



ASEM Eco-innovation Index 2016

SUMMARY



Small and Medium
Business Administration



ASEM
SMEs
Eco-Innovation
Center

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Introduction of ASEIC

Facing alarming global environmental and economic challenges, the world has come to the realization that sustainability is not an option but a necessity, not only to prevent further impact on the environment but to reorient the way we do business. In this regard, the importance of the SMEs has to be addressed as they are the main engine of innovation and growth as well as the foremost employer in national economies over the world. However, SMEs often have difficulty getting appropriate information and adjusting in times of green transition, given the establishment of a growing number of environmental regulations in many countries.

Awareness is the key. The cooperative efforts of ASEM member countries to encourage SMEs to find green- growth opportunities through eco-innovation and to promote their exemplary practices or products are very much in need. Awareness of these green innovation paradigms is essential to guide each country's own sustainable development, for maintaining dynamic growth, and ultimately for adapting to and mitigating climate change.

The 2010 ASEM Forum on Green Growth and SMEs was endorsed as an official project at the 7th ASEM Summit (October 2008) in Beijing, China. Hosted by the Ministry of Foreign Affairs and Trade (MOFAT) and the Small and Medium Business Administration (SMBA) of the Republic of Korea, the Forum was an international meeting aimed at exchanging information and experiences among ASEM members as way to better assess the roles of SMEs in promoting emerging green growth opportunities.

At the end of the 2010 ASEM Forum on Green Growth and SMEs, a joint statement of the ASEM Forum 2010 on Green Growth and SMEs – which was drafted by SMBA and modified by a Steering Committee, composed of the representatives from Denmark, Germany, Spain, Sweden, China, Indonesia, Portugal, and the Republic of Korea – was released in an effort to support the establishment of ASEIC. In the forum, sixty representatives from ASEM member countries affirmed the need and urgency to take specific cooperative measures to leverage the capacity of the SMEs, as the main engine of innovation and as the primary employers, to facilitate Asia and Europe's common and mutually supportive progress on the path toward low-carbon green growth. They agreed to launch a working group in order to identify and discuss such actions in a more concrete and detailed manner. This forum formed a productive and innovative consensus surrounding the necessity to promote green growth for SMEs.

Following the agreement, leaders from ASEM member countries officially endorsed the establishment of the ASEM SMEs Eco-Innovation Center (ASEIC) at the 8th ASEM Summit, which was held at Brussels, Belgium.

The ASEIC was established in 2011 with the principal mandate of promoting Asia-Europe cooperation to create and enhance eco-innovation of small and medium sized enterprises (SMEs) in both regions. Having agreed upon the importance of SMEs as main engine of innovation and growth, ASEM member countries have joined together to create ASEIC as international platform where growing environmental regulations and eco-innovative technologies are shared and new business opportunities are created, and ultimately implementing the vision of green growth around the globe.

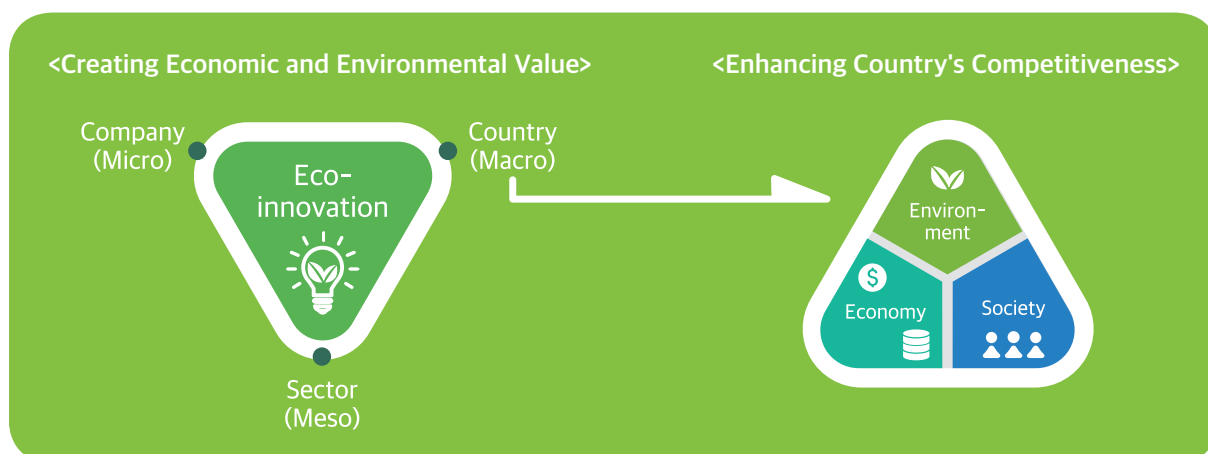
[Source] Website of ASEIC <http://www.aseic.org>

ASEM Eco-Innovation Index (ASEI)

ASEIC has developed ASEM Eco-Innovation Index (ASEI) since 2012 to use as an international tool to quantitatively and qualitatively measure the level and status of eco-innovation of ASEM member countries. ASEI expects to promote eco-innovation at regional and global level creating an active stage of communication between Europe and Asia, and as a result, encourage governments to enhance their eco-innovation related policies and regulations by comparing strengths and weaknesses of each country's eco-innovation status.

"Eco-Innovation is any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources." – European Commission Eco-Innovation Action Plan 2012

Eco-Innovation is a "key pre-requisite for sustainable development" at macro level as it brings positive synergetic effects towards economic, social and environmental conditions of a country. International organizations, research institutes, academia, etc. are continuously emphasizing the importance of eco-innovation, highlighting the roles of public and private sector to create enabling conditions.



Measuring ASEI

After the development of evaluation framework and indicators in 2012, ASEIC has annually measured eco-innovation phenomena across ASEM member countries using ASEI since 2014. The current members of ASEM consist of 31 countries from Europe and 20 countries from Asia (Table 1).

Table 1. ASEM member countries

Europe(31)	Asia(20)
Romania, Bulgaria, Estonia, Slovakia, Russian Federation, Lithuania, Latvia, Poland, Hungary, Croatia, Luxembourg, Norway, Switzerland, Denmark, Sweden, Austria, Netherlands, Ireland, Finland, Belgium, Germany, France, United Kingdom, Italy, Spain, Cyprus, Slovenia, Greece, Portugal, Malta, Czech Republic	Vietnam, Lao PDR, India, Pakistan, Cambodia, Bangladesh, Myanmar, Mongolia, Philippines, Brunei Darussalam, China, Thailand, Indonesia, Malaysia, Kazakhstan, Australia, Singapore, New Zealand, Japan, Republic of Korea

ASEI is composed of four evaluation categories consisting of 'Eco-Innovation Capacity', 'Eco-Innovation Supporting Environment', 'Eco-Innovation Activity' and 'Eco-Innovation Performance' (Table 2). The evaluation categories are applied to input-output model representing interdependence between a chain of eco-innovation activities. Twelve indicators were eventually used for ASEI 2016 depending on data availability: three indicators (Indicator no. 1.1, 1.2 and 1.5) for '**Capacity**', one indicator (Indicator no. 2.2) for '**Supporting Environment**', three indicators (Indicator no. 3.2, 3.4 and 3.5) for '**Activity**' and five indicators (Indicator no. 4.1, 4.2, 4.3, 4.4 and 4.6) for '**Performance**'. Annual report of ASEI 2016 includes the detail process of measuring ASEI including imputation of missing data, control of data quality, normalization and weighting.

Table 2. Data collecting of ASEI indicators

	Index Name	Source	Year Collected	Collected
1. Eco-Innovation Capacity	1.1 Country's Economic Competitiveness	GCI (WEF)	2015	Yes
	1.2. Country's General Innovation Capacity	GII (INSEAD)	2015	Yes
	1.3. Green Technology R&D Institution Capacity	Cleantech	-	No
	1.4. Green Technology possessed/acquired Firms	Cleantech	-	No
	1.5. Awareness of Sustainability Management	United Nations Global Compact	2015	Yes
2. Eco-Innovation Supporting Environment	2.1. Government's R&D expenditure in Green Industry	OECD	2013	Yes
	2.2. Implementation of Environmental Regulations	WEF	2015	Yes
	2.3. Maturity of Investment Setting for Green Technology Industry	Cleantech	-	No
	2.4. Investment Scale of Green Technology SMEs	Cleantech	-	No
3. Eco-Innovation Activities	3.1. Commercialization Level of Green Technology	Cleantech	-	No
	3.2. Firms' Participation on Environmental Management System	ISO	2014	Yes
	3.3. Economic Influence of Leading Environmentally Responsive Frims	Trucost & Sustainalytics	2015	Yes
	3.4. Green Patents	OECD(WIPO)	2014	Yes
	3.5. Activeness of Renewable Energy Utilization	IEA	2015	Yes
4. Eco-Innovation Performances	4.1. Level of Environmental Impact on Society	EPI	2015	Yes
	4.2. CO ₂ Emission Intensity	IEA	2015	Yes
	4.3. Nation's Energy sustainability level	ESI (WEC)	2015	Yes
	4.4. Water Consumption Intensity	IMD	2014	Yes
	4.5. Jobs in Green Technology Industry	Cleantech	-	No
	4.6. Green Industry Market Size	UK BIS	2011-2012	Yes

Note: Indicators in the bold cells were measured in 2015 and 2016.

• Regional analysis

ASEI 2016 scores were analyzed by the countries' regions (Asia and Europe). Comparing the scores of eco-innovation evaluation areas of countries in Asia and Europe, European countries, in general, showed higher level of Capacity, Activity and Performance than Asian countries. Especially, the European countries have higher scores of Eco-Innovation Supporting Environment than Asian countries (Figure 1.). It means that the European countries introduce more number of strict regulations on environmental issues than Asian countries do.

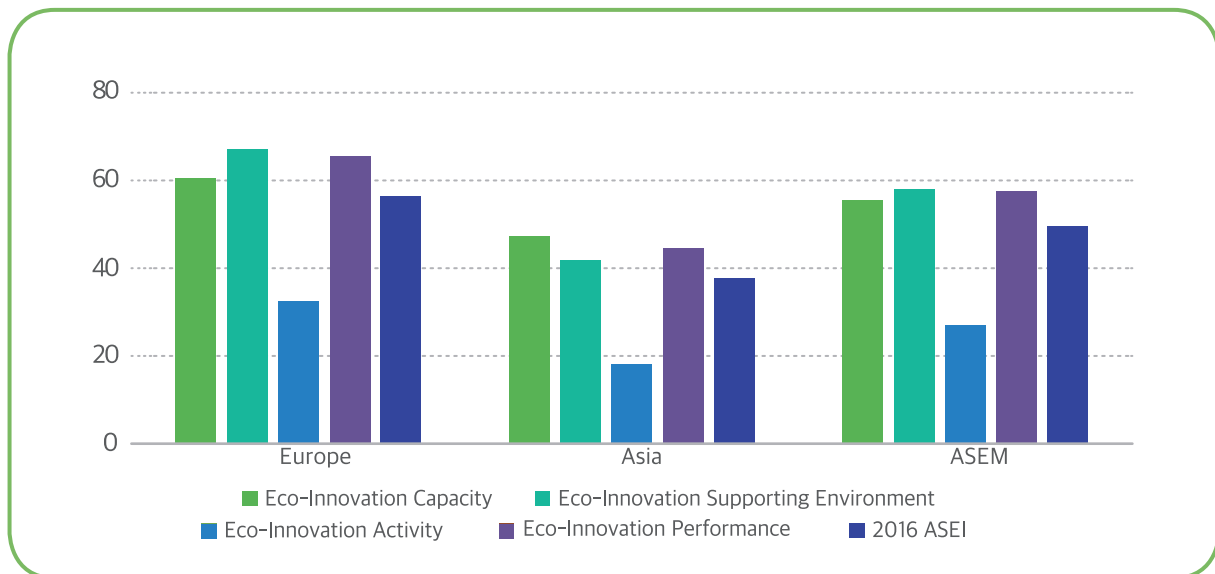


Figure 1. ASEI 2016 Results in Asia and Europe

• Quantile analysis

Target countries were divided into four quantile ranks based on the total scores and category scores of ASEI 2016 (Table 3). Most countries belong to the same quantile ranks in the total scores and category scores of ASEI 2016. Most of the countries that belong to the 1st and 2nd quantile ranks of categories of Capacity and Supporting Environment also belong to the 1st and 2nd quantile ranks of Performance. On the other hand, within the category of Activity, the quantile ranks of target countries were different from those in other categories. In Asia, Cambodia and Myanmar belong to the 4th quantile of the total scores and the categories of Capacity, Supporting Environment and Performance. However, the two countries belong to the 2nd quantile of the category of Activity, because they have the highest score in indicator 3.5 Activeness of Renewable Energy Utilization. In Europe, Romania belongs to the 3rd quantile of the total scores and the category of Performance and to the 4th quantile of the categories of Capacity and Supporting Environment. However, Romania belongs to the 1st quantile of the category of Activity, because it has the highest score in indicator 3.2 Firms' Participation on Environmental Management System from the number of firms with ISO 14001 certification per billion GDP.

Table 3. Quantile ranks of ASEI 2016 in Europe and Asia

Groups		European countries	Asian countries
2016 ASEI	1 st quantile	Switzerland, Sweden, Denmark, Finland, Norway, Germany, United Kingdom, Austria, Netherland, France	Japan, Singapore, New Zealand
	2 nd quantile	Luxemburg, Belgium, Estonia, Spain, Ireland, Portugal, Czech Republic, Lithuania, Slovenia, Latvia, Italy	Australia, Malaysia
	3 rd quantile	Slovakia, Croatia, Hungary, Romania, Poland, Cyprus, Malta, Bulgaria, Greece	Republic of Korea, China, Indonesia, Philippines
	4 th quantile	Russia	Thailand, India, Brunei, Vietnam, Cambodia, Bangladesh, Pakistan, Myanmar, Lao PDR, Mongolia, Kazakhstan
Capacity	1 st quantile	Switzerland, United Kingdom, Germany, Sweden, Netherland, France, Denmark, Finland, Norway	Republic of Korea, Australia, Japan, Singapore
	2 nd quantile	Spain, Luxembourg, Austria, Belgium, Ireland, Italy, Czech Republic, Portugal, Lithuania, Poland	China, Malaysia, New Zealand
	3 rd quantile	Estonia, Bulgaria, Slovenia, Russia, Latvia, Croatia, Greece, Hungary	India, Thailand, Indonesia, Philippines, Vietnam
	4 th quantile	Malta, Romania, Cyprus, Slovakia	Brunei, Mongolia, Bangladesh, Pakistan, Myanmar, Cambodia, Lao PDR, Kazakhstan
Supporting Environment	1 st quantile	Denmark, Switzerland, Finland, Germany, Austria, Luxembourg, Norway, Sweden, Belgium, Netherland	Japan, Singapore, New Zealand
	2 nd quantile	United Kingdom, Estonia, Ireland, Portugal, France, Slovenia, Czech Republic, Lithuania, Latvia, Malta, Cyprus	Australia, Malaysia
	3 rd quantile	Slovakia, Spain, Poland, Croatia, Hungary, Italy	Brunei, Republic of Korea, Philippines, Indonesia, India, China, Kazakhstan
	4 th quantile	Greece, Romania, Russia, Bulgaria	Thailand, Lao PDR, Cambodia, Vietnam, Bangladesh, Pakistan, Mongolia, Myanmar
Activity	1 st quantile	Czech Republic, Romania, Lithuania, Croatia, Slovenia, Norway, Bulgaria, Hungary, Estonia, Latvia, Finland, Slovakia, Austria	
	2 nd quantile	Spain, Italy, Sweden, Denmark, Switzerland, Poland, Portugal, Russian Federation, United Kingdom	Myanmar, Cambodia, China, New Zealand
	3 rd quantile	Luxembourg, France, Germany, Netherlands, Greece, Ireland	Australia, Philippines, Republic of Korea, Japan, Indonesia, Pakistan, Vietnam
	4 th quantile	Belgium, Cyprus, Malta	Malaysia, India, Thailand, Bangladesh, Lao, Singapore, Mongolia, Kazakhstan, Brunei Darussalam
Performance	1 st quantile	United Kingdom, Sweden, France, Norway, Switzerland, Spain, Denmark, Germany, Finland, Austria, Ireland	Japan, New Zealand
	2 nd quantile	Italy, Portugal, Lithuania, Latvia, Netherland, Luxembourg, Slovakia, Slovenia, Croatia, Belgium, Hungary	Singapore, Australia
	3 rd quantile	Greece, Cyprus, Malta, Czech Republic, Romania, Poland, Russia, Bulgaria, Estonia	Malaysia, China, Indonesia, Republic of Korea
	4 th quantile		Thailand, Philippines, Brunei, Vietnam, India, Pakistan, Myanmar, Cambodia, Bangladesh, Mongolia, Lao PDR, Kazakhstan

• Development stage analysis

Country scores were analyzed by using the categorization of national development stage. Referring to categorization of the World Economic Forum (WEF, 2014), which divides countries into five groups according to the development stages based on GDP and exportation of raw material, ASEM member countries can be categorized into five groups (Table 4).

Average scores of the categories, except the category of 'Eco-Innovation Activity', increase as the development stages increase (Figure 2). This phenomenon implies that the countries in the higher stages have already introduced a variety of strategies to promote eco-innovation with higher level of interest. In the category of 'Supporting Environment', differences in the average score from different development stages were more clearly presented than other categories. The category of 'Eco-Innovation Activity' is drawing interesting views by presenting that the development stages do not represent the clear correlation patterns. Average scores of countries from development stage 2 and 2-3 are higher than the average score of countries from development stage 3 within the category of Eco-Innovation Activity. In particular, some European countries in the development stage 2 and 2-3, have the high scores in the category of Activity. Romania, at the development stage 2, has the highest score in 3.2 Firms' Participation on Environmental Management System among all member countries. Bulgaria, at the development stage 2, and Estonia, at the development stage 2-3, have higher scores in 3.2 Firms' Participation on Environmental Management System than other countries in the development stage 3, except Italy and Czech Republic. Lithuania, at the development stage 2-3, has the highest score in 3.4 Green Patents among all member countries.

Table 4. National Development Stages

Stage	Europe	Asia
1	-	Vietnam, Lao PDR, India, Pakistan, Cambodia, Bangladesh, Myanmar
1-2	-	Mongolia, Philippines, Brunei Darussalam
2	Romania, Bulgaria	China, Thailand, Indonesia
2-3	Estonia, Slovakia, Russian Federation, Lithuania Latvia, Poland, Hungary, Croatia	Malaysia, Kazakhstan
3	Luxembourg, Norway, Switzerland, Denmark, Sweden, Austria, Netherlands, Ireland, Finland, Belgium, Germany, France, United Kingdom, Italy, Spain, Cyprus, Slovenia, Greece, Portugal, Malta, Czech Republic	Australia, Singapore, New Zealand, Japan, Republic of Korea

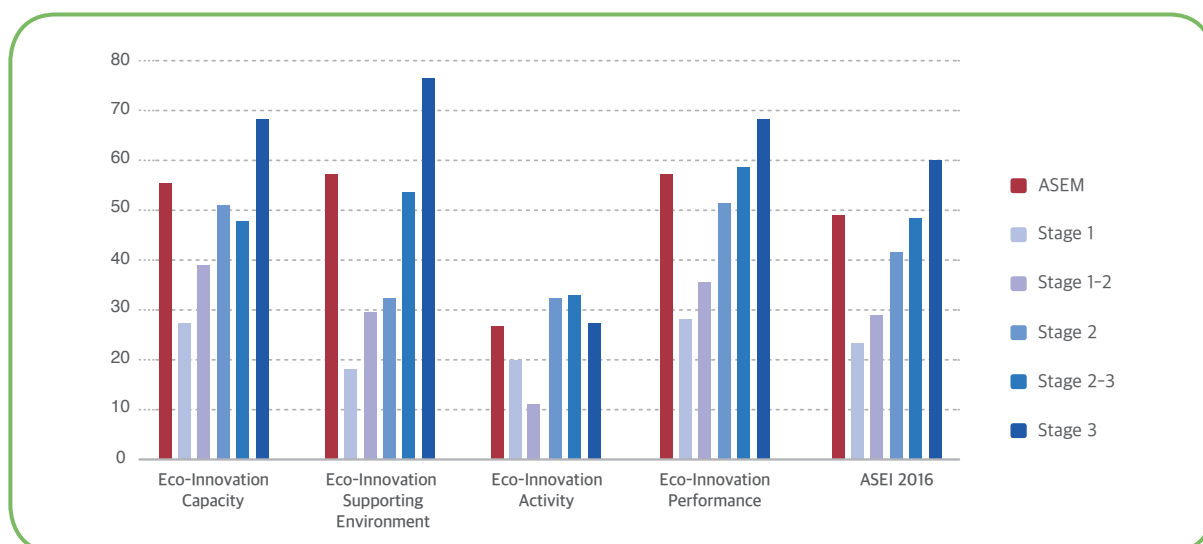


Figure 2. ASEI scores by National Development Stages

• Distribution analysis

The distribution of member countries by ASEI scores and scores of categories and indicators, was examined. Half of the member countries are located between 41 and 60 (Figure 3). In Europe, an interval between 51 and 55 has the most number of countries, while an interval between 21 and 25 has the most number in Asian countries. Distribution of European countries is in a bell shaped curve with symmetrical structure (Figure 4). Asia countries are separated into two groups: one small size group over the score 51 and one large size group under the score 45 (Figure 5). The smaller group consists of five countries with high scores: New Zealand, Australia, Malaysia, Japan and Singapore. This group can be interpreted as a group of leaders of eco- innovation in Asian countries (Jang et al., 2015).

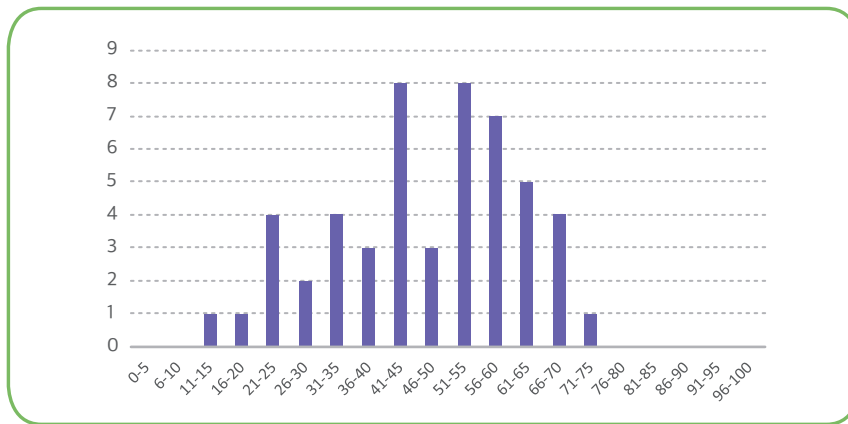


Figure 3. Distribution of countries by ASEI score (Europe and Asia)

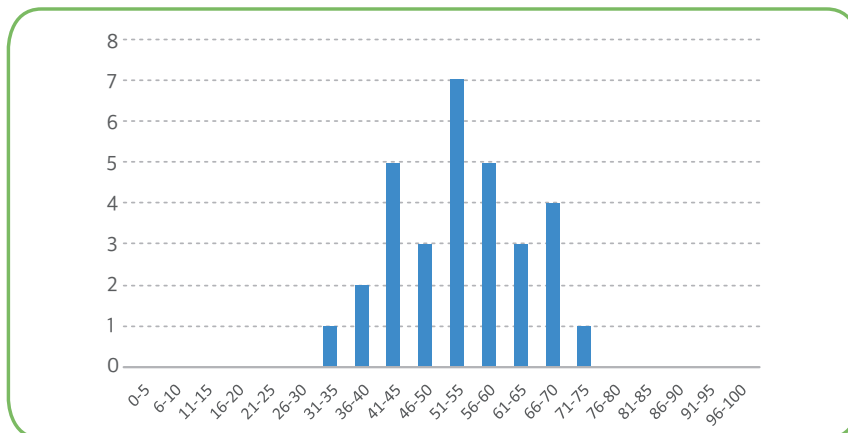


Figure 4. Distribution of European countries by ASEI scores

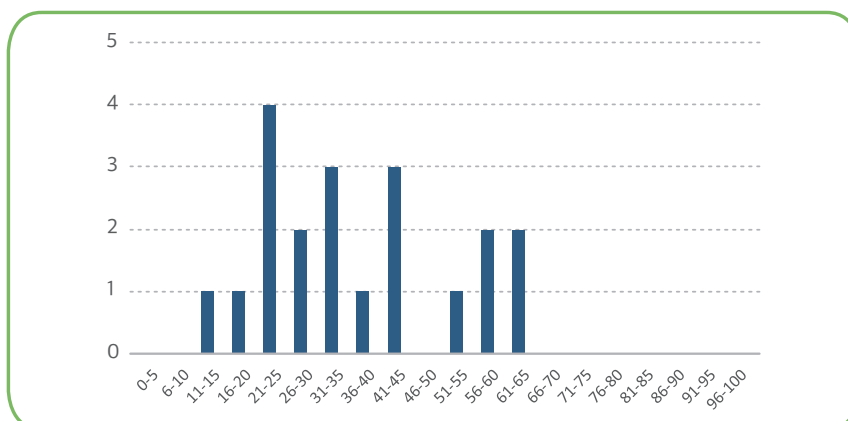


Figure 5. Distribution of Asian countries by ASEI scores

• **Category analysis**

In the ‘**Capacity**’ category, a number of member countries (31 countries, 59% of total countries) belong to the intervals of 41-50 and 66-80. Figure 6 presents the distribution curve with two peaks. The countries can be divided into medium and large eco-innovation capacity.

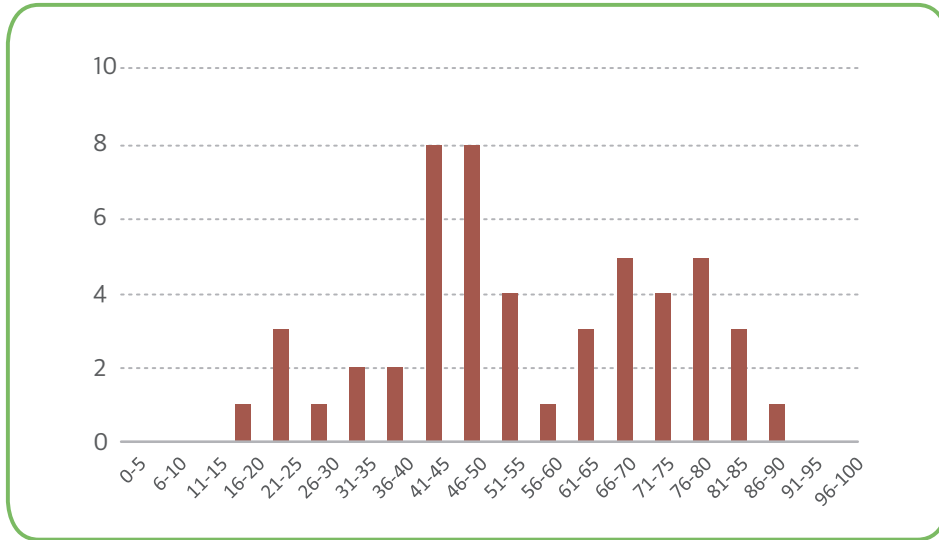


Figure 6. Distribution of countries by scores of ‘Capacity’ category

In the ‘**Supporting Environment**’ category, countries are distributed evenly from low scores to high scores (Figure 7). The distribution of countries has a relatively flatter shape, compared with distributions found in other categories. In particular, the number of countries with the scores from 86 and 90 is about twice as more in number than in other score intervals. All countries can be separated into two groups: the ones with score higher than 86 (small group) and the others with scores lower than 80 (large group). It means that the leaders exist in the category of supporting environment, which exactly indicates implementation of environmental regulation.

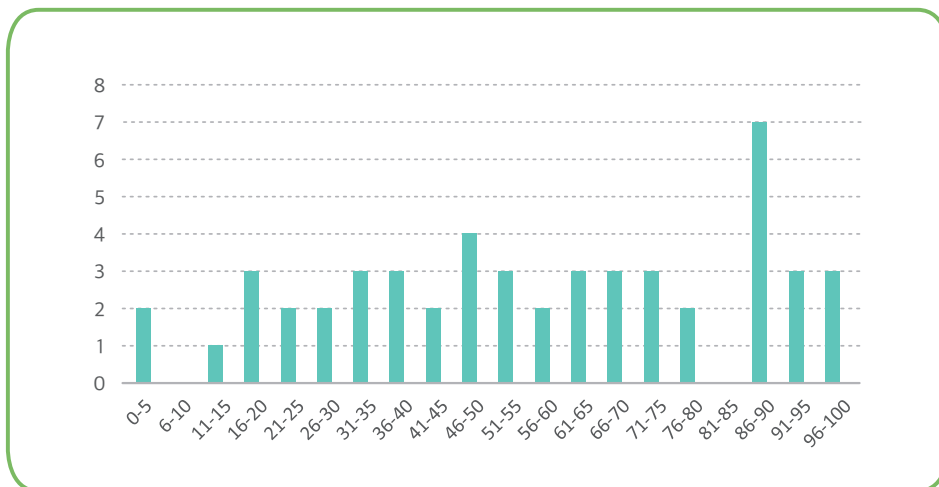


Figure 7. Distribution of countries by scores of ‘Supporting Environment’ category

In the 'Activity' category, it is noted that the countries are located in the lower scores range – most of the scores in this category are lower than 50 (Figure 8). The countries over the score 46 are Czech Republic, Romania, Croatia and Lithuania. The four countries belong to the 1st quantile of the Activity category. However they do not belong to the 1st quantile of the total scores and scores of other three categories.

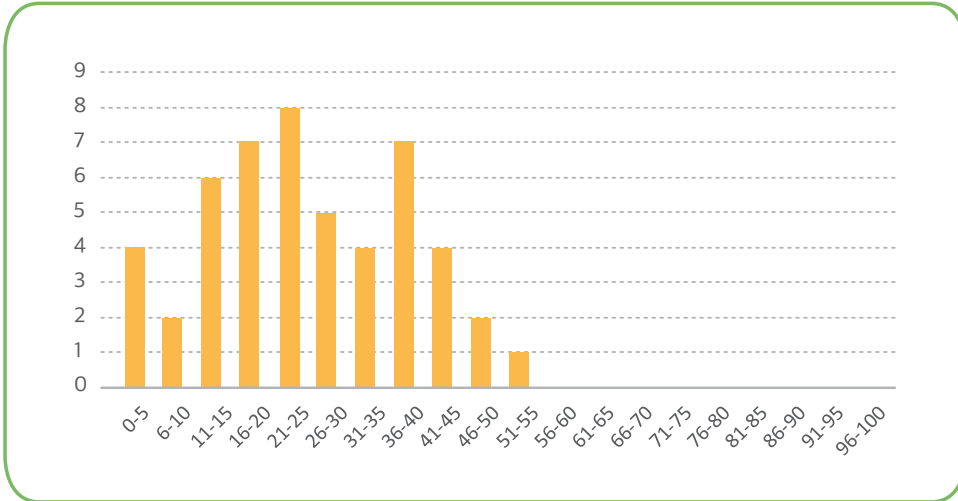


Figure 8. Distribution in countries by scores of 'Activities' category

In the 'Performance' category, the majority of countries are located in the higher score range on the graph (Figure 9). The largest number of countries lies in the intervals of 61-70. A group with the low scores (under the score 35) emerges. The group consists of 8 countries including Lao PDR, Mongolia, Bangladesh, Cambodia, Myanmar, Pakistan, India and Vietnam.

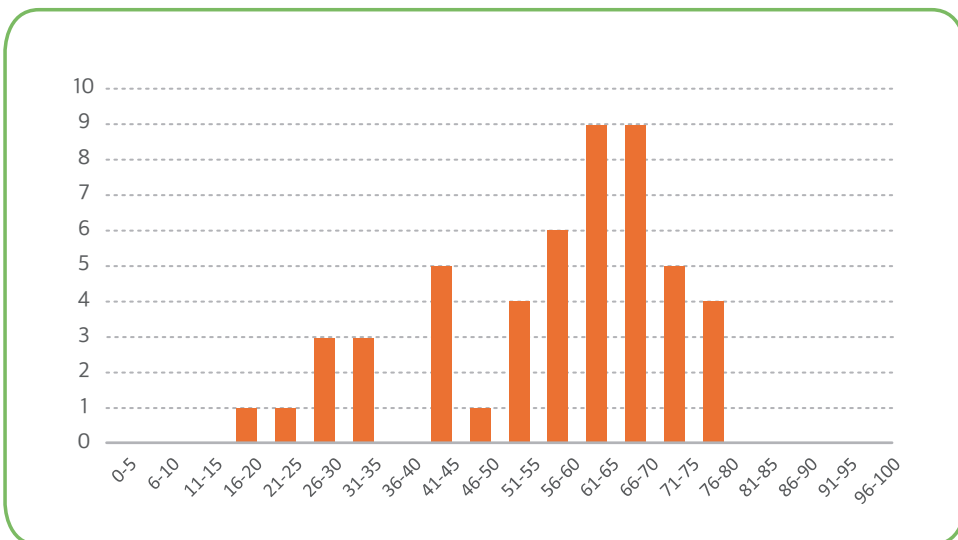


Figure 9. Distribution of countries by scores of 'Performance' category

Modification of ASEI Assessment

Twelve out of twenty developed indicators were measured to cover all 51 countries of ASEM. Due to limitations on data availability, Eco-Innovation Supporting Environment was measured based on only one indicator: 2.2 Implementation of Environmental Regulations. It is necessary to measure other indicators within the category of Supporting Environment. Eight indicators out of twenty indicators of ASEI were not measured in 2015 and 2016. Seven indicators among them were related to green technology and green industry (Table 2). The indicators on the green technology and green industry represent Capacity, Supporting Environment and Performance of eco-innovation in ASEI. Green or environmental technology covers a variety of different technologies and applications, and in particular filters, waste disposal, water cleaning, gas-flow silencers and exhaust apparatus, waste combustion or noise absorption walls (Schmoch, 2008). With a long-term perspective, data collection could be performed on green technology and green industry directly from the target countries to prevent lack of data. The related data can be collected using network with local experts in ASEM countries through national case studies. For example, government expenditures on green R&D (Indicator 2.1) have already been measured in OECD countries. Participation of local experts in Asian countries is expected through national case studies in order to gather government expenditure on green R&D. Jobs in Green Technology Industry (Indicator 4.5) can be collected with the same way in Asian countries. Moreover, Eco-innovation Scoreboard (Eco-IS), which was developed by Eco-Innovation Observatory to assess eco-innovation performance in 28 EU countries since 2010, can be linked with ASEI. Scores of one indicator of Eco-IS, employment in eco-industries for European countries, can be substituted for data source of the indicator 4.5. ASEI will be continuously measured and modified in order to provide information on the status of eco-innovation in ASEM member countries.

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