, electronic resources to ensure efficiency are important, including search technology and data bases. Lastly, modern patent offices should be equipped with what is referred to as patent administration management systems (PAM). Their study of the patent and trademark offices in the region, although with data more than five years old, revealed a mixed picture. First, they assessed the degree of autonomy of the IP offices, which is the degree to which they are independent of governments in managing their internal affairs and budgets. Only Malaysia, Philippines, and Singapore have such an autonomous status, while Cambodia, Laos, Indonesia, Myanmar, and Thailand do not. Vietnam's office is seen as semi-autonomous. This picture illustrates the mostly "government-heavy" innovation systems in the region.

Further, they discussed the capacity in terms of manpower, which is also crucial. Albeit with data from 2010, a very diverse situation concerning patent examination emerges. Malaysia and Indonesia seem to be at an appropriate level, with some 100 applications per examiner and some 5–6000 applications in total, while Thailand is significantly understaffed, with around 250 applications per examiner and close to 6000 applications in total. The Philippines and Vietnam have a number of applications per examiner that is similar to Malaysia and Indonesia, but with a lower overall volume. Further, Bernard and Wedel (2011) showed that all of the countries studied (Cambodia, Myanmar, and Singapore are not included) have patent examiners with bachelor degrees in science, except Laos. In particular, the Philippines and Indonesia have examiners with a great deal of experience, but the reverse is true in Cambodia, Thailand, and Vietnam.

40 Up to 2014 it was possible in Singapore to obtain a patent for an invention that was not patentable (e.g. not novel). It was possible to pay the grant fee and get the patent issued even in the case that an examiner had outstanding objections. This system changed at the beginning of 2014. Now it is necessary for the application to comply with novelty and inventive step requirements (cf.: http://mclaughlinip.com/patent-law-changes-2014/).

Table 6 shows data on the average time expected to register a patent in the respective countries. They are the estimates given by the IP offices. According to Bernard and Wedel (ibid.), only Indonesia and Malaysia did actual calculations on their operations, whereas the others did estimates. However, the results are different from what could be expected from the above figures. For example, Thailand does not take longer than the others, and Indonesia takes longer than most, despite an acceptable examiner/applications ratio. This points to additional challenges in many of the IP offices, such as the real qualifications, administrative support, and technological systems. For example, the Philippines IPO has been digitising data, and there is now an online data base. But only 50–60 % of patents have now been uploaded in the data base, and granting patents is slow, with much backlog, which is partly due to the shortage of skilled patent examiners. With the recent increase in patenting from local inventors, which is expected to continue, it is likely that most of the IP offices will remain under pressure, despite concerted efforts to boost their capability and capacity. A key issue is that patent applications in countries such as Thailand and Indonesia need to be translated into the local language. The quality of these translations is often low, leading to a transfer from the patent examiners back to the law firm from where it was filed, and this process may take several rounds of language checks and translations. In Thailand, there is also no obligation in the legal system to publish the applications after a given time, and sometimes, clients even tell the examiners to publish as late as possible to enable them to remain invisible and "below the radar". In this case, the novelty aspect of the application only counts when it has been published, while in Vietnam, the novelty aspect counts as soon as the patent is filed.

The situation is slightly different in the case of trademarks, where there is even greater diversity in the ratio between applications and examiners than is the case for patents. Thailand and Malaysia are under the most pressure, with some 37,000 and 26,000 trademark applications per examiner in 2010, whereas Vietnam has only 500 trademark applications per examiner. Indonesia, with the highest volume of almost 48,000 applications, is reasonably staffed with some 7–800 applications per examiner. Such numbers suggest, of course, a great difference in the volume, often reflecting the foreign companies' perceived need to protect their trademarks in given countries.

The time to register patents (and trademarks) differs greatly between the ASEAN countries (table 7). This has to do with a variety of factors ranging from the number of trained staff available at the IP office to the degrees of digitalisation, as well as the translation requirements (delaying the process because the documents move back and forth between the IP office, attorneys, and applicants). An interesting comparison is also the expected time of 3 years in China. Further, it should be noted that the major volume of infringements lies with trademarks, with a great deal of petty infringements through copying, counterfeited goods, etc. These are difficult to tackle due to the shortage of capacity, and among other things, a more complex ecosystem, including customs issues. This is also the reason why many ASEAN countries opt for signing the Madrid Protocol on trademark cooperation: Global treaties are often easier than the still immature ASEAN system.

Country	IP offices' time
Cambodia	3 years
Indonesia	5.61 years via normal process, 4.92 years via PCT
Laos	4 years
Malaysia	1.6 years via fast track basis without objections, 5.41 years via Paris convention, 2.15 years via PCT
Myanmar	N/A
Singapore	3–4 years
Thailand	3 years
Vietnam	2–3 years

Table 6: Average time expected to register a patent
Source: Bernard and Wedel (2011)

Country	IP offices' time
Cambodia	3 months
Indonesia	14 months
Laos	6 months
Malaysia	17–24 months
Myanmar	1 month
Philippines	9.99 months
Singapore	6–8 months
Thailand	12–18 months
Vietnam	15–18 months
China	3 years

Table 7: Average time expected to register a trademark
Source: Bernard and Wedel (2011)

The importance of international IP systems

The IP policy development in ASEAN is taking place in the context of a number of international initiatives and agreements, of which the TRIPS agreements have been discussed above. As argued above, the international systems are especially important for Southeast Asia and ASEAN, as the diversity in language, culture, legal systems, and economic development hinder harmonisation and make the IP management for inventors and investors complex.

While the TRIPS agreement serves as a minimum common denominator, and hence, as a platform for joint minimum standards for national IP systems, several other agreements and institutions come into play, offering valuable opportunities for IP holders. All ASEAN

	Invention / patent applications			Utility			Industrial designs		
Country	Resident	Non-res	Sum	Resident	Non-res	Sum	Resident	Non-res	Sum
Brunei	20	15	35	0	4	4	0	11	11
Cambodia	1	74	75	0	6	6	3	27	30
Indonesia	663	6,787	7,450	223	116	349	2,771	1,488	4,259
Malaysia	1,269	6,081	7,350	70	97	167	679	1,347	2,053
Philippines	220	3,065	3,285	743	35	778	887	489	1,376
Singapore	1,143	8,579	9,722		62	62	720	1,673	2,393
Thailand	1,572	5,832	7,404	1,561	87	1,648	2,774	1,028	3,802
Vietnam	443	3,552	3,995	226	47	273	1,362	733	2,095
Total	5,331	33,985	39,316	2,823	454	3,287	9,196	6,796	16,019

Table 8: Patenting activity in ASEAN 2013 (applicants from ASEAN residents and non-residents at ASEAN IP offices). Source: Calculated from ASEAN IP portal

member states are PCT members except Cambodia and Myanmar. While the filing of e.g. a patent takes place in the national patent office in question, at the regional offices (like the EPO) or at the WIPO directly, the application covers all of the selected PCT member states and uses one language (English), and there is only one set of fees to be paid. PCT patents are more expensive than national patents, but the flexibility in choosing coverage has advantages, particularly for inventions that applicants aim to exploit on a global market[41]. Hence, the general trend is for inventors and innovators in the region to use this process, with the included services for international search, examination, publication, etc. The PCT process has helped spur IP applications in many Southeast Asian countries. For example, when Malaysia joined the PCT in 2006, 98 % of the patents were foreign. This has changed. Not least through active government policy to stimulate universities to take an active stance on IP, a large increase in domestic patents of up to around 80 % can be observed. However, this picture is not clear, as according to the Vietnamese IP office, foreign inventors use PCT more than domestic ones.

The same pattern is taking place for trademarks, and the Madrid Protocol offers similar possibilities for simplified filing and protection. Currently, 95 countries worldwide have signed the Protocol, but only three of them are ASEAN members; however, it is expected that by the end of 2015, seven ASEAN countries will have signed. The Hague Agreement for industrial designs is also available and provides a correspondingly simplified procedure, but it has only one signatory from ASEAN (Brunei).

41 The main difference in the application process between national and PCT patents is that a PCT application process is divided into an international and a national phase. In the international phase, a PCT application is filed at any IP office in the signatory states or directly at the WIPO. After an international search report and the publication (18 months after filing), an optional international examination report can be requested. This can be used in the further examination during the national phase, which starts 30 months from the filing date. In the national phase, in each country or region selected by the applicant, the PCT application has the effect of a national or regional application. Global protection in all signatories is thus possible, but optional.

5.2.3 Intellectual property in ASEAN: Key statistics

Patenting in ASEAN

There is growing awareness of IP in the ASEAN region. This is evident from the governmental awareness of the issue as a part of the broader focus on innovation as a means of promoting greater growth and welfare. This is also reflected, as described above, by the engagement of the national IP offices and the AWGIPC. But what is the situation in the ASEAN member states? What is the patenting pattern of inventors and companies? Table 8 gives a snap shot overview with figures from 2013.

The table, derived from statistics elaborated from the national IP offices and the ASEAN secretariat, is divided between the three categories of patenting: invention, utility (incremental improvements in existing technologies), and industrial designs. The table gives a telling illustration of the patenting activity, with some broader implications.

First of all, Singapore is the country that stands out. The high level of patenting activity is, in large part, due to non-resident invention patents. This implies that foreign companies take advantage of the status of Singapore as a hub having a legal system and enforcement conditions in place that are on level with Western countries (the role of Singapore is also elaborated in section 5.2.4 on protecting IP in ASEAN). However, several countries enjoy a high level of foreign patenting as well, such as Indonesia, Malaysia, and Thailand. Although increasing, residential invention patenting is still relatively low.

The situation is the opposite with utility patents, with numbers that are also much smaller. Utility patenting is done by residential SMEs, mostly, to improve their products or processes, and it is part of their incremental innovation behaviour. The non-residential activity is very low. Thailand and the Philippines are the most active in this regard. IP protection in the form of industrial designs shows a more balanced pattern, with non-residential activities almost double those that are residential. In this category, Indonesia and Thailand score high.

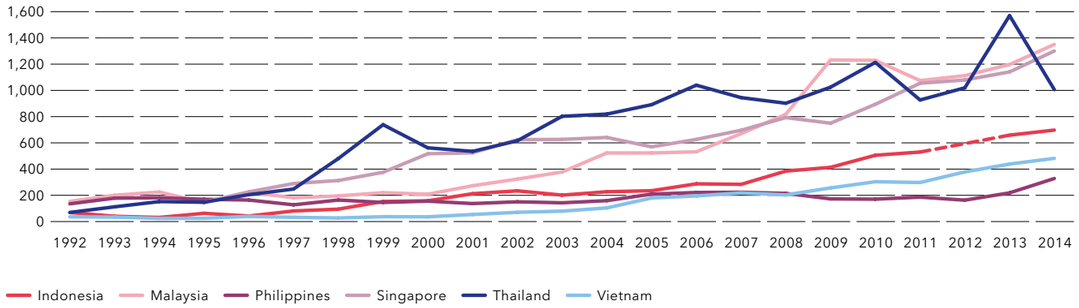

Figure 14: Resident patent applications (direct and PCT national phase entries) for selected ASEAN IP offices.
Source: OECD (2013 a), based on WIPO statistics database

In sum, Singapore enjoys a special status, and the figures confirm its role as a hub for the region as a whole. But the overall pattern also illustrates that Malaysia, Indonesia, and Thailand have high levels of activity, also illustrating the high involvement of foreign companies in those countries.

Even though the residential activity is still low, it is growing. Figure 14 illustrates steady growth, albeit from a low level in many cases. The figure confirms the ordinary status of Singapore for residential patenting, but also shows significant increases for Malaysia and Thailand over the period[42].

Summing up, the patenting activity in the ASEAN region is dominated by foreigners seeking protection for previously developed technology. This brings Singapore to its role as a hub and entry point, due to its well-developed legal and eco-system for IP. The residential activity is still low, but growing, except for utility patents, for which the residential activity is comparatively high.

Residential activity in ASEAN is not only growing regarding the applicants, i.e. the owners of the IP. There is also an increase in patent applications by inventors from ASEAN countries, indicating increased inventive activity in the region. Table 9 is extracted from a SEA-EU-NET analysis of ASEAN patent application output[43]. It shows the developments of PCT patent applications with at least one inventor based in an ASEAN country 2003–2013. The data for the last two years are incomplete (it takes 2–3 years for PATSTAT data to be completely registered in the database).

While we see a continuously low PCT patent application output for some ASEAN countries, others have shown a steady increase over the past decade. As in the case of the European countries (see above), a significant share of the patent applications with inventors based in ASEAN countries are produced in a cooperative fashion, i.e. they involve inventors from other countries. Among the countries with the highest output in the region, the share of international co-inventions is the highest in Thailand, Indonesia, and Vietnam. It is lower in the countries with the highest output, i.e. Singapore and Malaysia.

By far, the highest share of these international co-inventions of ASEAN countries (in PCT patent applications) is developed with either US or Europe-based co-inventors.

Data from our studies show that the shares of international co-inventions are even higher when it comes to nationally filed patent applications (filed in ASEAN countries). In these nationally filed patents, US co-inventors are, by far, the most important partners of ASEAN inventors, followed by European co-inventors.

We have discussed residential patenting activity in ASEAN, both regarding ASEAN-based inventors and applicants (i.e. IP owners). With regard to applications at ASEAN offices, additional important data are the shares and patterns of foreign ownership, i.e. of foreign applicants filing patent applications with one or more ASEAN-based inventors – not only in ASEAN offices (see the discussion on residential patenting above regarding this), but in general.

In the literature, foreign ownership of patents is seen as an indicator of knowledge flows (cf. Guellec, van Pottelsberghe de la Potterie 2001). If foreign applicants acquire IP invented locally e.g. in ASEAN, this indicates a knowledge flow out of the region. High foreign ownership of a country's or region's invented IP can be interpreted as a lack of innovation activity (with too few ASEAN investors acquiring IP). However, it also indicates that a region is attractive as a knowledge production hub.

Although it does not go into much detail[44], PCT patent application data shows the relevance of both Europe and the US as foreign owners of ASEAN-invented patent applications. While the share of exclusively foreign-owned ASEAN-invented PCT patent applications is low (below 5 %), the shares are much higher (partly above 50 %) for nationally filed patents. For instance, in around 50 % of nationally filed patent applications with Malaysian inventors, there is no Malaysian applicant involved. In Singapore, this is the case for 30 % of the applications. Among those nationally filed applications, the USPTO, as a filing authority, and US applicants play a dominant role. Taiwan and China also are featured prominently. For China, however, it is only the patent office that is of importance as a receiving office for ASEAN-invented patent applications. This indicates that China is predominantly considered important as a market and is not yet established as a knowledge acquiring player in ASEAN. Within the ASEAN region, Singapore is an important foreign owner of patent applications involving ASEAN inventors, especially from Malaysia, the Philippines, and Thailand.

42 It should be noted that the comparison of nationally filed patent applications is problematic. The different national systems can differ substantially in their understanding of patents and related procedures. However, for the present study, we work under the hypothesis that the national patent regimes in ASEAN countries do not diverge so vastly as, for instance, the Japanese and the European or US system. Most ASEAN countries have a patent system that is inspired in either the UK or the US system. They should thus be comparable to each other and to the situation in European countries.

43 Refer to www.sea-eu.net for detailed results.

44 See our SEA-EU-NET patent analysis.

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Brunei					1	1		3		1	1
Cambodia		1		1							1
Indonesia	5	17	17	19	29	32	17	33	30	32	17
Laos					2	1		3	1	3	1
Malaysia	53	77	105	124	177	274	331	410	374	369	136
Myanmar		1				1	2				
Philippines	27	25	53	55	42	40	43	40	48	46	20
Singapore	325	512	573	590	675	724	733	725	764	723	359
Thailand	21	37	36	54	48	64	66	104	111	90	40
Vietnam	6	1	15	11	10	16	16	30	31	8	10

Table 9: PCT applications with at least one inventor from ASEAN countries

	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Applications	7	3	248	11	2,430	4	439	6,703	671	154
Single inventor	3	0	115	6	1,784	0	282	4,712	297	79
Co-inventions	4	3	133	5	646	4	157	1,991	374	75
Share of co-inventions	57 %	100 %	54 %	45 %	27 %	100 %	36 %	30 %	56 %	49 %
Share of all ASEAN applications	0 %	0 %	2 %	0 %	23 %	0 %	4 %	64 %	6 %	1 %

Table 10: PCT applications, co-inventions and shares of co-inventions by country, 2003–2013

	ASEAN	EU	USA	Japan	South Korea	China	Australia	EU+
Patent applications with at least one ASEAN-based inventor	10,497							
Co-patents with at least one ASEAN-based inventor	3,219	1,282	1,307	299	42	300	154	1,384
Share of co-patents with region		40 %	41 %	9 %	1 %	9 %	5 %	43 %

Table 11: PCT applications with foreign based inventors

These numbers help to qualify the international exposure of ASEAN's knowledge production hotspots. Foreign ownership numbers and shares have been increasing over time, as are ASEAN's linkages with Europe, not only as a region of companies acquiring knowledge developed in ASEAN, but also as a market for ASEAN-invented applications.

ASEAN patenting in the European Patent Office (EPO)

The EPO's annual report for 2014 contains some statistics on the ASEAN member states' patenting in the EPO. The numbers for 2013 and 2014 are shown in table 12.

Again, Singapore stands out among the ASEAN member states, followed by Malaysia and Thailand. Malaysia shows faster growth. Not surprisingly, the numbers for other members of ASEAN are either low or missing. An interesting point is that while China exceeds the numbers of ASEAN by far, ASEAN is, in fact, on par with India, and it has a higher growth rate (EPO 2014). It

	EPO patent filings [45]			EPO patent applications [46]			EPO patents granted		
Country	2014	2013	Change	2014	2013	Change	2014	2013	Change
Brunei	0	1	−100%	1	2	−50%	0	0	±0%
Indonesia	15	16	−6%	2	4	−50%	2	2	±0%
Laos	3	2	+50%	0	0	±0%	0	0	±0%
Malaysia	390	322	+21%	53	47	+13%	32	25	+28%
Philippines	35	34	+3%	15	5	+200%	1	1	±0%
Singapore	991	918	+8%	348	316	+10%	127	111	14%
Thailand	68	77	−12%	20	18	+11%	6	7	−14%
Vietnam	7	19	−63%	4	3	+33%	0	0	±0%
Total ASEAN	1,509	1,389	+9%	443	395	+12%	168	146	+15%
China	26,472	22,396	+18%	4,624	4,075	+14%	1,186	941	+26%
India	1,535	1,431	+7%	542	562	−4%	143	181	−21%

Table 12: ASEAN member states' patenting in EPO. Source: EPO Annual Report 2014

would be interesting follow-up research to shed light on the role foreign subsidiaries of EU or US companies play in these data.

The data presented in this section show that patenting activity in ASEAN is on the rise, but it is unevenly distributed geographically, with hubs in Singapore and Malaysia. International networks are visible in the patent data. Patent applications in the region are frequently based on inventive activity spanning two or more countries (co-inventions). Foreign ownership is increasing. It is rather low in the case of PCT patents, but significant when it comes to nationally filed patents (many of which are filed in the US, Taiwan, China, or Europe, depending on the market targeted). ASEAN filing at the EPO is increasing. One of the core added values of the present study is that we are able to contextualise and qualify the quantitative data. We will take a close look at the practices for generating intellectual property in ASEAN countries and relate them to the innovation framework conditions and broader regional processes.

5.2.4 Generating IP in ASEAN: Current practices and challenges

This section will attempt to give an overview of the current situation in ASEAN, based on information gathered through a series of expert interviews carried out in selected ASEAN countries which have invested the most in the generation of IP and patents in particular. It will not review the situation country by country, but rather will pull together the key patterns of the practices, institutions, and challenges observed. However, we make one exception in treating Singapore separately, as the country in the region that has invested the most in its IP system.

45 Filings handled by the European Patent Organisation (this includes direct filings according to the EPC procedure as well as PCT filings for protection in Europe or elsewhere)

46 This includes patent applications seeking protection in Europe (including direct filings according to the EPC procedure as well as PCT filings entering the European phase).

The overall situation in ASEAN is one of great diversity, with partly underdeveloped and immature systems for IP generation. While the individual offices for IP in each country play a key role, and in several cases, arrange training and capacity building, along with the support and help of the WIPO, the situation is complex and challenging. Some issues emerge as critical in this assessment:

- The overall eco-system for commercialisation;
- Science-industry cooperation;
- Funding of R&D in universities and research institutes;
- The institutional set-up and coordination;
- Training and human capital.

The eco-system for commercialisation and technology transfer is, in many cases, characterised by a low inclination to commercialise knowledge or research results among university staff. As in universities in general, the culture, as well as the imperative of these institutions, give more credit to academic research and publications than to academic entrepreneurship. As such, this problem is not specific to universities in Southeast Asia, but it represents an Achilles heel when seen in connection with other challenges. One typical problem in the ecosystem is the lack of trained personnel in universities to support the process, such as in their technology transfer offices (TTOs), in particular, in patent examination and evaluation. In most of the ASEAN countries, the structure itself has emerged, often on the basis of a sound policy framework, but with weak implementation and many challenges related to the enforcement of the legal rules. Hence, there are still too few disclosures, leading to a weak deal flow towards the commercial end of the process. The funding of research is typically weak in the region, with the exception of Singapore, and the institutional situation is government dominated.

Even in countries where the eco-system provides for significant residential patenting activity (with an effective

IP office in place, technology transfer offices at the universities, etc.), the challenge of commercialisation remains. A feature that is increasingly being seen in some ASEAN member states is an increase in domestic patenting activity coming from the university sector. In some cases, universities produce codified intellectual property (mostly patents) as part of their outputs. They are partly also measured against patents as a performance indicator. The effect is that the universities hold increasingly large (and expensive) patent portfolios, which are difficult to manage and often insufficiently utilised. Discussions are in progress about how to mitigate this situation.

Malaysia provides a useful illustration, as the country investing most in its patent regime after Singapore. While the general description above fits Malaysia as well, its legal environment for IP is seen as acceptable, although there are challenges in enforcement in cases of disputes. There is a new court for IP in Malaysia, which is dedicated to IP cases. The situation in many universities and scientific areas has been partly compensated by specialised agencies like NanoMalaysia, which have taken over the TTO functions for the universities in their areas. The government is also launching incentives for the five main research universities' patent output, with targets for disclosures and the provision of credits for university professors. A system for disclosures is in place, with financial incentives and panels for different areas to decide whether to accept disclosures or not. In this way, universities and research institutes are adapting to the "third mandate" of commercialisation and innovation through performance indicators, where patents may even replace publications. However, generating economic and social value from their growing patent portfolios (mostly expensive PCT patents) remains a challenge. It will potentially become difficult for universities to maintain and manage their growing portfolios.

An interesting attempt to further improve the situation in Malaysia has been to develop roadmaps and plans for the many agencies and institutions involved. While this helps to create momentum, there are also arguments that, due to the institutional "thickness", there is a significant lack of coordination and implementation capacity. Further, Malaysia has developed three interconnected platforms to spur commercialisation and innovation:

- The Public Private Research Network for connecting universities with industrial entities through a bidding system for problem solving;
- A Malaysian Steinbeis-system for improved science-industry relations, based on the German model;
- And most importantly in this context, the PlaTCOM Ventures, the national IP facilitation platform supported by the Ministry of Trade (see also the next section).

A key problem related to the weaknesses in generating valuable patent output in this region is the weak level of R&D funding in most of the countries. As the data collected in Degelsegger et al. (2014) shows, the level of expenditures on R&D is very low, often in the area of 0.2–0.5% of GDP, with the exception of Singapore, although Malaysia and Thailand are countries which are gradually spending more. This obstacle results in the general complaint by university representatives and commercial players alike: There is too little input in the areas of investments and research activities to expect much to emerge in terms of IP potential. In some ASEAN countries, potential and actual innovators do not consider patenting because of the perceived deficiencies in the IP system in general (processes are long, protection is insecure). They instead opt for other means of harnessing their IP (e.g. the first mover advantage, making the most out of their innovation by being the first to the market). From the perspective of a developing economy, a weak IP system can be an advantage (allowing informal channels for technological catch up). However, it seems important to monitor the situation to determine whether and when the balance will shift to a situation that impedes domestic innovativeness.

In many countries, governments have initiated policies to stimulate the commercialisation of R&D from universities and public research institutes. For example, as is the case in Vietnam, scientists at universities often are not aware of the available support and funding for the commercialisation of research. In Malaysia, the performance system for faculty staff at universities has been reformed to put much more weight on disclosures and filings of IP. This has also led to a boost in disclosures, but so far, the typical result has been the growth of low-quality patent disclosures, a general problem throughout many Southeast Asian universities. In Malaysia, the five big national universities receive some 35m USD in funds for innovation and research through the CRDF program (Commercialisation of Research and Development Fund [47]), whose funds are 70% public and 30% private. For these universities, the performance indicators have been adapted to allow patents to replace publications. For example, at University Putra Malaysia (UPM), a patent is worth two publications. At the university level, innovation measured by patents comprises 10% of the overall performance assessment. IP is owned solely by the universities, but the revenues are shared according to specific schemes. The incentives are structured at various levels, from disclosures to accepted patents. UPM takes an equity position in companies, but stimulates its researchers/inventors to take roles in companies as well. Further, UPM organises training for researchers and lawyers to increase their expertise in the evaluation and examination of IP. In Thailand, the performance indicator is similarly tilted, and researchers are incentivised to seek normal patenting, as they receive 20 points in the system for a patent application and 50 points for patent granting, whereas

47 http://www.mtdc.com.my/crdf.php

they receive 5 points for filing a petty patent. The risk is great that low quality patenting is being promoted as an adaptive behaviour.

As mentioned, the ecosystem for commercialisation is often in place. But the main challenge is the lack of trained expertise. Ideally, patent examiners should have a technical background. This is a problem throughout most of the countries in Southeast Asia. However, training programmes have been initiated, in many cases, by their national IP offices. Further, the WIPO helps to train university staff, as well as final year graduate students in some cases. The WIPO also provides technical assistance, such as documents and manuals. In Vietnam, a distance learning programme by the WIPO was translated into Vietnamese.

As IP policies are being strengthened in many countries, the main universities are often being advanced to serve as hubs or specific resource centres for academic inventors. Malaysia has already been mentioned. An interesting additional case is the Innovation and Technology Support Office at the University of Santo Tomas in the Philippines. Box 3 highlights the elements of this effort.

Background and History

The concept of Intellectual Property (IP) has already reached the consciousness of the University. In 2009, the University promulgated its IP Policy and established an IP Unit under the Office of the Vice-Rector for Academic Affairs & Research (OVRAAR). The task of the unit is to (1) assist faculty members, support staff, and students in registering any IP that they have developed through the course of their employment or study; (2) inform faculty members, support staff, and students about IP through an ongoing IP education programme; and (3) be the forerunner in identifying IP for possible commercialisation and exploitation. With the numerous research studies produced by both faculty and students, there is a wealth of technology waiting to be registered and used for public consumption. IP ensures that, as the technologies are being used, the inventors and owners of it are given due recognition by the law.

On 25 November 2010, the University signed a Memorandum of Agreement (MOA) with IPOPhl to host a patent library called an Innovation and Technology Support Office (ITSO). The IP Unit also functions as the ITSO. In 2012, the World Intellectual Property Organization (WIPO), headed by Director General Dr. Francis Gurry, and the Intellectual Property Office of the Philippines (IPOPhil), headed by Director General Atty. Ricardo Blancaflor, awarded the University the Official ITSO Glass Emblem, which signifies that the University is now an ITSO. As an ITSO, the University will perform the following:

IP creation by facilitating access to global science & technology information

- Serve as a patent search facility and library for patent information
- Provide skills training in patent searching
- Render patent search services
- Organise a community of patent information users

IP protection by promoting domestic and globally competitive innovations by providing general information on patents and patenting

IP utilisation by assisting the commercialisation of globally competitive innovations

- Render IP audit and evaluation services
- Provide licensing support to University Research
- Provide advice on IP management and commercialisation strategies
- Be a depositary of patent-related documents, papers, and statistics.

Box 3: The Innovation and Technology Support Office at the University of Santo Tomas

Our data and interviews suggest taking a separate look at the case of Singapore with respect to the generation of intellectual property in the ASEAN context. While the diversity among the other countries is also considerable, the Singaporean case is peculiar because of the setup of the country's innovation system and its position in global knowledge production and value chains.

5.2.5 The special case of Singapore

We have seen above that Singapore is the region's most active country in terms of patenting activity and in IP generation in general. This has to do with its high and sustained public and private investments in R&D since the 1990s, its role as a traditional foreign direct investment recipient, as well as its financial and legal infrastructure. Inward patenting (foreign parties filing patents at the Singapore office) of foreign applicants is still the most frequent case for patent applications filed in Singapore.

Beyond the inward patenting of foreign affiliates, throughout the last decades, Singapore's universities and public research organisations (mostly A*Star) have also had a focus on securing IP protection for knowledge produced in Singapore. This is visible in the high patent application output, combined with the relevance of the university and government research sector in

producing this output (see the WIPO data presented above). The almost 50 % share of universities and government research in the patenting application output (of Singapore-based applicants) is unique, and in an ASEAN-EU context, it is only comparable with Malaysia. Singapore's main research universities (particularly NUS and NTU), as well as its large public research organisation (A*Star), have consistently produced considerable patent application output. At the same time, the high relevance of the public sector in domestically owned patents shows that Singapore-based companies might not be as active in securing and commercialising IP as the Singaporean government would like it to be.

The numbers regarding the shares of publicly-owned patents which are actually commercially used (through licensing, spin-off creation, etc.) have not been disclosed. In any case, there is much debate on the success, prospects, and best ways to commercialise the Singapore-generated IP. As is the case elsewhere, there are challenges within the universities and public research organisations. There is a potential disconnect between the TTO staff and the researchers, and different models are being explored to minimise it. For research emerging from Singapore's public research sector, the system in place is Bayh-Dole inspired, with the institutions owning (and applying for) the IP. Different rules are in place to compensate researchers/inventors. With respect to licensing or selling patents resulting from public research, valuation is a challenge, with expectations often differing between the researchers/inventors, the technology transfer intermediaries, and the companies.

Once the university or PRO internal challenges, as well as the question of valuation, are resolved, numerous public support instruments are in place in Singapore to ensure that innovations are funded properly. Among them are commercialisation grants for prototyping, demonstration, and scaling up; public-private innovation equity co-investment schemes; incubator and start-up funding for public research results on their way to the market; and support for the internationalisation of Singaporean companies[48]. An agreement has been found with three banks which now accept granted patents as collateral, i.e. as security for publicly backed loans.

Beyond the public research landscape, Singapore's recent investments in upgrading its IP Office (IPOS) reflect the government's focus on promoting an IP culture in the public, but also especially in the private sector. Purely private R&D investments have also grown consistently. In each of the past years, Singapore has attracted approximately half of the entire region's foreign direct investment inflows[49], particularly those in the high technology sectors. It is the hub of the region's young, but growing community of angel and venture capital investors. In addition, Singapore is the region's major financial hub and features a strong financial services sector and a flourishing legal industry.

Singaporean innovation policy makers are aware of the unique combination of being a knowledge production site, a foreign direct investment recipient, and an entry point to the regional market, as well as a market with a mature financial and legal infrastructure. The Ministry of Law set up a national IP Steering Committee in 2012, which produced an 'IP Hub Master Plan' for Singapore[50]. It formulates the vision of establishing Singapore as a global IP hub in Asia, particularly for IP transactions and management (where the financial sector plays an important role), for quality IP filings (through an effective intellectual property office), and for IP dispute resolution (building on Singapore's court and legal infrastructure). Our evidence suggests that Singapore already successfully occupies this hub function.

Southeast Asia's nascent business angels and venture capital landscape are centred in Singapore, with IP portfolio investors[51] being a potential further player in the ecosystem. Southeast Asian investors from the Philippines, for instance, use Singapore as a location for their investments, mergers and acquisitions, and more broadly, as a safe haven for expanding their business activities in the region. Singapore is the financial hub in the region. R&D intensive companies (e.g. in the life science or consumer goods sectors) entering the region often start with a presence in Singapore[52], which then typically services the Southeast Asian markets and potential future expansions. Foreign IP owners consider Singapore to be a safe haven for their IP assets, and thus, they file for protection there and rely on its judiciary for dispute settlement. Specifically in sectors such as the life sciences and pharmaceutical sector, the automotive sector, petrochemicals, and electronics, foreign companies have a long history of using Singapore as a production base and trade hub. In some specific sectors, the incentives to use Singapore are further increased by IP regulation: For instance, Singapore's IP office explicitly considers the second medical use of drugs as patentable. This makes it more interesting for pharma companies to file for protection in Singapore. Protection is secured, while negotiation is required in countries such as Thailand and the Philippines, which are concerned about big pharma benefiting from the second use as a loophole to maintain high prices for drugs (whose protection, in principle, have expired)[53].

Beyond these traditional patterns and concerns, an increasing number of international companies are

48 See Degelsegger et al. (2014).

49 See the data for the last three years in the UNCTAD *World Investment Report 2015:* http://unctad.org/wir

50 https://www.ipos.gov.sg/Portals/0/Press%20Release/IP%20HUB%20MASTER%20PLAN%20REPORT%202%20APR%202013.pdf

51 Often called patent trolls for their use of IP as a means to block competitors

52 Depending on the sector, Thailand and Malaysia are other important entry points.

53 In terms of software patents, the situation is still unclear in the entire region. While Singapore builds on a UK system, which has removed barriers for software patents, so far, a technical aspect is required when filing in Singapore.

looking for ways to open up innovation processes, benefiting not only from Southeast Asian markets and manufacturing labour forces, but also from the expertise and R&D facilities in the region. Multinationals are increasingly on the lookout for technologies from outside sources around the world and in Southeast Asia, in particular. The question for them is how to design models of open innovation without losing the IP that they consider a prime asset. One method used by these companies is to simply file their patents in Singapore and then to license it to partners, subsidiaries, or suppliers in other ASEAN countries. By this means, they can combine regional market access and location advantages, while keeping the risk of losing intellectual property at bay[54]. This model is insufficient, however, if actual R&D activities are set up in Southeast Asia and incorporated in the multinationals' value chains[55].

Being well aware of the needs of multinationals, as well as the need to grow its own start-ups and companies, Singapore has already invested significantly in the implementation of the IP hub vision. Public intermediary organisations such as IPI work to connect market demand with IP in Singapore and elsewhere. Singapore's Intellectual Property Office (IPOS) has been upgraded, as was mentioned above. Legal procedures have been adjusted to international standards (e.g., that only inventions meeting novelty and non-obviousness criteria can be granted). IPOS works to make the patenting process as fast and efficient as possible, partly by offering advisory services that are typically performed by patent attorneys. For a couple of years, IPOS has trained and employed its own patent examiners. It has increased its staff numbers (and relatedly, its processing rate), offers orientation and training for potential applicants in the public and private worlds, and has installed an IP valuation lab. In looking beyond Singapore, it has tapped into international networks (e.g. by organising the Singapore IP Week and being active in the ASEAN Working Group on IP Cooperation [AWGIPC]).

In the AWGIPC and regional innovation policy in general, Singapore has argued for stronger IP protection and collaboration. In addition to driving forward the mutual recognition of patent examination reports (through the ASPEC system), it has entered an arrangement with Cambodia by which the Cambodian IP office directly accepts and uses IPOS examination reports. This reduces the costs for Cambodia and provides Singapore with the opportunity to act in the aspired hub function. While the ASPEC system seems to reinforce Singapore's function as a hub, the overall idea is that a more mature IP infrastructure will nurture innovation, not only in Singapore, but the ASEAN region in general. It remains to be seen whether such a future can be realised and whether it will primarily benefit Singapore or the entire region.

What we have already learned is that an increasing number of countries in the ASEAN region are acutely aware of the topic of patents and how it is potentially linked to innovation. We expect relevant economic benefits, policies, and programmes to try to ensure that IP produced at a specific location stays at that specific location. In the case of internationally collaborative research (e.g. joint labs) or support for international start-ups, this can lead to misunderstandings by the non-ASEAN, or more generally, foreign parties.

With an increasingly open and internationally collaborative production of knowledge, the best way to commercially exploit knowledge that is jointly produced has yet to be found. While the European Union has made some progress in this field (e.g. in the intellectual property-related regulations for the Horizon 2020 Framework Programme), the question of collaboratively exploiting IP in an ASEAN or ASEAN-EU setting is still pending. It will ultimately become more important. Meanwhile, a number of other issues challenge intellectual property management in ASEAN, in general, especially in light of the changing framework conditions and ASEAN-EU cooperation patterns.

5.2.6 Managing IP in ASEAN: Key issues and challenges

The importance of trademarks

Much attention in innovation policy has been given to patents. However, with respect to companies that are already active in the ASEAN region, the more immediate problems relate to trademarks. The problem of counterfeiting goods is huge in the region, and action by governments is often minimal. This area of IP is therefore also more directly related to the AEC, with the attempt to create a more integrated trade area. With low activity by customs, but increased trade within the AEC, infringements of trademark rights are likely to continue to cause concern. Although the IP ecosystem is gradually moving towards more coordination, and ASEAN member countries are issuing legislation that is more in line with the common principles developed under the AWGIPC, companies need to pay attention to how to protect their trademarks and brands in the region. Goodwin and Kwok (2015) provided the following summary of the key issues to consider in the current situation in the region:

- It's important to understand that timelines can differ greatly from country to country. As mentioned above, countries like Vietnam and Indonesia have significant backlogs and registration will be slow to complete. A long runway is needed in such jurisdictions.
- Even pre-filing timelines need to be considered as some ASEAN members have filing formalities requirements that will take time to fulfil. For instance, before an application can be filed in Myanmar, one of the documents required is a power of attorney that must be notarised and endorsed by the Myanmar embassy in the applicant's home country.
- Post-filing timelines can be even more crucial because completion of the registration process is usually required before an infringement action can be taken out against a third party.
- In Indonesia, the registration process must be completed before any IP transaction can be recorded with the Indonesian trade mark office. Since the registration process in Indonesia is a lengthy one due to an extensive backlog, filing should be carried out as soon as possible in the business cycle. Many trade mark owners have been caught out by this requirement in Indonesia, resulting in a situation where they enter into agreements to license or transfer ownership of their trade mark, only to have their deal fall apart subsequently because such transactions cannot be recorded with the trade mark office until the registration has been completed.

Box 4: Protecting trademarks

With such diverse systems and for companies with significant problems, the harmonisation of IP systems will take a substantial amount of time. The AEC will, in this regard, have less of an impact. However, as many of the ASEAN countries are lining up to join the Madrid Protocol on trademarks, which provides similar international protection as that provided by the PCT for patents, protection will be better and easier to obtain. In addition, the Transpacific Partnership (TPP) is also likely to have an impact, as its requirements will be compliant with the Madrid Protocol. Hence, while the AEC provides a necessary avenue towards a more integrated economic region, innovators and companies look towards international treaties and agreements for protection.

However, the trade perspective gives rise to another concern. The interviews conducted for this study illustrated well that the real challenge is related to non-tariff barriers. While the AEC is pushing for tariffs to be lowered and intra-ASEAN trade to be increased, in many countries, there have been attempts to implement product standards and regulations to protect domestic industry. This is obviously counterproductive to what the AEC process is attempting to achieve. But it also puts IP and trademark protection in perspective: Non-tariff barriers will reinforce the problems that are already at hand concerning the low protection of trademarks by undermining the competition rules that are so important for an integrated marketplace to be functional and efficient.

Transfer pricing: An emerging issue

The traditional way to look at IP management and the protection of IP has been to see multinational companies (MNCs), normally with a base in the West, as the owners of IP and as transferring IP to subsidiaries in countries where the production or marketing functions are conducted. This view corresponds with the pattern of MNCs retaining the bulk of their R&D-activities in their home countries for the easier protection of know-how and technology. When deploying IP that has been developed at home or in the West in e.g. Southeast Asian countries, the subsidiaries using the IP could be charged with a cost contribution or otherwise contribute financially to the mother company for activities that have derived benefits from the use of the IP.

There are several dimensions to this: First, there is the interest of the MNC in ensuring that costly developed IP is recompensed, so that the economic benefits are attributed to the entity that developed the IP. Secondly, the MNC has an interest in reducing its overall tax bill, so there will be an element of tax planning in issuing the transfer prices when IP is deployed to a subsidiary or associated company. Thirdly, tax authorities in the receiving countries have an interest in properly taxing the real profits generated in their jurisdictions. And lastly, among other things, the valuation of the IP becomes a critical issue as a basis for transfer pricing, as well as taxation. But the main point in this context is that the MNC, when deploying IP that it developed at home, will charge some premium on the receiving end, relative to the optimal profit sharing and the tax landscape.

With increasing globalisation and increasing activities of R&D and innovation in developing and emerging economies, this traditional picture is gradually changing. The world-wide changes in the organisation of production and R&D have led to greater participation from developing and emerging economies. The story about China is, amongst other things, a story of the increasing deployment of R&D centres and greater innovation capacities. As Southeast Asia is becoming more integrated in the global value chains and innovation networks, the region's innovation capacity is increasing. European and US corporations are also incubating and developing technologies using Southeast Asian corporations' infrastructure and knowledge, for example, in the areas of paper, chemistry, and construction materials in Thailand. This means that IP is increasingly being developed

54 The specific arrangements and related corporate motivations remain to be further investigated, e.g. whether companies first file in Singapore to protect their IP as quickly as possible and file later in other ASEAN countries (either via national filings or a PCT procedure) or whether they refrain from filing elsewhere in ASEAN.

55 The discussion regarding whether or not, how and why multinationals are actually diversifying their R&D locations has been ongoing for many years (cf. Patel, Vega 1999; Zedtwitz, Gassmann 2002; Le Bas, Sierra 2002; Criscuolo et al. 2005; Carlsson 2006; or Dunning, Lundan 2009 on the role of non-traditional host countries). The traditional model of European and US multinationals is to retain R&D activities at the headquarters. Our evidence suggests that in Southeast Asia, at least some of the large multinationals are currently reconsidering this model.

in Southeast Asia. This again changes the traditional pattern of the transfer pricing of intangibles: Up to the present, the headquarters of MNCs have charged premiums on their subsidiaries. The regional tax offices have tended to reject such charges to retain the taxable profits in their jurisdictions. MNC subsidiaries may then charge the headquarters for the premium. This development will create new challenges for both the tax offices and the MNCs with deployed IP, as well as IP developed in the region.

In this context, the question circulates around who is entitled to the returns attributable to an intangible such as a patent. The OECD states four criteria for the legal owner to be entitled to all returns:

- It performs and controls all of the important functions related to the development, enhancement, maintenance, and protection of the intangibles;
- It controls other functions outsourced to independent enterprises as associated enterprises and compensates those functions on an arm's length basis;
- It provides all of the assets necessary to the development, enhancement, maintenance, and protection of the intangibles; and
- It bears and controls all of the risks and costs related to the development, enhancement, maintenance, and protection of the intangibles (OECD 2013b).

Hence, transfer pricing is a complex area, and it raises difficult questions regarding e.g. who owns the IP, who performs which functions relative to the profit-generating capacity of the IP (such as funding, risk-taking, R&D), which methods of valuation of the IP are appropriate (such as cost-based methods, market-based methods, and income-based methods), and whether there are skills and competences available in the tax offices, IP offices, companies, and R&D centres to ensure a legitimate and sound valuation of the IP? As noted elsewhere in this report, a critical area of the IP landscape in Southeast Asia is exactly the diversity and the frequent lack of competent personnel and agreed procedures for examination, valorisation, and valuation. Therefore, in line with the other findings in this report, the framework conditions related to IP management are still challenging and put great demands on the IP and tax authorities in the countries in the region.

Valuation of IP

There is, as mentioned, a general lack of trained human capital in the national systems for developing and evaluating IP. This is not least the case for evaluating and assessing the economic value of an IP, e.g. a patent. This is important for several reasons, as IP may serve as collateral for borrowing for start-ups, as well as being a necessity for transacting IP and as a basis for transfer pricing and taxation.

Malaysia has attempted to close this gap in setting up PlaTCOM Ventures, a national technology commercialisation platform. It is wholly owned by the Malaysian Innovation Agency (AIM):

> *Rather than following traditional technology transfer models, PlaTCOM Ventures has designed a model that facilitates any segment of the entire commercialisation process (end-to-end facilitation) from idea to products and services. The whole approach will be market driven in supporting industrial innovation and competitiveness. The model is more suited to the innovation environment in the South East Asia region in providing commercialisation support for the fledgling businesses, innovators and entrepreneurs including those from academia and public research institutes.* [56]

We cannot assess the functionality and effectiveness of this initiative. But it addresses a key gap in the innovation system and illustrates the importance of commercialisation, technology transfer, and IP in the Malaysian innovation policy. However, with the greater importance of innovation and IP in the region, Southeast Asian countries will need to pay close attention to how they can support and develop capacity in the valuation of IP. With the typical lack of venture or risk capital in most of these countries, the effective valuation of IP has also been addressed in connection with borrowing from banks. Banks are typically risk adverse and demand collateral for lending. A key issue that is still emerging is the extent to which IP, properly and transparently valued, can be used by start-ups as collateral for borrowing from banks. In Singapore and Malaysia, the two countries that are more advanced in this area, the banks normally assume only 10–20 % of the risk, and the rest is covered by the government.

Defensive filing and protection of patents

From the IP statistics above, there is a clear pattern that foreign companies make up the bulk of the patent grants. This is especially so in Singapore, where foreign companies are active in filing for patents, seeing Singapore as the main hub and technological centre in the region.

The patenting pattern signals these companies' need for protection of their know-how and technology when entering the region. As such, this is the normal picture in a region where the domestic inclination is low, albeit growing. However, there is another angle to this: When foreign firms, like EU and US companies, are patenting

56 See: http://platcomventures.com/What_is_Platcom_Ventures-@-Who_We_Are.aspx

in these countries, the result is that relevant R&D may be blocked. In fact, it has been stated among the key players in these countries that this is the intention behind much of the patenting, as old expired claims are included in the new patents.

Another pattern in this context is linked to the comparably very large patenting taking place in Singapore by foreign firms. Although such firms dominate patenting throughout the region, as domestic patenting is still low, the statistics illustrate the special role being taken by Singapore. This is due to the fact that the legal system is very good and on par with those of Western countries. But with the cumbersome situation in the region as a whole, firms often use patents granted in Singapore as a particular means of protection: As mentioned above, instead of seeking protection through patenting in the rest of Southeast Asia, the companies register their IP in Singapore, and then license the IP to subsidiaries or partners throughout the region, transferring the fees back to their regional headquarters in Singapore. This pattern is also linked to the issue of transfer pricing. It is difficult to assess the extent to which this happens, but there are some interesting aspects to this: First, it gives Singapore a greater role than the real economic activity warrants. Secondly, it reduces the need for IP management capacity in the countries concerned.

Patenting activity is often related to the innovation process in global value chains, as well as with the associated global innovation networks. These are different across sectors. A specific challenge relates to the pharmaceutical sector, where many Southeast Asian countries have seen a growing role in clinical trials, as they are very expensive in Western countries. Hence, Western firms are increasingly relying on conducting clinical trials in this region. Due to the very cost factor of such trials, patent protection has become vital, but as the time consumed for a granted patent is often lengthy, even up to 10 years, some companies have even risked launching their products without patent protection. This also concerns the development of new medicine more broadly: Regulators in some countries, such as in Thailand, where a new law against patented medicine is being pushed, are forcing the disclosure of the price structure for newly registered patented medicines in order for the regulator to decide whether it is fair. From the point of view of the drug producer, this may be at odds with the risk profile of developing the drug, which the regulators may not fully understand, and it may inhibit the development of new drugs.

6 Conclusions: Institutional integration for knowledge markets

This study has focused on contrasting the economic integration models in the two regions with a view to exploring how they facilitate innovation. We have given priority to the issue of IP and its protection, particularly patents. These are key concerns in both regions' innovation policies. We have also discussed the importance of layers of institutional and programmatic initiatives that are expanding the networking and integration capabilities in the regions. We conclude that, in the two regions, the relationship between economic integration and innovation performance is playing out differently. The analysis casts light on very diverse knowledge markets. We argue that the capacity to develop cooperative institutions and programmes across borders is crucial for boosting knowledge-based economic growth in a region. In this regard, ASEAN and the EU are also very distinct, a point which reflects the difference in the politically chosen integration models.

This difference is noticeable throughout economic integration and innovation dynamics. The EU has developed into a political union with the corresponding supranational governance structures. ASEAN is clearly inter-governmental, with a cooperative institutional base that is relatively weak. The European Union Single Market is unique in its consistent approach towards integrating the economies through supranational decisions and directives, creating, over time, a more unified competitive area in Europe. While there are still issues to be dealt with, this integration programme has been one of the notable successes of the European project. The ASEAN process, due to the intergovernmental approach, is slower and not as comprehensive. In fact, one does ASEAN a bit of an injustice in comparing it with the EU in this case, as the region's history, potential political will for integration and unification are so different.

The EU has had great success in reducing barriers in trade and competition, with low or zero tariffs in most sectors, and few non-tariff problems. Competition, but also the associated cooperation, has increased. Innovation performance has been improved, although we do not assess the extent to which this potential has been fulfilled. In the ASEAN case, tariffs have been reduced, and there has been, over some years, a substantial increase in intra-regional trade. However, there is still substantial concern about non-tariff barriers, not least from foreign companies. And while the innovation performance in the region is steadily improving, public support for this process is anchored at the national level, which perpetuates the diversity in innovation output.

The Singe Market case in Europe has been a success in its own right. The wider integration of the European knowledge market through decades of institutional development and programmatic achievements like the Framework Programmes and the European Research Area makes it even more so. Even though there is a great disparity between European member states in how much they spend on R&D and related activities, the joint EU level activities have had a noticeable impact.

This European-level impact includes developments in the IP area. Although a unified EU patent has not been achieved, the very existence of the European Patent Office and related procedures in the IP examination and granting process has been a great step forward. We see this institutional richness and integration as decisive for building innovative knowledge markets.

This is, of course, very different in ASEAN, where the lack of a supra-national governance system has led the region to rely on inter-governmental processes. A unified ASEAN patent is certainly beyond the horizon. Nevertheless, the region has made some critical steps forward in developing cooperative procedures and processes to ease IP granting, most notably through the ASPEC process. Still, innovators rely significantly on the more expensive international routes for IP applications, such as the PCT approach. The regional diversity, not least in terms of languages and capacities, represents a major challenge to an effective ASEAN way. The role played by the ASEAN Working Group on Intellectual Property Cooperation (AWGIPC) notwithstanding, the coordination and implementation processes are taking place at variable speeds and with variable capacities for implementation in the national laws and practices. The ASEAN IP system is still under-staffed, and lacking in capacity and technical support. At the same time, some countries are pushing the regional IP policy agenda, e.g. in trying to boost the universities' "third mission" in innovation activities and relationships with industry. In line with global trends and the requirements of free trade agreements, these countries are promoting a pro-IP vision of innovation in ASEAN in general.

While most ASEAN countries have opted for a Bayh-Dole-like system concerning patent ownership (institutional ownership rather than by individual professors or funding agencies), in general, there seems to be a mismatch between the typically low input to the process in terms of R&D funding and the expectations on the output side in terms of valuable patents. This is particularly the case for expectations of the valorisation of public sector research. There is no region-wide cooperative trend between university and PRO-based innovation, leaving unfulfilled potential for institutional cooperation and integration, including the mobility of human resources.

Much attention is often paid to the patent generation process in universities and to the innovation ecosystem that is supposed to bring patent applications to commercial results. With respect to Europe's cooperative activities in Southeast Asian research, there have been some challenges in finding suitable models for innovation-oriented international cooperation. Transparency and experience will help in resolving the issues related to different expectations and levels of trust. The greatest concerns related to bi-regional ASEAN-EU cooperation come from the private sector: European and other foreign companies, on the one hand, see the region's potential not only as a market, but as a knowledge production site relevant in more open innovation chains. At the same time, they worry about the protection of their trademarks and non-tariff barriers, in addition to the low protection of IP in general. This is among the factors that have contributed to the development of Singapore's key role in the region, a role as a hub, which is exemplified by its dominant position in hosting (and litigating) foreign IP, especially regarding patents. Singapore may be the entry point for many foreign companies, but the market is elsewhere, leading to licensing practices and other IP management approaches intended to avoid applying for patents in the countries beyond Singapore.

In sum, while the AEC has generated steam and has made significant improvements in trade and integration, and this is likely to continue, ASEAN and the EU could work together to do justice to the importance of institutional and programmatic arrangements that further integrate the Southeast Asian region into a more effective knowledge market for research and innovation. Stronger intra-regional cooperation can help to reap regional benefits from the gradual inclusion of Southeast Asian knowledge producing entities in global innovation networks.

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Embassy of France
Embassy of Italy
Indonesian Institute of Sciences LIPI
Law Office CCN & Asssociates
SKC Law, Advocates and IP Consultants
Suryomurcito & Co.
University of Indonesia

Malaysia
Academy of Sciences Malaysia
EU Delegation Malaysia
EU-Malaysia Chamber of Commerce and Industry
Malaysian Technology Development Cooperation
MIMOS Berhad
Ministry of Science, Technology and Innovation (MOSTI)
MyIPO
NanoMalaysia
SIRIM Berhad
Steinbeis Malaysia Foundation
Universiti Putra Malaysia
University of Malaya

Philippines
AMECOS Intellectual Properties Inc.
APEC Engineer Register, National Monitoring Committee
APEX Mining Co., Inc., EVP for Operations, Geology and Exploration
Baranda and Associates
DAP, Development Academy of the Philippines
De La Salle University
Dept. of S&T, Calabarzon Region
Dept. of S&T, National Research Council of the Philippines
Dept. of S&T, Technology Application and Promotion Institute
Design Center of the Philippines
Intellectual Property Office of the Philippines
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Unibersidad ng Pilipinas

Singapore
British High Commission Singapore
EU Delegation Singapore and EU Member State S&T Counsellors
EU-ASEAN Business Council
Gateway Law Corporation
IP Intermediary (IPI)
Marks & Clerk
National Research Foundation
National University of Singapore
Singapore Management University
SPRING Singapore
WIPO Singapore office

Thailand
EU Delegation Thailand
GSK
National Science and Technology Development Agency
Rouse
Science, Technology and Innovation Policy Office

Vietnam
European Chamber of Commerce in Vietnam
Hanoi University of Science and Technology
Hogan Lovells, Hanoi office
Ministry of Science & Technology
Unilever
Vietnamese-German University

In this **SEA-EU-NET** study, we analyse the interplay of ASEAN's economic integration project and its innovation policies and framework conditions. In doing so, we also present European approaches and experiences that can be of value.

Concretely, we first explore the ASEAN Economic Community (AEC) and its potential impact on framework conditions for innovation in ASEAN. We contrast this with related developments of economic integration in the EU. We then concentrate on the current environment for generating policies, systems and practices for the protection of intellectual property rights (IPR) as a specific set of dedicated framework condition. Finally, we compare the developments in framework conditions in ASEAN in areas related to IPR to the situation in the European Single Market.

By addressing these questions, we hope to facilitate mutual exchange and learning that supports science, technology and innovation cooperation between Southeast Asia and Europe.

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