Research Performance of the ASEAN University Network Member Universities

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Abstract:

The purpose of this research paper is to describe the research outputs of the member universities of the ASEAN University Network (AUN). The paper is an inductive type of research that used a variety of information from Scopus to determine what AUN member universities are actively writing about. The author captured data from 1997 to 2017 from scopus.com to analyze what the AUN member universities and their respective countries have been studying. Results show that almost 50% of the total research outputs of all the ASEAN nations are contributed by the AUN member Universities, with Singapore's NUS and NUT contributing 76% of Singapore's total research outputs, while the Philippines' DLSU, ADMU, and UP contributes 50%. Wealthy nations such as Singapore and Malaysia have been focusing their researches on engineering and computer sciences while countries like the Philippines, Laos, and Cambodia have been researching about agriculture and biological sciences. Another study can be conducted to show research activities of the different universities all over Asia, including those that are not part of the ASEAN University Network.

Background of the Study

Economic growth in leading world economies is increasingly based on knowledge, in addition to tangible assets such as capital and labor (Yeo, 2010). Stewart (1997) defined intellectual capital (IC) as "the intellectual material -- knowledge, information, intellectual property, experience - that can be put to use to create wealth" (p. #).

Importance of Knowledge Capital

Several authors have written about the relationship between knowledge capital and a country's economy. Successful economies are deemed to be those which can develop and exploit new knowledge to stay ahead of their global rivals (Sombatsompop et al., 2011). Human capital has been seen to be a major contributor to economic growth, although, classical growth theories failed to classify the differences in human capital

(Becker, 1992). Romer (1986) eliminated the assumption of decreasing returns to capital as he broadened the definition of capital to include human capital or knowledge capital. He said in the long run, growth is driven primarily by the accumulation of knowledge by forward-looking, profit-maximizing agents. Human capital encompasses health, education, and training, which at first glance may be equal to knowledge capital. Human capital is a rival good in nature (Tullao & Cabuay, 2015). knowledge capital is a non-rival good because it entails investment in R&D **(**Romer, **1990)**. Human capital has an overriding influence on the development of new innovations, as well as the R&D of new technologies (Tullao, 2012). A country's labor force should have sufficient human capital to conduct research that will contribute to the nation's knowledge capital. Such nation's capacity to innovate will eventually determine its competitiveness (Tullao, 2012).

Knowledge producers

One of the key issues in research production is the motivation of academic personnel, who are considered the main producers of new knowledge. Consequently, it is identified that a potentially winning strategy for universities and research institutions that want to improve their performance indicators would be to provide younger scholars with wider opportunities for professional growth, including intense global cooperation in the professional community.

Indicators of Knowledge Capital

A citation count reflects impact, higher impact reflects higher quality, and impact indices become a proxy for relative performance or excellence (Adams, Gurney, & Marshall, 2007). A simple measure of attention for a particular article, journal or researcher. As with all citation-based measures, it is important to be aware of citation practices. Journal Impact Factor represents citations in a year to documents published in previous two years the number of citable items. Outputs in top percentile are the extent to which a research entity's documents are present in the most-cited percentiles of a data universe.

The Association of Southeast Asian Nations

The Association of Southeast Asian Nations, or ASEAN, was established on 8 August 1967 in Bangkok, Thailand, with the signing of the ASEAN Declaration (Bangkok Declaration) by the Founding Fathers of ASEAN, namely Indonesia, Malaysia, Philippines, Singapore, and Thailand. Brunei Darussalam then joined on 7 January 1984, Viet Nam on 28 July 1995, Lao PDR and Myanmar on 23 July 1997, and Cambodia on 30 April 1999, making up what is today the 10 Member States of ASEAN.

As set out in the ASEAN Declaration, the aims and purposes of ASEAN are:

- To accelerate the economic growth, social progress and cultural development in the region through joint endeavors in the spirit of equality and partnership in order to strengthen the foundation for a prosperous and peaceful community of Southeast Asian Nations;
- To promote regional peace and stability through abiding respect for justice and the rule of law in the relationship among countries of the region and adherence to the principles of the United Nations Charter;
- To promote active collaboration and mutual assistance on matters of common interest in the economic, social, cultural, technical, scientific and administrative fields;
- To provide assistance to each other in the form of training and research facilities in the educational, professional, technical and administrative spheres;
- To collaborate more effectively for the greater utilization of their agriculture and industries, the expansion of their trade, including the study of the problems of international commodity trade, the improvement of their transportation and communications facilities and the raising of the living standards of their peoples;
- To promote Southeast Asian studies; and
- To maintain close and beneficial cooperation with existing international and regional organizations with similar aims and purposes, and explore all avenues for even closer cooperation among themselves.

In their relations with one another, the ASEAN Member States have adopted the following fundamental principles, as contained in the Treaty of Amity and Cooperation in Southeast Asia (TAC) of 1976:

- Mutual respect for the independence, sovereignty, equality, territorial integrity, and national identity of all nations;
- The right of every State to lead its national existence free from external interference, subversion or coercion;
- Non-interference in the internal affairs of one another;
- Settlement of differences or disputes by peaceful manner;
- Renunciation of the threat or use of force; and
- Effective cooperation among themselves.

ASEAN Community

The ASEAN Vision 2020, adopted by the ASEAN Leaders on the 30th Anniversary of ASEAN, agreed on a shared vision of ASEAN as a concert of Southeast Asian nations, outward looking, living in peace, stability and prosperity, bonded together in partnership in dynamic development and in a community of caring societies.

ASEAN Member States: Selected Basic Indicators, 2016

Country	Total land area	Total population [1]	Population density [1]	Annual population growth [1]	Gross domestic product	Gross domestic product per capita at current prices		International merchandise trade [4]		
						US$ [2]	US$ PPP [3]	Exports	Imports	Total trade
	km²	thousand	persons per km²	percent	US$ million			US$ million	US$ million	US$ million
Brunei Darussalam	5,765	423.0	73	1.4	11,206	26,493	77,085	4,874	2,670	7,544
Cambodia	181,035	15,158.2	84	1.2	19,194	1,266	3,848	10,073	12,371	22,444
Indonesia	1,913,579	258,705.0	135	1.3	931,216	3,600	11,701	145,186	135,653	280,839
Lao PDR	236,800	6,621.1	28	2.0	15,903	2,402	7,123	3,124	4,107	7,231
Malaysia	331,388	31,660.7	96	1.5	299,632	9,464	27,584	189,414	168,392	357,807
Myanmar	676,576	52,917.0	78	0.9	68,636	1,297	5,959	11,509	15,696	27,205
Philippines	300,000	103,242.9	344	1.7	311,453	3,017	7,987	56,313	85,935	142,248
Singapore	719	5,607.3	7,797	1.3	296,977	52,963	87,858	338,083	291,909	629,993
Thailand	513,120	67,454.7	131	0.3	407,048	6,034	17,273	215,327	194,668	409,994
Viet Nam	331,231	92,695.0	280	1.1	198,196	2,138	6,325	176,575	174,463	351,038
ASEAN	**4,490,212**	**634,484.9**	**141**	**1.2**	**2,559,463**	**4,034**	**15,164**	**1,150,479**	**1,085,865**	**2,236,343**

Sources: ASEAN Macro-economic Database, ASEAN Merchandise Trade Statistics Database, ASEAN Foreign Direct Investment Statistics Database (compiled/computed from data submission, publications and/or websites of ASEAN Member States' national statistics offices, central banks and relevant government agencies, and from international sources)

Symbols used

- not available as of publication time

n.a. not applicable/not available/not compiled

Data in *italics* are the latest updated/revised figures

from previous posting.

Notes

1/ Refers to/based on mid-year total population based on country projections

2/ Based on AMSs data submission to ASEANstats and Official National Statistical Offices website

3/ Computed based on IMF WEO Database April 2017 estimates and the latest actual country data

4/ ASEAN IMTS Database 2016 figures are as of September 2017

5/ Unless otherwise indicated, figures include equity, reinvested earnings and inter-company loans

6/ FDI 2016 figures are preliminary as of 31 October 2017

ASEAN Member States: Selected Key Macroeconomic Indicators, 2016

Country	Growth rate of gross domestic product at constant prices	Inflation rate (year-on-year growth of CPI at **end of period**)	Exchange rate at **average of period**		Unemployment rate [1]	International merchandise trade [2]						Year-on-year change in foreign direct investments inflows [3/4]	
						Ratio of exports to GDP	Ratio of imports to GDP	Ratio of total trade to GDP	Growth of nominal value of exports	Growth of nominal value of imports	Growth of nominal value of total trade		
	percent	percent	national currency per US$	Currency	percent	percent	percent	percent	percent	percent	percent	US$ million	percent
Brunei Darussalam	(2.5)	(1.6)	1.4	Dollar (B $)	*6.9*	43.5	23.8	67.3	(23.3)	(17.5)	(21.4)	(321.8)	(187.8)
Cambodia	6.9	3.9	4,233	Riel	*1.0*	52.5	64.5	116.9	17.7	4.9	10.3	578.7	34.0
Indonesia	5.0	3.0	13,328	Rupiah (Rp)	5.6	15.6	14.6	30.2	(3.4)	(4.9)	(4.1)	(13121.3)	(78.8)
Lao PDR	7.0	2.5	8,129	Kip	*1.9*	19.6	25.8	45.5	4.7	8.7	6.9	(3.5)	(0.3)
Malaysia	4.2	1.8	4.1	Ringgit (RM)	3.4	63.2	56.2	119.4	(4.9)	(4.3)	(4.6)	1148.8	11.3
Myanmar	5.7	6.6	1,182	Kyat	*4.0*	16.8	22.9	39.6	(0.8)	(6.8)	(4.4)	165.0	5.8
Philippines	6.9	2.6	46.4	Peso (PhP)	5.5	18.1	27.6	45.7	(4.0)	22.4	10.4	2293.9	40.7
Singapore	2.0	0.2	1.4	Dollar (S $)	3.0	113.8	98.3	212.1	(5.5)	(5.3)	(5.4)	(8534.6)	(13.7)
Thailand	3.2	1.1	35.3	Baht	1.0	52.9	47.8	100.7	0.4	(4.0)	(1.7)	(5474.3)	(68.2)
Viet Nam	6.2	4.7	22,719	Dong	2.1	89.1	88.0	177.1	9.0	5.3	7.1	800.0	6.8
ASEAN	**4.8**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**45.0**	**42.4**	**87.4**	**(1.8)**	**(1.4)**	**(1.6)**	**(22469.0)**	**(18.6)**

Sources ASEAN Macro-economic Database, ASEAN Merchandise Trade Statistics Database, ASEAN Foreign Direct Investment Statistics Database (compiled/computed from data submission, publications and/or websites of ASEAN Member States' national statistics offices, central banks and relevant government agencies, and from international sources)

Symbols used

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from previous posting.

Notes

1/ Brunei Darussalam is 2014 figure, Cambodia and Myanmar 2015 figures, Lao PDR is 2010 figure

2/ ASEAN IMTS Database 2016 figures are as of September 2017

3/ Unless otherwise indicated, figures include equity, reinvested earnings and inter-company loans.

Gross domestic product in ASEAN, at current prices (nominal), in national currency

Country	Currency	Base year 1/	2009	2010	2011	2012	2013	2014	2015
Brunei Darussalam	Dollar (B $)	2010	11.5	11.8	12.3	12.4	19.2	18.7	18.6
Cambodia	Riel	2000	28,692.0	30,403.3	32,552.7	34,933.0	37,503.0	40,141.0	43,009.0
Indonesia	Rupiah (Rp)	2010	2,178,850	2,314,459	2,464,566	2,618,932	8,156,498	8,566,271	8,976,932
Lao PDR	Kip	2012	29,132.2	31,500.9	34,033.7	36,721.9	39,674.9	42,646.7	45,871.3
Malaysia	Ringgit (RM)	2010	629.9	821.4	864.9	912.3	955.3	1,012.5	1,062.6
Myanmar	Kyat	2010	18,964.9	39,776.8	42,000.9	45,080.7	48,879.9	53,132.3	56,908.0
Philippines	Peso (PhP)	2000	5,297.2	5,701.5	5,909.0	6,305.2	6,750.1	7,164.0	7,579.9
Singapore	Dollar (S $)	2010	279.6	322.4	342.4	355.0	371.5	383.7	391.4
Thailand	Baht	2002	7,653.4	8,228.0	8,296.5	8,896.5	9,136.9	9,211.6	9,471.3
Viet Nam	Dong	2010	2,027,591	2,157,828	2,292,483	2,412,778	2,543,596	2,695,796	2,875,857

Source   ASEAN Secretariat Database (compiled/computed from data submission, publications and/or websites of ASEAN Member States' national statistics offices

and relevant government agencies, and from the International Monetary Fund World Economic Outlook (IMF WEO) Database April 2016.

Symbols used

-        not available as of publication time

n.a.   not applicable/not available/not compiled

Scopus

Publications for Worldwide, Asiatic and ASEAN during 1996-2010 in SCOPUS

Years	Worldwide	Asiatic	ASEAN
1996	1,124,261	159,052	6,132
1997	1,150,355	171,533	7,232
1998	1,142,426	178,062	7,372
1999	1,151,601	187,781	8,675
2000	1,221,158	199,746	9,806
2001	1,318,342	217,054	9,769
2002	1,350,850	218,864	10,406
2003	1,413,906	251,756	12,955
2004	1,565,695	296,032	14,059
2005	1,730,364	370,477	17,876
2006	1,811,071	416,089	22,096
2007	1,891,849	447,061	23,663
2008	1,924,519	487,563	28,188
2009	2,159,231	595,908	34,792
2010	2,406,772	666,569	42,941
Total 96-08	23,362,400	4,863,547	255,962
Growth	114%	319%	600%

Thai-Journal Citation Index (TCI) Centre , 2014

AUN

The AUN's strategic focus is built on those identified by ASEAN to facilitate regional cooperation in developing:

- To strengthen the existing network of cooperation among universities in ASEAN and beyond;
- To promote collaborative study, research and educational programs in the priority areas identified by ASEAN;
- To promote cooperation and solidarity among scholars, academicians and researchers in the ASEAN Member States; and
- To serve as the policy-oriented body in higher education in the ASEAN region.

Currently, AUN has 30 member universities. Malaysia has the most represented country with four members in the organization.

1. Universiti Brunei Darussalam	16. University of Mandalay
2. Royal University of Phnom Penh	17. Ateneo de Manila University
3. Royal University of Law and Economics	18. De La Salle University
4. Universitas Airlangga	19. University of the Philippines
5. Universitas Gadjah Mada	20. Nanyang Technological University
6. Universitas Indonesia	21. National University of Singapore
7. Institut of Teknologi Bandung	22. Singapore Management University
8. National University of Laos	23. Burapha University
9. Universiti Kebangsaan Malaysia	24. Chiang Mai University
10. Universiti Malaya	25. Chulalongkorn University
11. Universiti Putra Malaysia	26. Mahidol University
12. Universiti Sains Malaysia	27. Prince of Songkla University
13. Universiti Utara Malaysia	28. Vietnam National University, Hanoi
14. Yangon Institute of Economies	29. Vietnam National University, Ho Chi Minh City
15. University of Yangon	30. Can Tho University

Objectives of the Study
What areas of research are the AUN member universities publishing?
This paper aims:
- to determine the research areas that the AUN member are publishing; and
- to determine the total number of research publications each of the AUN members are producing and their impact to their respective country's research production.

Scope/Coverage of the Study

This study covers the 30 member universities of the ASEAN University Network in terms of the research outputs. The researcher only made used of the data from scopus.com. There might be other papers that the member universities have published but are not in Scopus.

Review of Related Literature

Several authors have indicated that higher education institutions (HEIs) are considered major producers of research and development. These HEIs produce research outputs that are for both private and public good. Academic research activities and their output are also good for the public for there is a general rule of openness and the free circulation of ideas are the rule (Schoenenberger, 2005). According to Korber and Paier (2014), there are different sectors in the country which are expected producers of R&D. Private firms, public and private research organizations, and universities are considered as heterogeneous agents that create scientific publications, patents, as well as high-tech jobs (). R&D activities and implementation of its results are becoming one of the most important tasks for universities (Laliene & Sakalas, 2014). Meanwhile, NEHRA 2-CHED indicated that research and development is a major function in higher education as it sets higher education apart from basic education. HEIs, according to them, is acknowledged as the place where education is converted to specific and new knowledge thru R&D.

Empirical results suggest that R&D performed by higher education is positively affecting productivity growth in all specifications (Eid, 2012). Even if the current trend in most developing countries is characterized by a less significant role of universities in funding and carrying out research, their role remains unchallenged in the area of research training (Varghese & Sanyal, 2006).

Theoretical Framework
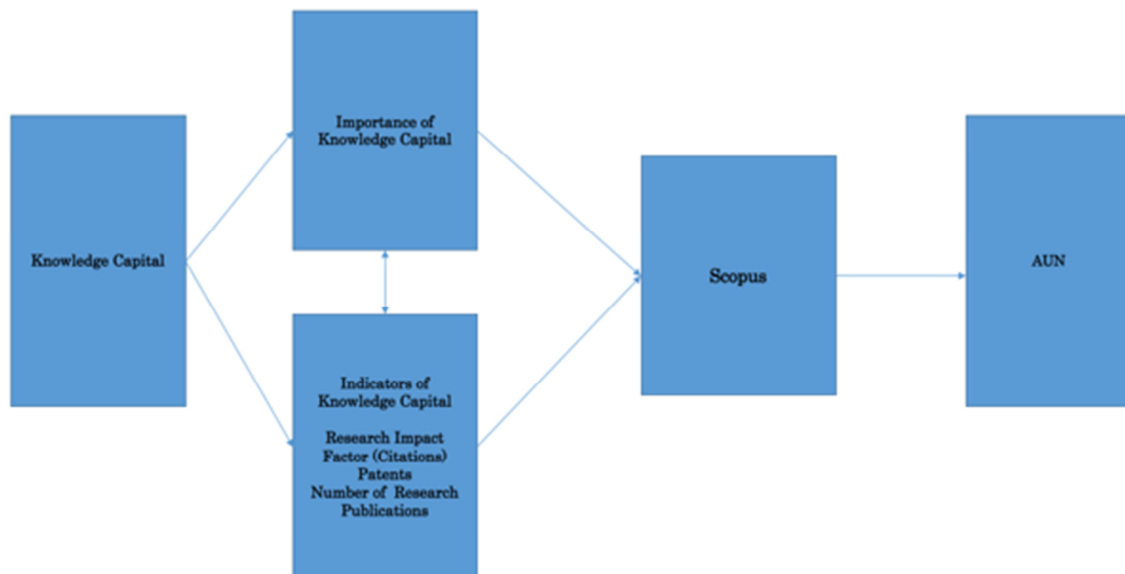
Method(s) of Data Collection and Analysis:

The researcher collated all data from scopus.com pertaining to the research production of AUN member Universities only.

These data are then organized in MicrosoftExcel to obtain the needed outputs such as total research outputs per country and per AUN member university as well as the subject matter where the member universities and countries have been focusing on.

Results and Discussion

Using the data captured from scopus.com, the following information was generated. First, a summary of the total number of research publications per country for the past 20 years. Second, figures were computed to show the percentage these AUN members per country contribute to their respective countries' research publications. Growth of research publications per country is also shown to show progress per country in terms of research publications. Then, tables that show contributions of each AUN members to each country is show, which is accompanied by the subject areas where their research are focused on.

Table 1. *Summary of Results for the ASEAN Countries*

Year	Vietnam	Laos	Cambodia	Myanmar	Singapore	Malaysia	Indonesia	Philippines	Thailand	Bruinei
2017	5,344	176	333	305	17,209	24,555	14,243	2,469	12,497	364
2016	5,697	267	383	299	20,791	29,628	12,004	2,965	14,493	510
2015	4,468	242	351	219	20,215	27,103	8,059	2,611	12,954	432
2014	4,038	221	325	144	19,715	28,319	6,478	2,209	13,514	381
2013	3,695	204	266	111	19,119	25,316	5,174	1,908	12,287	292
2012	3,141	212	263	120	18,257	22,692	3,950	1,749	11,964	246
2011	2,389	156	221	166	16,558	20,784	3,365	1,614	10,727	172
2010	2,172	137	195	116	15,625	15,768	2,755	1,341	10,088	124
2009	1,760	102	189	139	13,987	11,441	2,070	1,246	8,497	116
2008	1,504	110	153	105	12,946	7,948	1,504	1,080	7,948	103
2007	1,151	82	146	89	11,883	5,396	1,368	987	6,781	102
2006	990	94	122	72	11,621	4,454	1,324	902	5,988	91
2005	850	69	94	94	10,885	3,397	1,172	888	4,808	66
2004	698	70	86	48	9,750	2,723	968	674	3,937	69
2003	686	40	55	35	8,105	2,412	836	709	3,336	62
2002	431	23	53	28	6,816	1,800	712	615	2,840	36
2001	419	15	30	24	6,033	1,427	644	455	2,322	42
2000	395	18	27	30	5,871	1,638	710	570	2,241	54
1999	363	11	32	24	4,765	1,294	605	488	1,780	49
1998	311	14	12	19	3,903	1,136	590	482	1,605	58
1997	341	10	13	17	3,907	1,133	605	495	1,426	47
Total	40,843	2,273	3,349	2,204	257,961	240,364	69,136	26,457	152,033	3,416

The table above shows the year per year research outputs that are published in Scopus for each of the ASEAN member countries for the past 20 years starting in 1997.
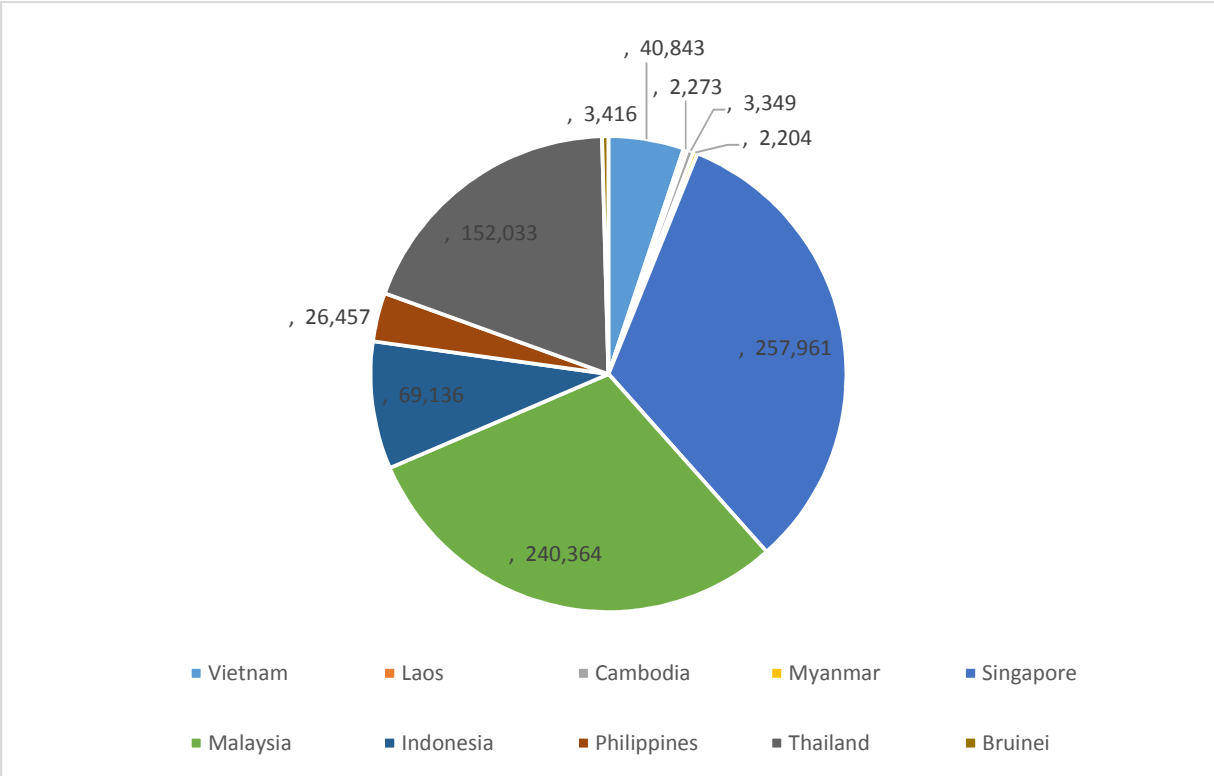

Figure 1. Contribution of ASEAN member countries to the ASEAN research productivity.

Figure 1 shows that in the past 20 years, the big 3 nations in terms of research productivity are Singapore, Malaysia, and Thailand. Laos and Myanmar have produced the lowest output among all these nations.

Table 2. Percentage of Contribution of the AUN Members to Their Respective Country's Research Outputs

Year	Vietnam	Laos	Cambodia	Myanmar	Singapore	Malaysia	Indonesia	Philippines	Thailand	Bruinei
Total of AUN	2651	420	263	586	193855	87957	11497	13292	41943	1565
% of impact	6%	18%	8%	27%	75%	37%	17%	50%	28%	46%

Table 2 shows the impact of the AUN member universities to the research productivity of their respective countries. Singapore and the Philippines have the biggest figures in this table, which mean that Singapore's NUS and NTU have been contributing 75% of Singapore's total research output. DLSU, ADMU, and UP contribute 50% of the Philippines' research outputs. In the case of other countries such as Vietnam and Cambodia, there are a number of reasons why their contributions to the total research outputs to their country is low such as the presence of other universities within their country that have been producing research outputs but are not a member of the AUN and the production of the private sector or the government of research papers.

Table 3. *Growth Rate on Research Outputs per ASEAN Member Country*

Year	Vietnam	Laos	Cambodia	Myanmar	Singapore	Malaysia	Indonesia	Philippines	Thailand	Bruinei
2017	-6%	-34%	-13%	2%	-17%	-17%	19%	-17%	-14%	-29%
2016	28%	10%	9%	37%	3%	9%	49%	14%	12%	18%
2015	11%	10%	8%	52%	3%	-4%	24%	18%	-4%	13%
2014	9%	8%	22%	30%	3%	12%	25%	16%	10%	30%
2013	18%	-4%	1%	-8%	5%	12%	31%	9%	3%	19%
2012	31%	36%	19%	-28%	10%	9%	17%	8%	12%	43%
2011	10%	14%	13%	43%	6%	32%	22%	20%	6%	39%
2010	23%	34%	3%	-17%	12%	38%	33%	8%	19%	7%
2009	17%	-7%	24%	32%	8%	44%	38%	15%	7%	13%
2008	31%	34%	5%	18%	9%	47%	10%	9%	17%	1%
2007	16%	-13%	20%	24%	2%	21%	3%	9%	13%	12%
2006	16%	36%	30%	-23%	7%	31%	13%	2%	25%	38%
2005	22%	-1%	9%	96%	12%	25%	21%	32%	22%	-4%
2004	2%	75%	56%	37%	20%	13%	16%	-5%	18%	11%
2003	59%	74%	4%	25%	19%	34%	17%	15%	17%	72%
2002	3%	53%	77%	17%	13%	26%	11%	35%	22%	-14%
2001	6%	-17%	11%	-20%	3%	-13%	-9%	-20%	4%	-22%
2000	9%	64%	-16%	25%	23%	27%	17%	17%	26%	10%
1999	17%	-21%	167%	26%	22%	14%	3%	1%	11%	-16%
1998	-9%	40%	-8%	12%	0%	0%	-2%	-3%	13%	23%
Average	16%	20%	22%	19%	8%	18%	18%	9%	12%	13%

In the past 20 years, Laos and Cambodia have been showing the highest growth rate in research productivity. Singapore and the Philippines have recorded the lowest growth rate. It is worth noting, however, that despite the low growth rate of Singapore in research productivity, they still are the most productive country in research among all ASEAN Nations.

Table 4. *Top Research Areas per Country*

Research Areas	VIE	LAO	CAM	MYA	SIN	MAL	IND	PHI	THA	BRU
Engineering	12%	3%	2%	8%	18%	18%	15%	7%	12%	11%
Computer Science	11%	1%	1%	10%	12%	10%	10%	5%	7%	7%
Medicine	9%	26%	32%	21%	10%	8%	7%	14%	17%	15%
Materials Science	6%	0%	0%	1%	9%	7%	4%	2%	6%	5%
Physics and Astronomy	8%	0%	1%	2%	9%	7%	8%	3%	5%	3%
Biochemistry, Genetics and Molecular Biology	5%	6%	7%	7%	6%	4%	4%	7%	8%	4%
Chemistry	5%	1%	1%	2%	6%	5%	3%	2%	5%	4%
Mathematics	8%	0%	0%	2%	5%	4%	4%	3%	3%	4%
Social Sciences	4%	7%	8%	5%	4%	5%	6%	10%	3%	9%
Chemical Engineering	2%	0%	0%	1%	3%	3%	2%	1%	3%	2%
Agricultural and Biological Sciences	9%	20%	15%	15%	2%	5%	9%	17%	8%	7%
Business, Management and Accounting	1%	1%	1%	1%	2%	3%	3%	2%	2%	3%
Environmental Science	4%	11%	7%	4%	2%	4%	6%	7%	4%	5%
Energy	1%	1%	1%	1%	2%	3%	3%	2%	2%	5%
Immunology and Microbiology	3%	9%	10%	6%	1%	1%	2%	3%	4%	1%
Economics, Econometrics and Finance	1%	1%	1%	1%	1%	2%	2%	3%	1%	2%
Arts and Humanities	1%	1%	2%	1%	1%	2%	1%	3%	1%	3%
Pharmacology, Toxicology and Pharmaceutics	2%	2%	2%	2%	1%	2%	2%	1%	3%	1%
Neuroscience	0%	0%	0%	1%	1%	0%	0%	1%	1%	0%
Earth and Planetary Sciences	3%	4%	2%	5%	1%	2%	4%	3%	2%	5%
Decision Sciences	1%	0%	0%	1%	1%	1%	1%	1%	1%	1%
Psychology	0%	0%	1%	0%	1%	0%	0%	1%	0%	1%
Multidisciplinary	0%	1%	1%	1%	1%	2%	1%	1%	1%	1%
Nursing	0%	0%	2%	1%	0%	0%	1%	1%	1%	0%
Health Professions	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dentistry	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Veterinary	1%	2%	1%	1%	0%	0%	1%	1%	1%	0%

Table 4 shows which research areas each country in the ASEAN region have been focusing on in the past 20 years. The table shows that wealthy countries in terms of GDP and infrastructure such as Singapore and Malaysia have been focusing on engineering and computer science. Laos, Myanmar, Cambodia, and the Philippines have been researching on agricultural and biological sciences.

The section below shows the total number of Scopus published research papers per AUN member per country. The section also shows which subject area these member universities have been researching about.

THE PHILIPPINES

YEAR	DLSU	ADMU	UP
2017	471	147	924
2016	555	136	1070
2015	409	120	897
2014	376	114	751
2013	264	91	692
2012	227	95	611
2011	174	73	586
2010	120	54	470
2009	102	41	445
2008	136	28	391
2007	103	19	362
2006	65	28	264
2005	96	27	267

2004	72	13	190
2003	47	17	203
2002	31	18	180
2001	29	4	139
2000	16	6	134
1999	21	2	91
1998	20	6	126
1997	17	3	106
TOTAL	3351	1042	8899

*DLSU – De La Salle University
*ADMU – Ateneo De Manila University
*UP – University of the Philippines

SUBJECT AREA	DLSU
Engineering	12%
Computer Science	11%
Social Sciences	10%

SUBJECT AREA	ADMU
Social Sciences	25%
Arts and Humanities	13%
Computer Science	11%

SUBJECT AREA	UP
Agricultural and Biological Sciences	15%
Medicine	15%
Social Sciences	9%

Of the three AUN members from the Philippines, only DLSU has been focusing on engineering and computer science. The subject areas are the same areas that Singapore and Malaysia have been researching about.

SINGAPORE

YEAR	NTU	NUS
2017	6307	7722
2016	7075	8685
2015	6613	8452
2014	6357	8498
2013	6100	8401

2012	5885	7813
2011	5503	6999
2010	5112	6620
2009	4368	6047
2008	4153	5882
2007	3766	5469
2006	3534	5256
2005	3416	4776
2004	2992	4374
2003	2418	3663
2002	2013	3121
2001	1798	2787
2000	1449	2356
1999	912	1926
1998	761	1812
1997	819	1845
TOTAL	81351	112504

*NTU – Nanyang Technological University
*NUS – National University of Singapore

SUBJECT AREA	NUS
Engineering	14%
Medicine	10%
Computer Science	10%

SUBJECT AREA	NTU
Engineering	23%
Computer Science	15%
Materials Science	11%
Physics and Astronomy	11%

Both the NUS and NTU have been putting their focus on engineering research. This reflects Singapore's research focus.

BRUNEI DARUSSALAM

YEAR	UBD

2017	223
2016	275
2015	215
2014	161
2013	119
2012	88
2011	45
2010	50
2009	31
2008	38
2007	37
2006	16
2005	22
2004	29
2003	18
2002	15
2001	24
2000	24
1999	19
1998	24
1997	11
1996	22
1995	8
1994	10
1993	7
1992	10
1991	15
1990	4
1989	2
1988	1
1987	2
TOTAL	1565

*UBD – University of Brunei Darussalam

SUBJECT AREA	Universiti Brunei Darussalam
Social Sciences	12%

Agricultural and Biological Sciences	12%

CAMBODIA

YEAR	RUPP	RULE
2018	2	
2017	28	19
2016	18	19
2015	17	10
2014	28	7
2013	12	2
2012	12	1
2011	14	2
2010	5	7
2009	8	8
2008	6	8
2007	5	3
2006	4	2
2005	3	4
2004		
2003	1	1
2002		
2001	2	2
1999	1	1
1998	1	
TOTAL	167	96

*RUPP - Royal University of Phnom Penh
*RULE - Royal University of Law and Economics

SUBJECT AREA	RULE
Medicine	18%
Social Sciences	16%
Business, Management and Accounting	15%
Economics, Econometrics and Finance	13%

SUBJECT AREA	RUPH
Social Sciences	20%

		18%
Environmental Science		18%
Agricultural and Biological Sciences		11%
Medicine		10%

INDONESIA

YEAR	UA	ITB	UI	UGM
2017	157	687	2154	691
2016	74	665	1176	656
2015	25	449	539	269
2014	26	479	360	230
2013	14	280	375	136
2012	3	253	229	84
2011	2	248	144	55
2010	2	146	69	32
2009	1	130	31	10
		93	24	4
2007	1	62	32	4
2006	1	62	21	4
2005	2	40	19	2
2004	1	35	15	
		30	21	2
2002	1	27	7	2
2001	3	18	7	1
2000	1	18	8	3
1999	1	9	8	2
1998	1	6	8	
1997	1	7	1	1
TOTAL	317	3744	5248	2188

*Universitas Airlangga
*Institut of Teknologi Bandung
*Universitas Indonesia
*Universitas Gadjah Mada

SUBJECT AREA	Universitas Airlangga
Medicine	14%
Physics and Astronomy	11%

SUBJECT AREA	Universitas Gadjah Mada
Engineering	14%
Computer Science	12%

SUBJECT AREA	Universitas Indonesia)
Engineering	18%
Physics and Astronomy	16%
Computer Science	10%
Medicine	10%

SUBJECT AREA	Institut of Teknologi Bandung
Engineering	21%
Physics and Astronomy	17%
Computer Science	17%

LAOS

YEAR	National University of Laos
2017	40
2016	52
2015	46
2014	55
2013	32
2012	36
2011	33
2010	31
2009	14
2008	26
2007	16
2006	17

2005	6
2004	8
2003	6
2001	2
TOTAL	420

SUBJECT AREA	National University of Laos
Agricultural and Biological Sciences	21%
Medicine	13%

MALAYSIA

YEAR	UKM	UM	UPM	USM	UUM
2017	2031	835	2493	2820	508
2016	2623	1012	2732	2970	972
2015	2539	977	2625	2781	620
2014	2650	892	2812	3179	430
2013	2930	712	2758	3101	291
2012	2576	558	2279	3157	226
2011	2460	477	2061	2920	177
2010	1558	304	1437	2433	116
2009	1354	226	1167	1497	76
2008	841	152	768	1138	71
2007	501	104	499	758	48
2006	440	95	408	661	54
2005	319	55	307	446	24
2004	279	47	272	381	14
2003	206	25	221	325	13
2002	186	28	199	231	13
2001	106	41	174	255	6
2000	160	42	149	243	7
1999	106	22	128	264	
1998	120	29	90	206	2
1997	86	30	29	180	1
total	24071	6663	23608	29946	3669

*Universiti Kebangsaan Malaysia

*Universiti Malaya
*Universiti Putra Malaysia)
*Universiti Sains Malaysia
*Universiti Utara Malaysia

MYANMAR

YEAR	University of Yangon	University of Mandalay
2017	39	29
2016	41	27
2015	32	23
2014	24	12
2013	15	7
2012	9	12
2011	19	24
2010	7	8
2009	25	36
2008	24	27
2007	21	4
2006	18	6
2005	17	14
2004	11	6
2003	6	6
2002	7	3
2001	4	
2000	8	1
1999	7	
1998	2	
1997	5	
TOTAL	341	245

SUBJECT AREA	University of Yangon
Mathematics	17%
Biochemistry, Genetics and Molecular Biology	10%

SUBJECT AREA	university of Mandalay
Computer Science	21%
Engineering	16%
Agricultural and Biological Sciences	10%

THAILAND

YEAR	BU	CMU	MU
2017	179	1366	2306
2016	189	1486	2442
2015	211	1259	2116
2014	200	1188	2050
2013	178	1035	1910
2012	148	1042	1937
2011	113	937	1724
2010	84	821	1551
2009	69	751	1395
2008	60	717	1243
2007	64	631	1169
2006	52	543	1080
2005	39	452	1021
2004	36	347	760
2003	34	282	701
2002	28	239	643
2001	19	181	539
2000	5	152	558
1999	4	126	523
1998	3	113	404
1997	3	94	391
TOTAL	1718	13762	26463

*Burapha University
*Chiang Mai University
*Mahidol University

SUBJECT AREA	Burapha

	University
Agricultural and Biological Sciences	11%
Engineering	10%

SUBJECT AREA	Chiang Mai University
Medicine	20%
Biochemistry, Genetics and Molecular Biology	9%

SUBJECT AREA	Mahidol University
Medicine	38%
Biochemistry, Genetics and Molecular Biology	12%

VIETNAM

YEAR	VNU, H	VNU, HCM	CTU
2017	241	135	144
2016	220	104	135
2015	153	99	111
2014	117	71	75
2013	88	51	65
2012	90	34	67
2011	65	16	48
2010	48	24	50
2009	44	10	24
2008	34	9	20
2007	36	11	22
2006	20	4	23
2005	17	4	12
2004	9	1	13
2003	13		5
2002	6	1	14
2001	7	1	10

2000	4		3
1999	4		4
1998	2		5
1997	4		4
TOTAL	1222	575	854

*Vietnam National University, Hanoi
*Vietnam National University, Ho Chi Minh
*Can Tho University

SUBJECT AREA	Vietnam National University, Hanoi
Engineering	14%
Materials Science	12%
Physics and Astronomy	12%

SUBJECT AREA	Vietnam National University, Ho Chi Minh
Engineering	17%
Materials Science	13%
Mathematics	10%

SUBJECT AREA	Can Tho University
Agricultural and Biological Sciences	22%
Environmental Science	12%

Conclusion

The research production of the ASEAN nations has grown in the past 20 with an average of 15% annually. In general, most research papers written by the ASEAN nations are focused on Medicine, Agriculture and Biological Sciences, and Engineering. Areas less research on the other hand are Pharmacology, Toxicology and Pharmaceutics, Nursing, Health Professions, and Dentistry.

This study shows that almost 50% of the total research outputs of all the ASEAN nations are contributed by the AUN member universities, with Singapore's NUS and NUT contributing 76% of Singapore's total research outputs, while the Philippines' DLSU, ADMU, and UP contributes 50%. Wealthy nations such as Singapore and

Malaysia have been focusing their researches of Engineering and Computer Sciences while countries like the Philippines, Laos, and Cambodia have been researching about Agriculture and Biological Sciences.

Recommendation for Further Study

The study was conducted only to ASEAN University Network Member Universities. These members were chosen to become members of the AUN based on the criteria set by AUN itself. A study that will include all other universities in the ASEAN region is recommended to capture the totality of the region in terms of their research productivity. Furthers, this study only uses Scopus as its data source. The study can be conducted to include other sources.

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