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Chapter I Project Overview, Analysis Indicator, and Data Source

1.1 Project Objective and Background

Essential Science Indicators[SM] (ESI) acts as a significant indicator source employed widely for evaluating the scientific research performance of organizations, countries/ regions, journals and scholars and monitoring the category development. Meanwhile, it is also a significant indicator of China Academic Degrees and Graduate Education Development Center for scientific evaluation. This report will start from ESI category and be based on the bibliometric theory and relevant indicators, so as to carry out bibliometric analysis for overall scientific research output from 2013 to 2017 and scientific research output of 12 ESI categories of Southern University of Science and Technology and conduct contrastive analysis with six global newly-developed research universities. It aims to reveal the status of scientific research performance of Southern University of Science and Technology and its coordinate in global universities, thus providing objective information support for Southern University of Science and Technology in the rapid realization of an excellent and world-class university.

Through the in-depth communication with Southern University of Science and Technology at the preliminary stage, the project will be analyzed from the aspects below:

- **Analysis of overall scientific research performance of Southern University of Science and Technology**: analyze the escalating trend of publication scale and publication citation impact from 2013 to 2017, and compare it with six benchmarking universities; summarize the characteristics of the world-class universities from the perspective of scientific research performance, investigate the difference of scientific research performance between Southern University of Science and

Technology and world-class universities; analyze the ESI category distribution of publications of Southern University of Science and Technology, reveal the category layout and characteristics of Southern University of Science and Technology, and compare its category structure with six benchmarking universities; analyze the international collaboration status of Southern University of Science and Technology.

- **Analysis of 12 categories of Southern University of Science and Technology**: analyze the publication output scale and citation impact of 12 categories of Southern University of Science and Technology, and compare with six universities; analyze the 21 categories of Southern University of Science and Technology entering ESI global top 1%.
- **Analysis of departments in 12 categories of Southern University of Science and Technology**: analyze the major departments in 12 categories of Southern University of Science and Technology, their scientific research performance as well as their contribution for the category in terms of citations.
- **Analysis of scholars in 12 categories of Southern University of Science and Technology**: analyze the major scholars in 12 categories of Southern University of Science and Technology, their academic title and age information, their scientific research performance as well as their contribution for the category in terms of citations.
- **Analysis of the published journals in 12 categories of Southern University of Science and Technology:** analyze the main published journals of Southern University of Science and Technology in 12 categories as well as their citation performance, then compare it with five universities.
- **Analysis of high impact publications of Southern University of Science and Technology**: analyze the ESI Highly Cited Publications and participating scholars of Southern University of Science and Technology, and analyze the ESI Research Fronts with the participation of Southern

University of Science and Technology.

1.2 Definition of indicators

Number of Publications

"Number of publications" in this report indicates the number of publications which is included in Web of Science™ core collection database (covering 7 indexes, such as SCIE and SSCI) and has document types of Article and Review.

Citations

Citations mean the number of citing the publications included in Web of Science™ Core Collection from its publication to now.

Citations per publication

It refers to the number of a publication being cited.

Category Normalized Citation Impact （CNCI）

The Category Normalized Citation Impact (CNCI) of a publication is calculated through dividing the citations by average citations of the same year of publication, category field, and document type. When a publication is assigned to more than one category field, an average value of CNCI obtained from different categories shall be used. The CNCI of a set of publications, such as CNCI of an individual, institution or country, is the average value of CNCI of the set of publications. CNCI is valuable, proved and unbiased impact indicator irrespective of the impact of the year of publication, category field and document type, and is available for the comparison of citation impact crossing the year of publication, category, and document type. If CNCI of a publication is 1, it means the citation performance of the publication is comparable to the average citation performance of the same category in the world. If it is greater than 1, it means the citation performance of the publication is higher than the average citation performance of the same category in the world, similarly, less than 1, lower. CNCI in this report is often referred to as the average category normalized citation performance.

Journal Normalized Citation Impact (JNCI)

CNCI refers to the comparison between the citations of a publication and the average citations of the same year of publication, category and document type, while Journal Normalized Citation Impact (JNCI) refers to the comparison between the citations of publications with the average citations of the same year of publication, journal and document type, which is the difference between JNCI and CNCI despite of their similarity. If the JNCI of a publication is 1, it means the citation performance of the publication is comparable to the average citation performance of the same journal. If it is greater than 1, it means the citation performance of the publication is higher than the average citation performance of the same journal, similarly, less than 1, lower.

ESI Category Percentile

ESI Category Percentile is obtained by establishing the citations distribution (descending order based on citations) of all institutions on the same category and determining the percentage of the number of institutions lower than citations of an institution. If the percentile of an institution is 1%, the citations of 99% institutions in this category are lower than the institution.

Percentage of Documents in Top 10%

Top 10% Cited Publications refer to the publications whose citations rank the top 10% among those of same year of publication, category and document type. Percentage of Documents in Top 10% of an institution is the result of dividing the top10% cited publications by total number of institutional publications. The indicator signifies the output competence of high impact publications of the institution, and the global benchmark for the indicator is 10%. If the Percentage of Documents in Top 10% of a university is higher than global baseline, its output competence of high impact publications is higher than global baseline.

ESI Highly Cited Publications

Top 1% cited publications of the same category and year of publication in ESI category.

ESI Hot Publications

Top 0.1% cited publications of the same category in recent two months among the ESI publications in recent two years.

Percentage of Highly Cited Publications

The Percentage of Highly Cited Publications of an institution equals to the result of dividing the number of Highly Cited Publications by the total number of publications of the institution.

International Collaborations

The publications involving one or several international co-authors.

Percentage of International Collaborations

The percentage of the number of International Collaborations in total number of publications. The indicator measures the strength of international research collaboration to a certain extent.

Journal Impact Factor

Journal Impact Factor comes from the Journal Citation Reports® database (JCR). Often, the impact factor of one journal can be calculated only when the journal has been indexed in the Web of Science™ Core Collection for more than three years. Because the impact factor actually means the citations published in the JCR year to the publications in the previous two years divided by the total number of publications published by the journal in the previous two years. For example, the impact factor of *PLoS Biology* in JCR year 2012 was 12.690, which means that the average number of citations for articles published by the journal in 2011 and 2010 was 12.690 in 2012.

Quartile

The journals of each Web of Science category in Journal Citation Reports® Database are presented in the order from top to bottom. If the impact factor of a journal belongs to the top 1/4, it is assigned to Q1, and when the impact factor of a journal belongs to the subsequent 1/4, it is assigned to Q2, Q3 and Q4 are the same, hence, Q1, Q2, Q3, and Q4 are also referred to as Area 1, 2, 3, 4.

Journal Impact Factor Percentile

Journal Impact Factor Percentile measures the relative position of journal impact factor in the journals of the same category. If the impact factor percentile of a journal is 99%, its impact factor exceeds 99% journals of the same category.

ESI Category Classification

ESI Category Classification divides the journals collected in Web of Science™ Core Collection into 22 categories, and a kind of journal is allocated to one category. The 22 categories include the followings:

Agriculture Sciences
Biology & Biochemistry
Chemistry
Clinical Medicine
Computer Science
Economics & Business
Engineering
Environment & Ecology
Geosciences
Immunology
Materials Science
Mathematics

Microbiology

Molecular Biology & Genetics

Multidisciplinary

Neuroscience & Behavior

Pharmacology & Toxicology

Physics

Plant & Animal Science

Psychiatry & Psychology

Social Science, General

Space Science

Web of Science Category Classification

Web of Science Category Classification divides the journals collected in Web of Science Core Collection into 252 categories, and a kind of journals may belong to multiple categories. See Web of Science Category List in

https://images.webofknowledge.com/WOKRS57B4/help/WOS/hp_subject_category_terms_tasca.html

Normalized Institution Name

We have cleared and merged the variations of the name of institutions involved in this report, in order to obtain the relatively complete and accurate publications and citation data.

1.3 Introduction to data sources

Web of Science^{TM} Core Collection Database

Web of Science^{TM} Core Collection Database is an important global database for academic information, composed of the following important parts:

- Science Citation Index-Expanded (SCIE) back to 1900
- Social Sciences Citation Index (SSCI) back to 1900
- Arts & Humanities Citation Index (A&HCI) back to 1975

- Conference Proceedings Citation Index - Science back to 1990
- Conference Proceedings Citation Index - Social Science & Humanities back to 1990
- Book Citation Index– Science back to 2005
- Book Citation Index– Social Sciences & Humanities back to 2005
- Emerging Sources Citation Index (ESCI) back to 2005
- Index Chemicus Including the factual data of chemical substances since 1993
- Current Chemical Reactions Collecting the factual data of chemical reactions since 1840

Based on a set of rigorous selection procedures and objective evaluation process, Web of Science™ Core Collection contains the most authoritative and influential academic journals, conference proceedings and academic works of various categories. At the same time, it also contains the cited references in each publication, prepares the indexes according to the cited author, source and year of publication, and establishes the world's most influential and authoritative citation index database. Through unique citation index, you can understand the evolution of research content and research direction, without being limited by keyword changes.

Essential Science Indicators℠

Essential Science Indicator℠ is an evaluation benchmark database based on SCIE (Scientific Citation Index Expanded) and SSCI (Social Science Citation Index). It is able to:

- Provide quantitative analysis of scientific research performance for researchers and research management and help them understand the leading countries, journals, scientists, publications and research institutions in different fields of research;
- Identify important trends and direction of natural science and social science;
- Confirm the research performance and impact in specific research fields.

Journal Citation Reports®

Based on citation data from the Web of Science™ Core Collection (SCIE and SSCI), Journal Citation Reports® provides reliable statistical analysis methods that offer an objective and systematic assessment of global academic journals to help users understand the global academic journals in a quantitative manner and through these analytical data, users can understand the impact of academic journals in the corresponding research fields.

- Select more than 11,000 high-impact journals from peer-reviewed academic journals in the world, covering more than 230 categories;
- Provide statistical analysis data of journal citations since 1997;
- Users can obtain statistical indicators of various journals, including impact factor, impact factor of 5 years, immediacy index, total citations, the number of citable items, cited half-life, category rankings, etc.

InCites™ database

InCites™ is a scientific research evaluation tool on the basis of more than 30 years authoritative citation data of Web of Science™ Core Collection. Decision-makers, scientific research managers from Government and academic-institutions can analyze the academic performance and impact of the institution accordingly and compare the scientific achievements with global peers. As an integrated scientific research management information resource, InCites™ provides all data and tools necessary for easily generating the customized report. The data resources wherein cover information of 10,000 institutions with normalized names in 224 countries and regions, includes the title catalogues and indicator information of all references as well as a series of rich and proven citation measuring index in 30 years, and adds the classification indicator of institution types including academic institution, company, and hospital. Through InCite™, users can simplify the analysis of category performance of institutions, optimize the course of category construction; carry out benchmarking analysis for scientific research performance, specify the

global positioning of institutions; analyze the implementation of scientific research collaboration of the institution, identify efficient partner; analyze the scientific research performance of research team, and seek the potential researchers.

Derwent Data Analyzer

Derwent Data Analyzer® is a text-mining software with powerful analysis function, users can carry out multi-angle data mining and visualized panoramic analysis for text data. It has the functions below:

- Data import - Derwent Data Analyzer® inlays the Filters of numerous references and patent databases, users can import the data of external database into Derwent Data Analyzer® for analysis;
- Data cleanup - Derwent Data Analyzer® inlays many data cleaning methods, including List Cleanup and Thesaurus cleanup, which can assist the intelligence analysts in shortening the analysis cycle and improving the accuracy of analysis;
- Data analysis - Derwent Data Analyzer® provides several analysis methods such as one-dimensional diagram, two-dimensional matrix, three-dimensional diagram, bubble diagram, and map, so as to mine the intelligence information behind the data from an all-round and multi-angle manner;
- One-click report generation - Derwent Data Analyzer® inlays various common analysis reports, so that intelligence analysts can make use of Derwent Data Analyzer® to generate an informative and comprehensive analysis report in the shortest possible time, thus providing a decision basis for decision-making department.

Chapter II Overall Scientific Research Performance and Benchmarking Analysis of Southern University of Science and Technology

This Chapter will deeply analyze the publication scale and citation impact of Southern University of Science and Technology in recent years, reveal the research status and development trend and compare it with the world-class universities, top universities in Chinese Mainland and six benchmarking universities, in order to provide an objective data support to scientific research management and category planning of Southern University of Science and Technology.

2.1 Publication scale and citation performance of Southern University of Science and Technology

Figure 1 shows that until October 2018, Southern University of Science and Technology has published 3152 papers between 2013 and 2018. We can see a rapid increasing since 2015. The number of publications has been increased from 229 in 2015 to 1151 in 2018. At the same time, the proportion of papers of Southern University of Science and Technology, especially in Mainland China, has also increased significantly. The growth rate of papers of Southern University of Science and Technology has far exceeded the average level of that in Chinese Mainland, especially in 2016, up to 136.68% (Figure 2), thus it can be seen that the number of publications of Southern University of Science and Technology has been increased rapidly in recent years.

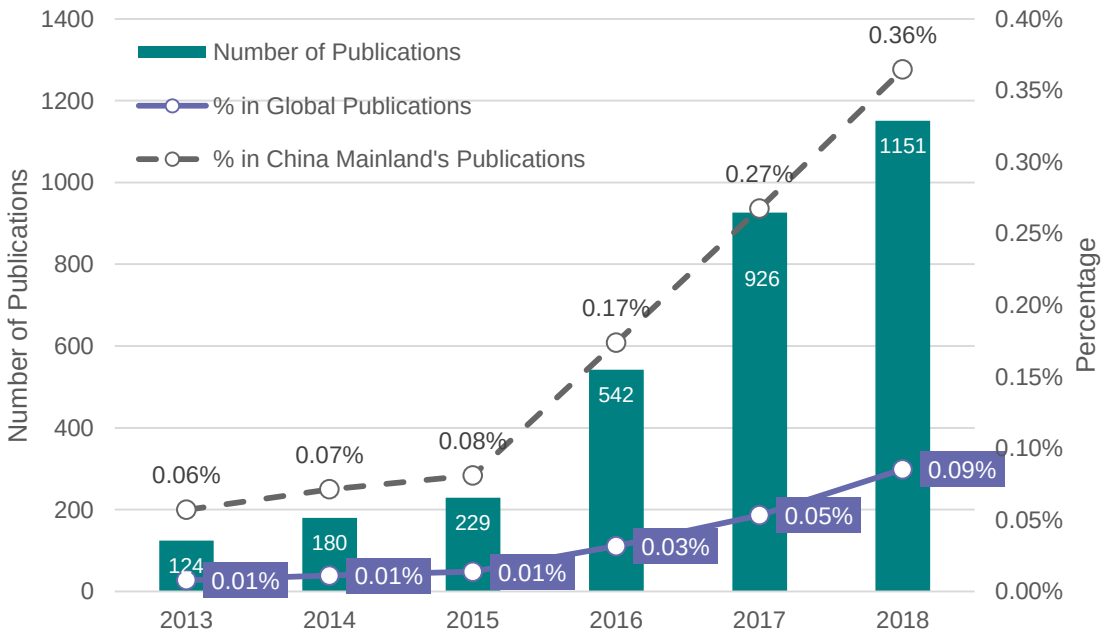

Figure 1 Number of publications and the percentage of publications of Southern University of Science and Technology in global/Chinese Mainland's publications, 2013-2018

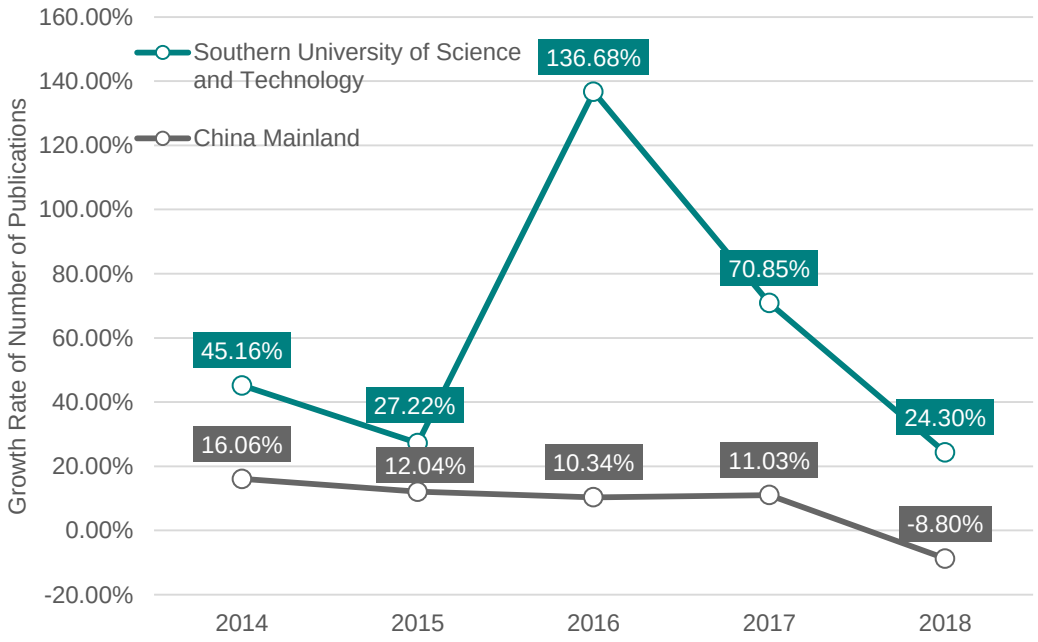

Figure 2 Comparison of the growth rate of number of publications between Southern University of Science and Technology and Chinese Mainland, 2013-2018

Table 1 presents the number of publications and citation performance of Southern University of Science and Technology and six benchmarking universities from 2013 to 2017. The number of publications measures the scientific research output scale of universities, total citations show the non-normalized impact of publications, while citations per publication indicate the non-normalized average impact of publications. The indicators of total citations and citations per publication ignore the influence of publication year, category and document type for citations. In recent years, scientometricians propose a more proven indicator - Category Normalized Citation Impact (CNCI), which effectively eliminates the influence of publication year, category and document type for citations. In short, CNCI indicates the normalized average citation performance of publications. The global baseline of CNCI indicator is 1.0, if CNCI exceeds 1.0, it means the average citation performance of the publications exceeds global average citation performance of publications in the same category. Indicator CNCI has been widely applied in recent years, being one of the most important indicators of scientific research evaluation. Percentage of Documents in Top 10% is the top ten percent most cited documents in a given category, year and document type divided by the total number of documents in a given set of documents, displayed as a percentage. This indicator measures the output competence of a university in producing highly impact publications. The global average level of this indicator is 10%. If the Percentage of Documents in the Top 10% of a university is higher than 10%, it shows that output competence of high impact publications is higher than the global average level.

From the output scale of publications, University of Chinese Academy of Sciences ranks 1st, much higher than other universities; followed by Nanyang Technological University, Hong Kong University of Science and Technology, Pohang University of Science and Technology and King Abdullah University of Science and Technology with more than 5,000 publications. Southern University of Science and Technology has 2001 publications from 2013 to 2017, increasing

by 927 compared with 1074 publications from 2013 to 2016, and the increasing percentage is close to 90%.

From the perspective of total citations, University of Chinese Academy of Sciences is also the leading organization, closely followed by Nanyang Technological University and Hong Kong University of Science and Technology with more than 100,000 citations. In terms of CNCI, ShanghaiTech University and King Abdullah University of Science and Technology perform best, with 2.03 and 1.98 respectively; meanwhile, CNCI of University of Chinese Academy of Sciences is the lowest but still higher than the global average level. Performance of Percentage of Documents in Top 10% is similar to that of CNCI. The Percentage of Documents in Top 10% of 7 universities are much higher than the global average level and King Abdullah University of Science and Technology is the highest with 23%; ShanghaiTech University, Nanyang Technological University and Hong Kong University of Science and Technology are fairly close (about 20%); Southern University of Science and Technology ranks fifth; and University of Chinese Academy of Sciences is the lowest.

In a word, in the aspect of two important indicators that can measure the impact of publications - CNCI and Percentage of Documents in Top 10%, the performances of 7 universities are much higher than the global average level, which shows that the scientific research impact of 7 universities are in the global leading position.

Table 1 Publication output and citation performance of seven universities

Institution name	Number of publications from 2013 to 2015*	Number of publications from 2013 to 2016*	Number of publications	Citations	Citations per publication	CNCI	Percentage of Documents in Top 10%
University of Chinese Academy of Sciences	23719	34163	48475	460052	9.43	1.26	13.08
Nanyang Technological University	12835	17664	22680	349765	15.42	1.78	20.81
Hong Kong University of Science and Technology	4902	6840	8749	121854	13.93	1.79	20.93

Institution name	Number of publications from 2013 to 2015*	Number of publications from 2013 to 2016*	Number of publications	Citations	Citations per publication	CNCI	Percentage of Documents in Top 10%
Pohang University of Science and Technology	4533	5786	7847	88741	11.31	1.3	14.08
King Abdullah University of Science and Technology	3444	4789	6243	95647	15.32	1.98	23
Southern University of Science and Technology	515	1074	2001	20926	10.46	1.75	18.79
ShanghaiTech University	307	713	1341	15508	11.56	2.03	20.58

Note*: In order to conduct the vertical comparison for the scientific research output performance of Southern University of Science and Technology during different periods, the second column lists the scientific research output of each university from 2013 to 2015, the third column lists the scientific research output of each university from 2013 to 2016, and the data in other columns are based on 2013 to 2017.

2.2 Interpret the world-class universities from few core bibliometric indicators

There still is no consensus for the seemingly fundamental problem what the world-class university is, which also brings some confusion to the construction of a world-class university. Without a recognized, accurate and quantitative definition for a world-class university, it is difficult for us to measure the gap between a university and world-class universities and the construction results of a world-class university.

The world-class university shall be first class in various aspects, such as world-class scholar, student pool, management, reputation, scientific research output, etc. To have a world-class scientific research output is necessary to become a world-class university, and in other words, the world-class university must have world-class scientific research output. Based on the theory of scientometrics, measuring the scientific research performance of a country, institution, category or scholar through quantitative methods and indicators has relatively been developed, and quantitative analysis of scientific research

performance also has been widely adopted around the world. Next, we will take a look at two recognized most central scientific research indicators of a world-class university: number of publication and CNCI performance. Then, we will investigate the performance difference of scientific research between Southern University of Science and Technology and six benchmarking universities with the world-class universities, so that we can evaluate the construction achievements and status of these 7 universities and world-class universities.

2.2.1 Bibliometric analysis for top 20 world-class universities

Table 2 shows the performance of the number of publications and CNCI of 20 recognized world-class universities. The data source is the Web of Science publications with document types as Article and Review published between 2013 and 2017.

Table 2 Publication output performance of world-class universities

University Name	Number of publications	CNCI	University Name	Number of publications	CNCI
Harvard University	108435	2.26	University of Copenhagen	37377	1.85
Johns Hopkins University	48215	1.98	University of California - Berkeley	35301	2.15
University of Michigan	47776	1.81	Massachusetts Institute of Technology	33650	2.54
University of Oxford	46234	2.12	Cornell University	32368	1.94
Stanford University	45512	2.39	Duke University	31799	2.02
University of Cambridge	40958	2.04	The University of Chicago	29709	2.11
University of Pennsylvania	39979	1.99	Northwestern University	27733	2.05
Imperial College London	37721	2.04	California Institute of Technology	16750	2.32
Columbia University	37686	2.11	Princeton University	15422	2.26

Table 2 shows that, from the perspective of publication scale, Harvard University is the highest, with 108,435 publications from 2013 to 2017 which means Harvard University has more than 20,000 publications each year; Princeton University and California Institute of Technology have relatively small output, with about 3,000 annual publications. In terms of CNCI, Massachusetts Institute of Technology performs best with 2.54, much higher than the global average level; University of Michigan and University of Copenhagen rank last with 1.81 and 1.85 respectively.

Table 2 covers the recognized world-class universities. We can see that being a world-class university, the annual publications shall be more than 3,000, and the average citation performance - CNCI shall reach 1.8. Generally, the public thinks there are around 100 world-class universities. By analyzing data of more universities and summarizing the characteristics of universities in publication output and impact, it is acknowledged that the annual publications shall be more than 3,000, and the CNCI shall reach 1.6 if a university wants to be world-class. In this point, Southern University of Science and Technology has reached the threshold value of a world-class university in terms of citation performance, however, because the establishment history of Southern University of Science and Technology is relatively short, its publication scale is not so much. Among the benchmarking universities, Nanyang Technological University has entered the rank of a world-class university from the aspect of publication performance.

2.2.2 Bibliometric analysis for top 11 Chinese universities

Table 3 presents the performance of publication of top 11 universities in Chinese Mainland. The annual output of these 11 universities are all over 3,000, but their citation performance has a gap with the world-class universities on the whole. In terms of CNCI, University of Science and Technology of China has achieved to 1.55, approaching the threshold value (1.6) of citation performance of world-class universities; followed by Tsinghua University and Peking University.

Table 3 Publication output and citation performance of top universities in Chinese Mainland

University	Number of publications	CNCI	University	Number of publications	CNCI
Shanghai Jiao Tong University	44965	1.2	Sun Yat-sen University	28556	1.32
Zhejiang University	43192	1.19	Nanjing University	25354	1.41
Tsinghua University	39829	1.51	Xi'an Jiaotong University	24468	1.14
Peking University	38618	1.43	Harbin Institute of Technology	23049	1.23
Fudan University	30177	1.32	University of Science and Technology of China	22841	1.55
University of Chinese Academy of Sciences	48475	1.26			

2.3 SWOT analysis on ESI category between Southern University of Science and Technology and six benchmarking universities

We can identify the Strengths, Weaknesses, Opportunities, and Threats of universities through SWOT analysis on the categories of universities in the aspects of the number of publications and CNCI, thus providing a valuable reference for further planning.

2.3.1 SWOT analysis of Southern University of Science and Technology

Southern University of Science and Technology published 2001 papers from 2013 to 2017, in 21 ESI categories. Table 4 shows the number of publications and citation performance in each category. It can be seen that scientific research output of Southern University of Science and Technology mainly focus on Chemistry, Physics and Materials Science, especially, Chemistry and Physics contribute the highest output. Citation performance of Chemistry is outstanding, whose CNCI reaches 2.01, ranking 1st among the top 10 ESI categories.

Table 4 ESI category distribution of publications of Southern University of Science and Technology

ESI category	Number of publications from 2013 to 2015[1]	Number of publications from 2013 to 2016	Number of publications	Category proportion	Category Normalized Citation Impact
Chemistry	139	290	519	25.94%	2.01
Physics	131	240	395	19.74%	1.81
Materials Science	81	198	380	18.99%	1.93
Life Science[2]	60	116	220	10.99%	1.42
Engineering	40	85	174	8.70%	1.4
Mathematics	30	48	80	4.00%	1.49
Biology & Biochemistry	25	46	77	3.85%	0.89
Environment & Ecology	3	28	71	3.55%	1.48
Computer Science	19	31	57	2.85%	1.27
Molecular Biology & Genetics	10	31	57	2.85%	1.24
Geosciences	2	14	55	2.75%	1.88
Clinical Medicine	12	17	33	1.65%	1.47
Economics & Business	4	9	19	0.95%	0.39
Animal & Plant Science	3	6	15	0.75%	2.64
Social Science, General	2	6	15	0.75%	1.13
Neuroscience & Behavior	4	5	11	0.55%	1.88
Pharmacology & Toxicology	5	6	10	0.50%	0.74
Multidisciplinary	4	6	8	0.40%	1.93
Space Science	0	3	8	0.40%	1.1
Microbiology	0	0	8	0.40%	4.55
Agriculture Sciences	0	3	7	0.35%	2.46

ESI category	Number of publications from 2013 to 2015[1]	Number of publications from 2013 to 2016	Number of publications	Category proportion	Category Normalized Citation Impact
Immunology	1	2	2	0.10%	1.41

Note: 1. In order to make a vertical comparison for the scientific research output of Southern University of Science and Technology at different periods, the second column lists the scientific research output of each category between 2013 to 2015, the third column lists the scientific research output of each category between 2013 to 2016, and other data is calculated from 2013 to 2017.

2. Life Science includes Agriculture Sciences, Biology & Biochemistry, Clinical Medicine, Immunology, Microbiology, Molecular Biology & Genetics, Neuroscience & Behavior, Pharmacology & Toxicology, Plant & Animal Science, and Psychiatry & Psychology.

Based on the data in Table 4, Figure 3 to Figure 5 show the development of relevant indicators of 11 ESI categories accounting for over 1% of publications of Southern University of Science and Technology from 2013 to 2017. It should be noted that due to the incomplete data of papers in 2018, it is expected that relevant data will change in 2013-2018. In terms of the number of publications, the number of publications published in all 11 categories shows a steady growth trend in the three periods. Among them, the number of publications on Materials Science accumulates rapidly, reaching 594 in 2013-2018, surpassing Physics (590 papers), which has been the second place before. In terms of the percentage of publications, the percentages of publications of Material Science and Engineering have increased from 15.70% and 7.80% in 2013-2015 to 18.83% and 10.02% in 2013-2018. In contrast, the percentage of publications in Physics has decreased from 25.40% to 18.71%. In terms of CNCI, the CNCI of Chemistry, Physics and Material Science are always above 1.4. The CNCI of the two categories of Environment & Ecology and Clinical Medicine grow the fastest, from significantly lower than the global average level to above 1.4 in 2013-2018.

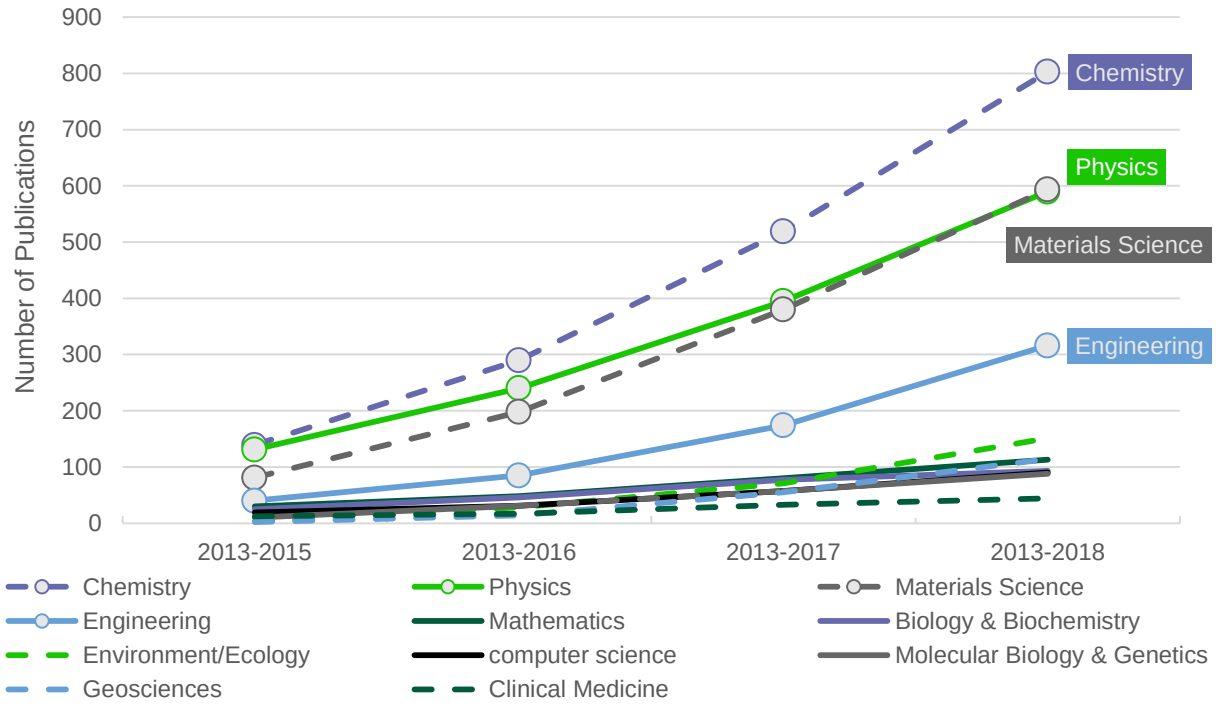

Figure 3 Yearly trend of publication number of 11 categories of Southern Universities of Science and Technology

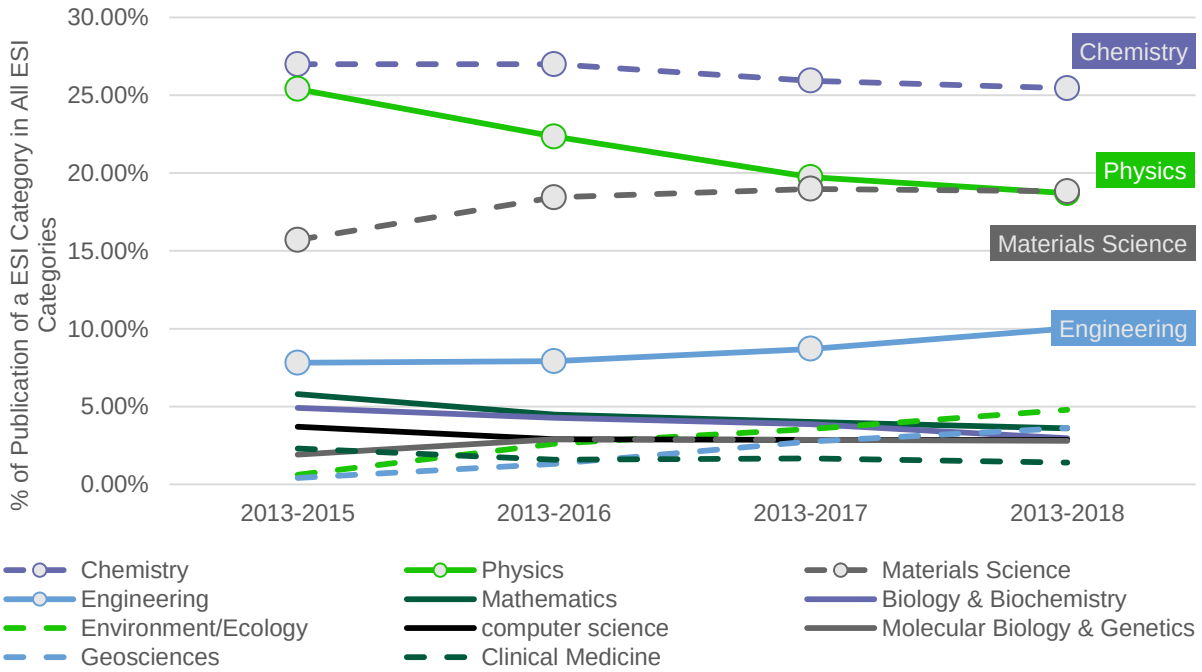

Figure 4 Yearly trend of publication percentage of 11 categories of Southern Universities of Science and Technology

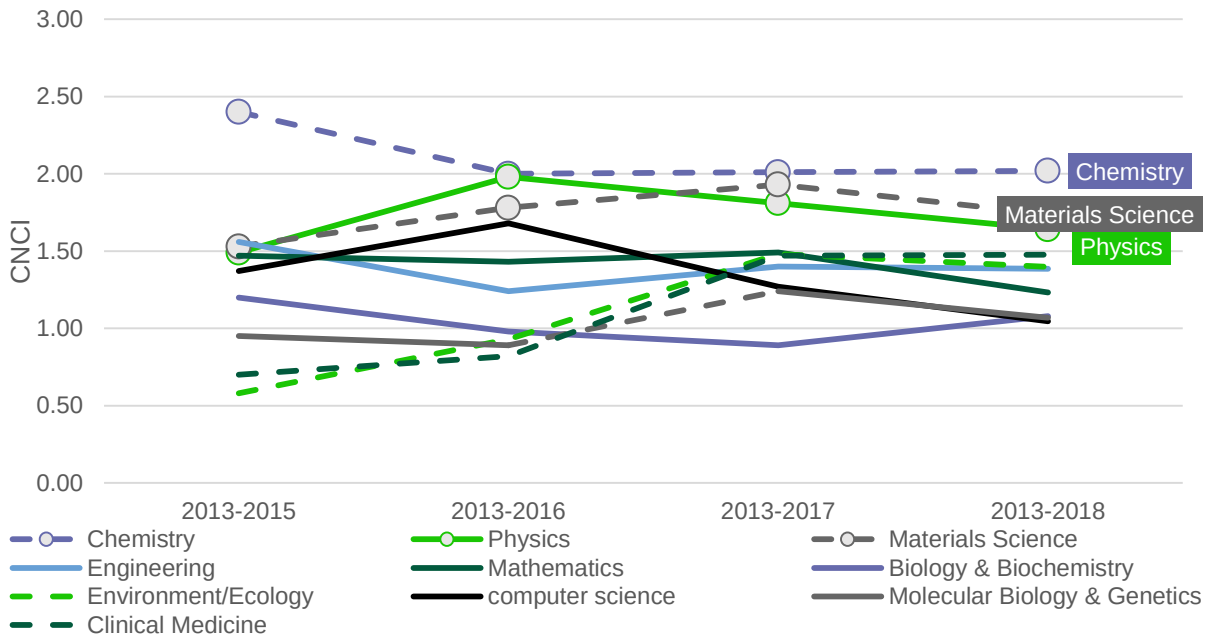

Figure 5 Yearly trend of CNCI of 11 categories of Southern University of Science and Technology[1]

A category presenting low publications shall not be regarded as a "real" category, because of this, we only analyze 16 ESI categories of Southern University of Science and Technology with no less than 10 publications during 2013 and 2017 in this SWOT analysis. In the SWOT analysis process, CNCI 1.0 (the global average level) is adopted as the basis in judging the citation impact, and the ratio (1.0) of category proportion to global category proportion is applied as the basis for judging the output performance.

Figure 6 shows the SWOT analysis results of 16 ESI categories. Materials Science, Physics and Chemistry are strength categories with most publications and good citation performance. At the same time, Mathematics, Computer Science, Environment & Ecology are also in the strength area; For Engineering, Geosciences, Molecular Biology & Genetics, CNCI values of these three disciplines are higher than the global average level, but their output percentage is

[1] Due to the small number of publications, the CNCI of Geosciences fluctuates the most, from 10.73 in 2013-2015 to 1.88 in 2013-2017, and is therefore not included in this illustration.

slightly lower than the global average level. Thus, these 3 are the most potential disciplines of Southern University of Science and Technology. If the university can expand the output scale of these 3 categories while maintaining the good citation performance, we can expect to see these three disciplines grow into the strength area. On the contrary, Pharmacology & Toxicology and Economics & Business have small output and citation performance are lower than the global average level. Hence, these 2 are the weakness disciplines. Although Biology & Biochemistry is in the weakness area, both the output percentage and citation performance are close to the global average, it is very promising to become the next potential or advantage discipline. Finally, the four ESI categories that are Social Science, Plant & Animal Science, Clinical Medicine, Neuroscience & Behavior, although the CNCI values all exceed 1, there is still a certain gap on output scale. Therefore, it is necessary to expand the scale of these disciplines.

We can see from Figure 6 that, there is no discipline with larger output scale and lower citations, which means Southern University of Science and Technology doesn't have threat discipline.

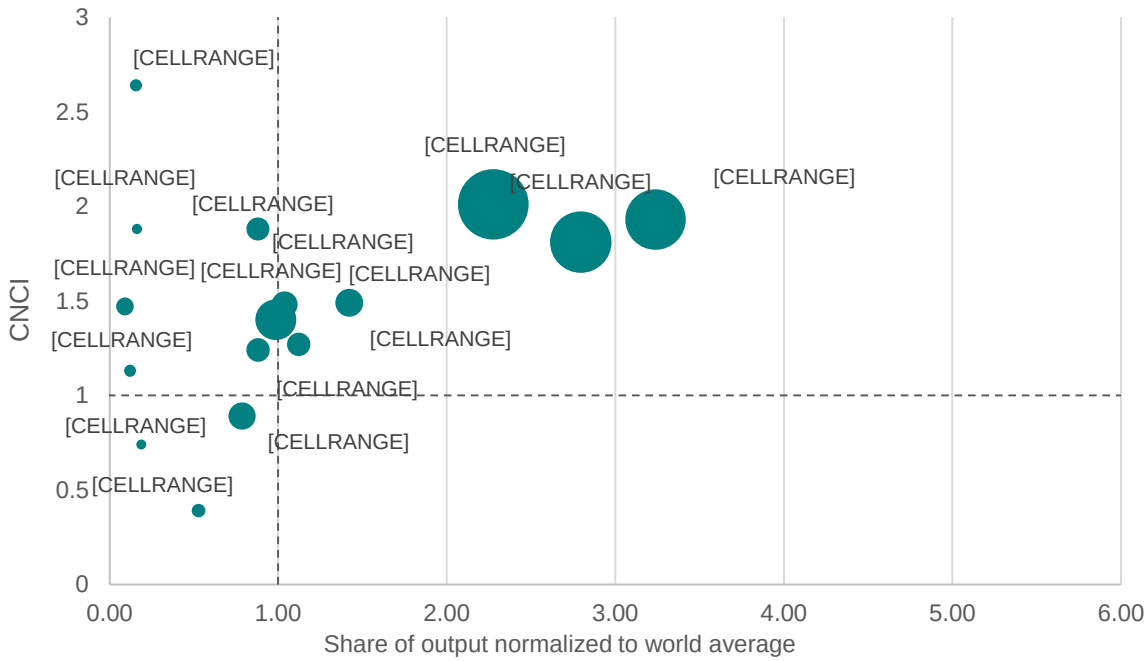

Figure 6 SWOT Analysis of 16 ESI categories of Southern University of Science and Technology

2.3.2 SWOT analysis of six benchmarking universities

Table 5-Table 10 present category distribution of six benchmarking universities which are University of Chinese Academy of Sciences, Nanyang Technological University, Hong Kong University of Science and Technology, Pohang University of Science and Technology, King Abdullah University of Science and Technology, and ShanghaiTech University.

University of Chinese Academy of Sciences has the largest output in Chemistry, Physics, and Materials Science. Among the top 10 categories based on output number, citation performances of all categories are higher than the global average level except Geosciences and Physics. Moreover, Materials Science and Agriculture Sciences perform best.

Table 5 Category distribution of publications of University of Chinese Academy of Sciences

	ESI category	Number of publications	Publication proportion	CNCI
1	Chemistry	11411	23.54%	1.44
2	Physics	5884	12.14%	0.94
3	Materials Science	5196	10.72%	1.79
4	Geosciences	5060	10.44%	0.95
5	Environment & Ecology	4226	8.72%	1.06
6	Animal & Plant Science	3169	6.54%	1.46
7	Engineering	2983	6.15%	1.24
8	Biology & Biochemistry	2304	4.75%	1.13
9	Molecular Biology & Genetics	1605	3.31%	1.16
10	Agriculture Sciences	1323	2.73%	1.56
11	Space Science	1122	2.31%	0.57

	ESI category	Number of publications	Publication proportion	CNCI
12	Computer Science	891	1.84%	0.82
13	Pharmacology & Toxicology	663	1.37%	1.16
14	Microbiology	649	1.34%	0.98
15	Clinical Medicine	566	1.17%	2.08
16	Neuroscience & Behavior	471	0.97%	0.89
17	Mathematics	297	0.61%	0.94
18	Psychiatry & Psychology	276	0.57%	0.97
19	Social Science	274	0.57%	2.45
20	Immunology	263	0.54%	1.03
21	Economics & Business	80	0.17%	0.82
22	Multidisciplinary	72	0.15%	1.84

Nanyang Technological University has the largest output in Engineering, Chemistry, and Materials Science. Among the Top 10 categories based on output number, CNCI of all categories exceed the global average level, except Social Science. Moreover, Materials Science and Chemistry perform best, with more than 2.

Table 6 Category distribution of publications of Nanyang Technological University

	ESI category	Number of publications	Publication proportion	CNCI
1	Engineering	4324	19.07%	1.53
2	Chemistry	4202	18.53%	2.23
3	Materials Science	3073	13.55%	2.41

	ESI category	Number of publications	Publication proportion	CNCI
4	Physics	2744	12.10%	1.79
5	Computer Science	1775	7.83%	1.76
6	Social Science	1229	5.42%	0.96
7	Biology & Biochemistry	951	4.19%	1.29
8	Clinical Medicine	742	3.27%	1.92
9	Molecular Biology & Genetics	517	2.28%	1.66
10	Geosciences	517	2.28%	1.6
11	Psychiatry & Psychology	439	1.94%	1.08
12	Environment & Ecology	396	1.75%	1.44
13	Mathematics	364	1.60%	0.89
14	Economics & Business	359	1.58%	1.12
15	Microbiology	222	0.98%	1.5
16	Neuroscience & Behavior	212	0.93%	1.02
17	Pharmacology & Toxicology	192	0.85%	1.56
18	Immunology	168	0.74%	1.41
19	Animal & Plant Science	154	0.68%	1.79
20	Agriculture Sciences	54	0.24%	1.05
21	Multidisciplinary	41	0.18%	6.06
22	Space Science	5	0.02%	0.73

Among all ESI categories published by Hong Kong University of Science and Technology, Engineering, Chemistry, Physics, Materials Science, and Computer Science have most publications. Among the Top 10 categories based on output, citation performances of all categories are higher than the global average level. Moreover, citation performances of Materials Science and Physics are the best.

Table 7 Category distribution of publications of Hong Kong University of Science and Technology

	ESI category	Number of publications	Publication proportion	CNCI
1	Engineering	1813	20.72%	1.62
2	Chemistry	1409	16.10%	1.96
3	Physics	1230	14.06%	2.11
4	Materials Science	951	10.87%	2.57
5	Computer Science	779	8.90%	1.68
6	Economics & Business	407	4.65%	1.53
7	Environment & Ecology	378	4.32%	1.62
8	Biology & Biochemistry	251	2.87%	1.31
9	Geosciences	259	2.96%	1.46
10	Mathematics	229	2.62%	1.62
11	Clinical Medicine	193	2.21%	0.96
12	Molecular Biology & Genetics	192	2.19%	1.46
13	Social Science	153	1.75%	1.25
14	Pharmacology & Toxicology	130	1.49%	0.86
15	Neuroscience & Behavior	107	1.22%	1.85

	ESI category	Number of publications	Publication proportion	CNCI
16	Psychiatry & Psychology	77	0.88%	1.15
17	Animal & Plant Science	63	0.72%	1.25
18	Agriculture Sciences	42	0.48%	1.23
19	Microbiology	39	0.45%	0.95
20	Space Science	26	0.30%	1.06
21	Multidisciplinary	11	0.13%	2.03
22	Immunology	10	0.11%	1.21

Pohang University of Science and Technology has the largest publication output in Materials Science, Chemistry, Physics, and Engineering. Among the Top 10 categories based on output number, citation performances all exceed the global average level except Computer Science.

Table 8 Category distribution of publications of Pohang University of Science and Technology

	ESI category	Number of publications	Publication proportion	CNCI
1	Materials Science	1932	30.95%	1.38
2	Chemistry	1547	24.78%	1.61
3	Physics	1344	21.53%	1.18
4	Engineering	1029	16.48%	1.05
5	Biology & Biochemistry	373	5.97%	1.07
6	Mathematics	272	4.36%	1.1
7	Computer Science	242	3.88%	0.91

	ESI category	Number of publications	Publication proportion	CNCI
8	Clinical Medicine	207	3.32%	1.11
9	Molecular Biology & Genetics	201	3.22%	1.02
10	Animal & Plant Science	126	2.02%	2.09
11	Environment & Ecology	111	1.78%	1.87
12	Geosciences	103	1.65%	1.44
13	Immunology	77	1.23%	1.41
14	Neuroscience & Behavior	53	0.85%	1.4
15	Social Science	41	0.66%	1.39
16	Pharmacology & Toxicology	41	0.66%	1.54
17	Space Science	37	0.59%	0.94
18	Economics & Business	35	0.56%	0.6
19	Microbiology	29	0.46%	1.06
20	Agriculture Sciences	17	0.27%	1.16
21	Psychiatry & Psychology	17	0.27%	1.09
22	Multidisciplinary	13	0.21%	0.91

King Abdullah University of Science and Technology has the largest publication output in Chemistry, Engineering, Materials Science, and Physics. Among the Top 10 categories based on publication output, citation performances are all higher than the global average level. Moreover, CNCI of Chemistry, Materials Science, Physics and Mathematics exceed 2.

Table 9 Category distribution of publications of King Abdullah University of Science and Technology

	ESI category	Number of publications	Publication proportion	CNCI
1	Chemistry	1359	17.32%	2.34
2	Engineering	864	11.01%	1.41
3	Materials Science	801	10.21%	2.62
4	Physics	789	10.05%	2
5	Computer Science	478	6.09%	1.41
6	Environment & Ecology	390	4.97%	1.91
7	Geosciences	382	4.87%	1.24
8	Biology & Biochemistry	266	3.39%	1.66
9	Mathematics	244	3.11%	2.27
10	Animal & Plant Science	240	3.06%	1.98
11	Molecular Biology & Genetics	157	2.00%	1.91
12	Microbiology	91	1.16%	1.87
13	Clinical Medicine	42	0.54%	1.27
14	Neuroscience & Behavior	31	0.40%	2.11
15	Agriculture Sciences	26	0.33%	2.92
16	Pharmacology & Toxicology	22	0.28%	2.08
17	Multidisciplinary	22	0.28%	7.67
18	Immunology	15	0.19%	1.47
19	Social Science	14	0.18%	1.3

	ESI category	Number of publications	Publication proportion	CNCI
20	Psychiatry & Psychology	7	0.09%	0.76
21	Space Science	2	0.03%	0.2
22	Economics & Business	1	0.01%	0

ShanghaiTech University has the largest publication output in Chemistry, Physics, Biology & Biochemistry, and Molecular Biology & Genetics. Among Top 10 categories based on output, except Pharmacology & Toxicology, CNCI of 9 categories are higher than the global average level and 8 categories exceed 2.

Table 10 Category distribution of publications of ShanghaiTech University

	ESI category	Number of publications	Publication proportion	CNCI
1	Chemistry	296	22.07%	2.05
2	Physics	252	18.79%	2.08
3	Biology & Biochemistry	201	14.99%	1.59
4	Molecular Biology & Genetics	182	13.57%	2.21
5	Materials Science	125	9.32%	2.02
6	Engineering	81	6.04%	2.05
7	Computer Science	55	4.10%	2.54
8	Clinical Medicine	42	3.13%	2.69
9	Pharmacology & Toxicology	26	1.94%	0.81
10	Immunology	18	1.34%	2.02
11	Neuroscience & Behavior	19	1.42%	1.79

	ESI category	Number of publications	Publication proportion	CNCI
12	Multidisciplinary	8	0.60%	3.52
13	Animal & Plant Science	11	0.82%	5.05
14	Mathematics	4	0.30%	2
15	Environment & Ecology	4	0.30%	2.33
16	Microbiology	7	0.52%	0.7
17	Space Science	2	0.15%	0.31
18	Economics & Business	2	0.15%	0.62
19	Geosciences	2	0.15%	0
20	Psychiatry & Psychology	2	0.15%	0.41
21	Agriculture Sciences	1	0.07%	0
22	Social Science	1	0.07%	1.16

Table 11 lists the Top 5 categories of seven universities based on output. We can see that the top categories of the seven universities are Chemistry, Physics and Materials Science. Regarding the category concentration, distribution of Southern University of Science and Technology's categories are more focus, in which publication proportion of Chemistry and Physics reach to 46% of the total.

Table 11 Major categories of seven universities

Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science and Technology	ShanghaiTech University
Chemistry (25.94%)	Chemistry（23.43%）	Engineering (19.07%)	Engineering (20.72%)	Materials Science (30.95%)	Chemistry (17.32%)	Chemistry (22.07%)

Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science and Technology	ShanghaiTech University
Physics (19.47%)	Physics （12.14%）	Chemistry (18.53%)	Chemistry (16.1%)	Chemistry (24.78%)	Engineering (11.01%)	Physics (18.79%)
Materials Science (18.99%)	Materials Science （10.72%）	Materials Science (13.55%)	Physics (14.06%)	Physics (21.53%)	Materials Science (10.21%)	Biology & Biochemistry (14.99%)
Life Science (10.64%)	Geosciences （10.44）	Physics (12.1%)	Materials Science (10.87%)	Engineering (16.48%)	Physics (10.05%)	Molecular Biology & Genetics (13.57%)
Engineering (8.7%)	Environment & Ecology （8.72%）	Computer Science (7.83%)	Computer Science (8.9%)	Biology & Biochemistry (5.97%)	Computer Science (6.09%)	Materials Science (9.32%)

2.4 Similarity degree of category structure between Southern University of Science and Technology and six benchmarking universities

If two universities have similar proportions of publications in each ESI, they have similar category structures. Based on such idea, we use the following formula to calculate the similarity degree of category between different institutions.

$$s_{ij} = \sqrt{(p_{i1} - p_{j1})^2 + (p_{i2} - p_{j2})^2 + ... + (p_{i22} - p_{j22})^2} \quad (1)$$

Of which, p_{i1} means the output proportion of publications of institution *i* in the first category, p_{j1} means the output proportion of publications of institution *j* in the first category. No requirement is needed for the sequence of 22 categories in the formula, as long as the two items in the brackets corresponding to the same category.

According to Formula (1), when universities *i and j* have the same proportion of publications in any category, they have the same category structure, and their category structures are of the highest similarity degree at this time, hence, $s_{ij} = 0$. When all publications of university *i* center on category A, and that of university *j* center on category B, the two universities have the most different category

structure, at this time, s_{ij} = $\sqrt{2}$. In order to easily and clearly judge the similarity degree of category structure of the two universities according to the value of similarity degree, we standardize the Formula (1), as shown in Formula (2). At this time, scope of S_{ij} is $S_{ij} \in [0,1]$. The closer the S_{ij} approaches 0, the higher the similarity degree of category structure of the two universities; the closer the S_{ij} approaches 1, the lower similarity degree of category structure of the two universities;

$$S_{ij} = \sqrt{(p_{i1} - p_{j1})^2 + (p_{i2} - p_{j2})^2 + ... + (p_{i22} - p_{j22})^2} \Big/ \sqrt{2} \quad (2)$$

Table 12 shows the similarity degree of category structure of seven universities. In general, the values of similarity degree among different universities are close to 0, which shows that the seven universities' category structures are very similar. Category structure of Southern University of Science and Technology is closest to that of Pohang University of Science and Technology but differs most with that of Hong Kong University of Science and Technology and ShanghaiTech University. Among the seven universities, category structures of Nanyang Technological University and Hong Kong University of Science and Technology are the closest, and the value of their similarity degree of category structure is merely 0.05, quite close to 0.

Table 12 Similarity degree of category structure of seven universities

	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology
University of Chinese Academy of Sciences	0.12					
Nanyang Technological University	0.13	0.15				
Hong Kong University of Science and Technology	0.14	0.15	0.05			

	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology
Pohang University of Science and Technology	0.11	0.20	0.16	0.18		
King Abdullah University of Science & Technology	0.12	0.09	0.09	0.09	0.19	
ShanghaiTech University	0.14	0.16	0.17	0.18	0.20	0.15

2.5 International collaboration analysis among Southern University of Science and Technology and six benchmarking universities

2.5.1 Analysis on collaborative countries and regions between Southern University of Science and Technology and six benchmarking universities

Figure 7 and Figure 8 show the Top 10 countries and regions that collaborate most with Southern University of Science and Technology. From the figure, we can see that the top countries/regions Southern University of Science and Technology collaborated with are USA, Hong Kong, and Singapore. In terms of citation impact of collaborated publications, the top three countries and regions with the highest CNCI value are France (2.59), USA (2.47) and Australia (2.30). In addition, the CNCI values of collaborative publications with Top 10 countries and regions are higher than the global average level, indicating that the collaborations improve the citation impact of Southern University of Science and Technology.

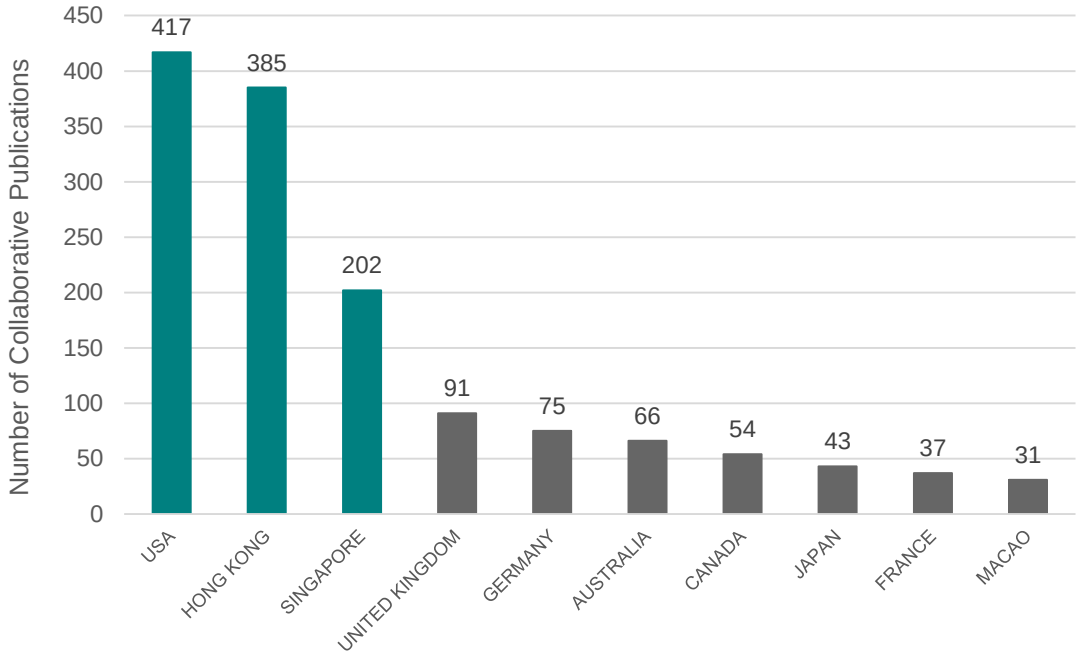

Figure 7 Number of collaborative publications of main collaborative countries and regions of Southern University of Science and Technology

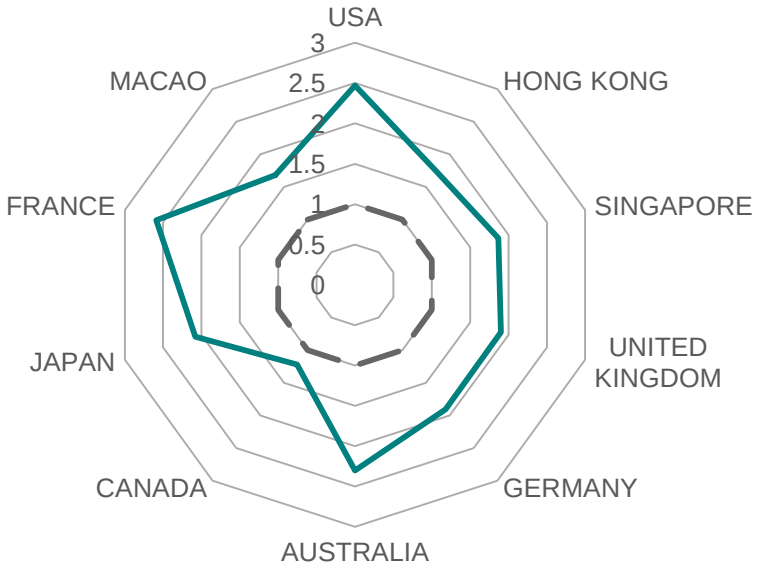

Figure 8 CNCI of main collaborative countries and regions of Southern University of Science and Technology

Table 13 shows the Top collaborated countries and regions (excluding the countries and regions where the institutions are located) among the seven universities as well as the number of publications and CNCI. The first figure in the bracket below the country or region represents the number of publications that Southern University of Science and Technology has collaborated with, and the second figure means the CNCI of collaborative publications. According to Table 13, the citation performances of collaborative publications with Top countries and regions are significantly higher than the global average level. Chinese Mainland is one of the regions that the seven universities closely collaborated with. For Southern University of Science and Technology between 2013 and 2017, most collaborated countries/regions are the USA, Hong Kong, and Singapore. Moreover, collaborations with the USA increased the most and the USA has become the country with most collaborations. Comparing with data in the previous year, we can see 9 of the top 10 collaborated countries or regions are consistent with that in 2013-2016.

Table 13 Main collaborative countries and regions with the six universities

Southern University of Science and Technology (2013-2015)*	Southern University of Science and Technology (2013-2016)	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology	ShanghaiTech University
Hong Kong (176, 1.53)	Hong Kong (276, 1.76)	USA (417, 2.47)	USA (4631,1.8)	Chinese Mainland (6290, 1.78)	Chinese Mainland (4640, 1.97)	USA (1325, 1.69)	USA (1593, 2.48)	USA (312, 3.28)
USA (99, 2.56)	USA (218, 2.77)	Hong Kong (385, 1.73)	Germany (1217, 2.05)	USA (3144, 2.26)	USA (1767, 2.36)	Japan (392, 1.76)	Chinese Mainland (751, 2.14)	Germany (86, 3.93)
Singapore (84, 1.46)	Singapore (138, 1.83)	Singapore (202, 1.87)	UK (1030, 2.19)	UK (1498, 2.47)	UK (607, 2.83)	Chinese Mainland (340, 1.61)	UK (546, 2.68)	UK (71, 4.8)
Germany (16, 2.01)	Australia (39, 1.46)	UK (91, 1.9)	Australia (843, 2.18)	Australia (1182, 2.48)	Australia (515, 2.89)	Germany (282, 1.78)	Germany (496, 2.72)	Hong Kong (45, 2.51)
France (14, 3.39)	UK (33, 2.36)	Germany (75, 1.91)	Japan (751,205)	Hong Kong (731, 2.42)	Canada (479, 3.15)	UK (205, 2.35)	France (423, 2.11)	Japan (42, 1.52)
UK (14, 3.40)	Germany (29, 1.65)	Australia (66, 2.3)	Canada (700,2.15)	Germany (689, 3.51)	Germany (463, 3.11)	India (167, 1.27)	Italy (375, 1.95)	Sweden (34, 2.04)
Turkey (13, 1.55)	Canada (23, 1.60)	Canada (54, 1.22)	Hong Kong (664, 2.34)	Korea (610, 3.16)	Japan (459, 3.07)	Iran (106, 0.93)	Australia (348, 2.77)	Australia (31, 1.46)

Southern University of Science and Technology (2013-2015)*	Southern University of Science and Technology (2013-2016)	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology	ShanghaiTech University
Canada (13, 1.15)	Turkey (20, 1.59)	Japan (43, 2.08)	France (564, 2.39)	France (604, 2.96)	Taiwan (441, 2.99)	Canada (104, 1.94)	Spain (298, 2.42)	Korea (27, 2.88)
Australia (12, 2.19)	France (19, 3.14)	France (37, 2.59)	Holland (486, 2.71)	India (553, 2.65)	France (426, 3.08)	France (101, 1.68)	Singapore (256, 3.11)	Canada (27, 5.94)
Japan (12, 1.62)	Japan (17, 1.45)	Macao (31, 1.68)	Russia (413, 2.68)	Japan (507, 3.05)	Holland (392,3.25)	Saudi Arabia (90, 1.69)	Canada (252, 3.37)	Italy (25, 2.29)

Note*: In order to carry out vertical comparison among the collaborative countries and regions of Southern University of Science and Technology during different periods, the first column in the table lists the university's collaborative countries and regions during 2013-2015; second column in the table lists the university's collaborative countries and regions during 2013-2016; and other columns are the data during 2013-2017.

2.5.2 Analysis on the collaborative institutions among Southern University of Science and Technology and six benchmarking universities

Figure 9 and Figure 10 show the top 10 collaborative institutions of Southern University of Science and Technology. According to the figure, Southern University of Science and Technology mainly collaborates with Chinese Academy of Sciences, Peking University, and the University of Hong Kong. From the perspective of citation impact of collaborative publications, CNCI of collaborative publications of top 10 collaborative institutions are higher than the global average level, indicating that the collaborations improve the citation impact of Southern University of Science and Technology.

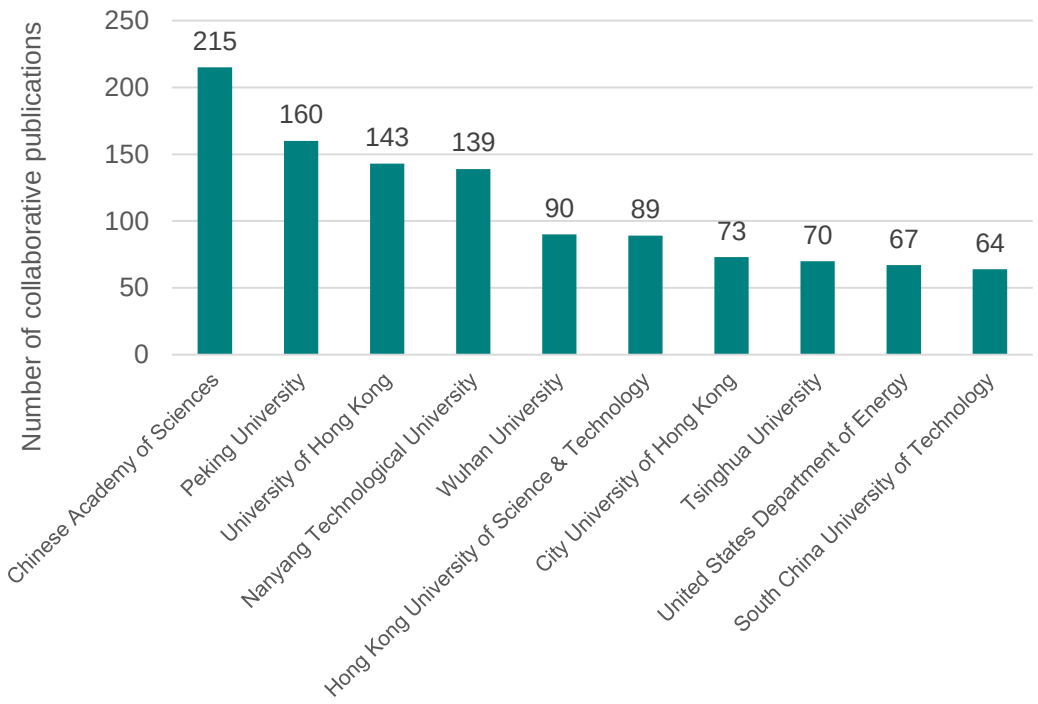

Figure 9 Number of collaborative publications of main collaborative institutions of Southern University of Science and Technology

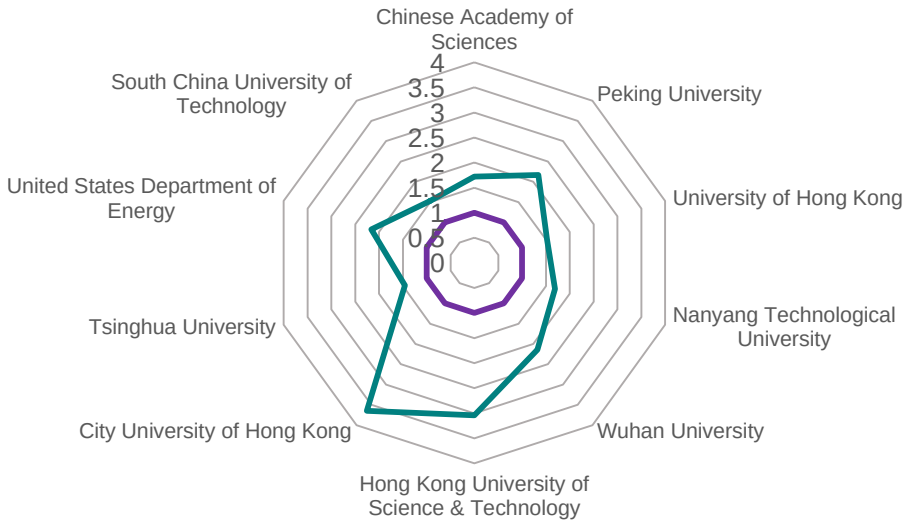

Figure 10 CNCI of main collaborative institutions of Southern University of Science and Technology

Table 14 shows the top institutions with the most collaborative publications among the seven universities as well as the number of publications and CNCI. The major contributors that collaborated with Southern University of Science and Technology are located in Hong Kong and Singapore. Top collaborative institutions of University of Chinese Academy of Sciences are mainly from Chinese Mainland. Top collaborative institutions of Nanyang Technological University are mainly from Singapore and Chinese Mainland. Top collaborative institutions of Hong Kong University of Science and Technology mainly come from Chinese Mainland and Hong Kong. Top collaborative institutions of Pohang University of Science and Technology are mainly from South Korea. Top collaborative institutions of King Abdullah University of Science & Technology are in Saudi Arabia, Singapore, and USA. In addition, as shown in Table 14, collaborative institutions of Southern University of Science and Technology in 2013-2017 are almost the same as that of 2013-2016. It is worth noting that number of collaborative publications between Southern University of Science and Technology and Peking University, Wuhan University have increased significantly, indicating that these two universities had more close collaborations in 2017 with Southern University of Science and Technology.

Table 14 shows that CNCI values of all collaborative institutions are higher than the global average level.

Table 14 Main collaborative institutions of the seven universities

Southern University of Science and Technology (2013-2015)*	Southern University of Science and Technology (2013-2016)	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology	ShanghaiTech University
University of Hong Kong (72, 1.87)	Chinese Academy of Sciences (113, 1.52)	Chinese Academy of Sciences (215, 1.72)	Chinese Academy of Sciences (26188, 1.37)	National University of Singapore (2353, 1.9)	Chinese Academy of Sciences (828, 2.48)	Korean Basic Science Institute (477, 1.94)	French National Center for Scientific Research (247, 2.17)	Chinese Academy of Sciences (971, 1.84)
Nanyang Technological University	University of Hong Kong (110, 2.35)	Peking University (160, 2.17)	Peking University (1032, 2.2)	Agency for Science, Technology and	Tsinghua University (603, 2.84)	University of Science & Technology	National University of Singapore	Fudan University (90, 2.07)

Southern University of Science and Technology (2013-2015)*	Southern University of Science and Technology (2013-2016)	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology	ShanghaiTech University
(67, 1.42)				Research (1738, 1.88)		, South Korea (446, 1.77)	(177, 3.42)	
City University of Hong Kong (41, 1.4)	Nanyang Technological University (104, 1.46)	University of Hong Kong (143, 2.16)	Tsinghua University, (834, 1.96)	Chinese Academy of Sciences (646, 3.43)	Sun Yat-sen University (532, 2.74)	Seoul National University (444, 1.94)	Chinese Academy of Sciences (175, 2.19)	Max Planck Society (88, 3.14)
Hong Kong University of Science and Technology (34, 1.27)	Peking University (79, 2.40)	Nanyang Technological University (139, 1.69)	University of Science and Technology of China (812, 1.76)	National Institute of Education (593, 0.94)	The Chinese University of Hong Kong (513, 2.8)	Ulsan National Institute of Science and Technology (385, 2.52)	USA DEPARTMENT OF ENERGY (140, 3.99)	Shanghai Jiao Tong University (79, 1.42)
The Chinese University of Hong Kong (26, 1.37)	Hong Kong University of Science and Technology (60, 1.51)	Wuhan University. (90, 2.14)	Shanghai Jiao Tong University (519, 2.34)	Massachusetts Institute of Technology (483, 2.34)	University of Hong Kong (478, 2.97)	Korea University (244, 2.21)	Imperial College London (139, 3.96)	USA DEPARTMENT OF ENERGY (64, 6.02)
Agency for Science, Technology and Research (25, 1.37)	City University of Hong Kong (56, 1.42)	Hong Kong University of Science and Technology (89, 1.52)	Beijing Normal University (515, 1.43)	Singapore Institute of Manufacturing Technology (402, 1.65)	Shanghai Jiao Tong University (438, 2.96)	Kyungpook National University (229, 1.14)	Consejo Superior de Investigaciones Cientificas (119, 2.69)	Shanghai University (59,1.44)
National University of Singapore (20, 1.09)	The Chinese University of Hong Kong (40, 1.26)	City University of Hong Kong (73, 1.46)	Lanzhou University (509, 1.36)	French National Center for Scientific Research (316, 2.58)	South China University of Technology (427, 3.11)	Korea Institute of Science and Technology (215, 2)	University of London (100, 2.52)	Lawrence Berkeley National Laboratory (46, 6.33)
Peking University (18, 3.48)	National University of Singapore (37, 2.64)	Tsinghua University (70, 3.04)	Jilin University (464, 2.05)	Zhejiang University (290, 3.37)	Peking University (389, 1.88)	USA DEPARTMENT OF ENERGY (207,1.96)	Georgia Institute of Technology (97, 2.54)	Tsinghua University (40, 4.45)
Hong Kong Baptist University (18, 1.31)	South China University of Technology (35, 1.81)	USA DEPARTMENT OF ENERGY (67, 3.65)	ShanghaiTech University (462, 1.67)	Imperial College London (274,4.82)	University of Science and Technology of China (379, 3.19)	Sungkyunkwan University (206, 1.85)	école Polytechnique Fédérale de Lausanne (93, 2.49)	East China Normal University (33, 2.68)
USA DEPARTMENT OF ENERGY (17, 5.24)	Agency for Science, Technology and Research (35, 1.55)	South China University of Technology (64, 1.52)	French National Center for Scientific Research (421,	University of New South Wales (255, 3.62)	Nanjing University (368, 3.28)	Yonsei University (205, 1.45)	Université Paris-Saclay (89, 2.12)	University of California, Berkeley (31, 7.59)

Southern University of Science and Technology (2013-2015)*	Southern University of Science and Technology (2013-2016)	Southern University of Science and Technology	University of Chinese Academy of Sciences	Nanyang Technological University	Hong Kong University of Science and Technology	Pohang University of Science and Technology	King Abdullah University of Science & Technology	ShanghaiTech University
			1.76)					

Note: 1. In order to carry out vertical comparison among the collaborative institutions of South University of Science and Technology at different time periods, column 1 of the Table shows the collaborative institutions of Southern University of Science and Technology during 2013-2015, column 2 of the Table shows the collaborative institutions of Southern University of Science and Technology during 2013-2016, and other rows are the data during 2013-2017.
2. Collaborative institutions during 2013-2015 only include universities, with research institutions excluded; the collaborative institutions from 2013 to 2016 and 2013 to 2017 shall be included into Chinese Academy of Sciences if they belong to the subordinated branches or institutions of Chinese Academy of Sciences.

Chapter III Analysis on Scientific Research Performance of 12 ESI Categories and Life Science Area of Southern University of Science and Technology

This chapter will deeply analyze the performance in 12 ESI categories and Life Science area of Southern University of Science and Technology, and the 12 categories include Chemistry, Physics, Materials Science, Engineering, Mathematics, Biology & Biochemistry, Computer Science, Molecular Biology & Genetics, Clinical Medicine, Economics & Business, Environment & Ecology, and Geosciences.

3.1 Publications output performance of each category

Table 15 shows the performance of 12 ESI categories of Southern University of Science and Technology. CNCI measures the standardized average citation performance of publications. Percentage of documents in Top 10% measures the output competence of high impact publications.

From Table 15, we can see that except Biology & Biochemistry, and Economics & Business, CNCI of all remaining 10 categories are significantly higher than the global average level. It's worth saying that CNCI of Chemistry is twice the global average level. From the perspective of Percentage of Documents in Top 10%, Materials Science and Chemistry are the highest and that of Materials Science is up to 26.58%. This means that among all the 380 publications in Materials Science, more than one-quarter publications rank in the top 10% among the publications at the same publication year, same category, and same document type. In addition to these two categories, Percentage of Documents in Top 10% of Environment & Ecology also exceeds 20%.

According to indicators in Table 15, we can say that Chemistry is the most advantageous category in Southern University of Science and Technology.

Table 15 Scientific research output and citation performance of 12 ESI Categories of Southern University in Science and Technology

	ESI Category	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
1	Chemistry	519	25.94%	2.01	21.39
2	Physics	395	19.74%	1.81	14.68
3	Materials Science	380	18.99%	1.93	26.58
4	Engineering	174	8.70%	1.4	16.67
5	Mathematics	80	4.00%	1.49	16.25
6	Biology & Biochemistry	77	3.85%	0.89	6.49
7	Environment & Ecology	71	3.55%	1.48	21.13
8	Computer Science	57	2.85%	1.27	15.79
9	Molecular Biology & Genetics	57	2.85%	1.24	19.3
10	Geosciences	55	2.75%	1.88	16.36
11	Clinical Medicine	33	1.65%	1.47	12.12
12	Economics & Business	19	0.95%	0.39	0

3.2 Benchmarking analysis on 12 ESI Categories and Life Science

This section will make comparative analysis for each category between Southern University of Science and Technology and 6 benchmarking universities. The indicators include the number of publications, the proportion of publications (the proportion of publication number in a specific category to the total number of publications of this university), CNCI, and the Percentage of Documents in Top 10%. For the most advantageous category Chemistry, we will make a

comparison between Southern University of Science and Technology and top 20 world-class global universities in Section 2.2.

3.2.1 Chemistry

3.2.1.1 Publication trend of Chemistry

Figure 11 represents the publication growth trend of Chemistry in Southern University of Science and Technology since 2013. From the Figure, we can see that publication number in Chemistry has increased from 27 in the beginning to 229 in 2017, increasing more than 7 times, indicating that the growth rate of publications in Chemistry is very fast. Although this report is based on the data updated in October 2018, the number of publications in 2018 has reached to 208. It could be predicted that the number of publications in 2018 would increase further.

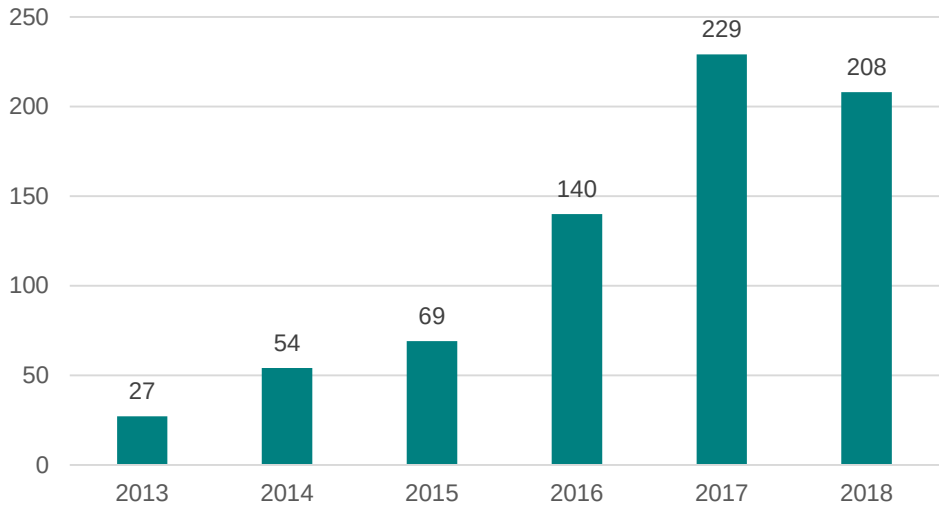

Figure 11 Growth trend of publications on Chemistry of Southern University of Science and Technology

3.2.1.2 Comparison of the impact of 20 global world-class universities

Table 16 gives the comparison of Chemistry between Southern University of Science and Technology and top 20 world-class universities in Section 2.2.

From the point of publication scale, among these universities, Duke University has the smallest number, which published 718 publications from 2013 to 2017; University of California, Berkeley published more than 3,800 publications in the four-year range. From the point of the publication proportion of Chemistry, the 20 universities are much lower than Southern University of Science and Technology.

In terms of CNCI, Southern University of Science and Technology reaches 2.01, which is only second to Massachusetts Institute of Technology in Table 16. This shows that Southern University of Science and Technology has extremely high citation performance in Chemistry, which has been ranked into the world's first-class categories. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology (21.39%) is higher than the average value of all universities in Table 16, which demonstrates that the output competence of high impact publications of Southern University of Science and Technology also reaches the level of the world first-class categories.

Table 16 Scientific research output and citation performance of Chemistry of 20 world-class universities

Institution	Number of publications in Chemistry	Total number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
University of California, Berkeley	3863	35301	10.94%	2.23	25.78
Massachusetts Institute of Technology	3493	33650	10.38%	2.07	25.94
Swiss Federal Institute of Technology, Zurich	3481	26556	13.11%	1.51	16.66
The University of Chicago	3374	29709	11.36%	1.84	20.48
University of Oxford	3178	46234	6.87%	1.83	17.94
University of Cambridge	2982	40958	7.28%	1.81	20.15
Imperial College London	2682	37721	7.11%	1.55	17.08

Institution	Number of publications in Chemistry	Total number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Northwest University	2507	27733	9.04%	2.46	27.92
Stanford University	2504	45512	5.50%	2.66	26.08
Harvard University	2295	108435	2.12%	1.85	21.92
University of Michigan	2259	47776	4.73%	1.54	18.11
California Institute of Technology	1599	16750	9.55%	2.25	24.83
University of Copenhagen	1573	37377	4.21%	1.09	10.81
University of Pennsylvania	1542	39979	3.86%	1.82	21.73
Cornell University	1515	32368	4.68%	1.67	18.35
Princeton University	1290	15422	8.36%	2.17	24.88
Columbia University	1283	37686	3.40%	1.85	19.17
Yale University	1238	32276	3.84%	1.8	21.89
Johns Hopkins University	1206	48215	2.50%	1.27	12.44
Duke University	718	31799	2.26%	1.66	17.97

Table 17 shows the comparison of seven universities in Chemistry. In terms of publication number, Southern University of Science and Technology is only higher than ShanghaiTech University, which still has a large gap with other five benchmarking universities. In terms of CNCI, Southern University of Science and Technology ranks the top among all the seven universities, twice more than the global average citation performance. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology also ranks the top.

In terms of the publications proportion, Southern University of Science and Technology is the highest among the seven universities. It can be seen that for Southern University of Science and Technology, although publication number in Chemistry is not very large, it has relatively high citation impact and moreover its CNCI has reached to the world-class level of this category. If the university can expand the output scale of Chemistry maintaining the high citation performance, Chemistry will certainly become a world-class category.

Table 17 Comparison of scientific research output and citation performance of ESI Chemistry in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Chemistry	Southern University of Science and Technology	519	25.94%	2.01	21.39
Chemistry	University of Chinese Academy of Sciences	11411	23.39%	1.44	14.86
Chemistry	Nanyang Technological University	4202	18.53%	2.23	24.01
Chemistry	Hong Kong University of Science and Technology	1409	16.10%	1.96	21.01
Chemistry	Pohang University of Science and Technology	1547	19.71%	1.61	16.1
Chemistry	King Abdullah University of Science & Technology	1359	21.77%	2.34	26.64
Chemistry	ShanghaiTech University	296	22.07%	2.05	22.97

3.2.2 Physics

Table 18 shows the comparison of the seven universities on ESI Physics. Based on the number of publications, the output of Physics of Southern University of Science and Technology is higher than ShanghaiTech University, but it still has a large gap with the other five benchmarking universities. In terms

of CNCI, except University of Chinese Academy of Sciences, the six universities are significantly higher than the global average level; Southern University of Science and Technology is lower than Hong Kong University of Science and Technology, King Abdullah University of Science & Technology and ShanghaiTech University, but higher than other three benchmarking universities. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is close to Pohang University of Science and Technology, and higher than the global average level. In terms of publication proportion, Southern University of Science and Technology is the highest among the seven universities, accounting for nearly 1/5 of total publications.

Table 18 Comparison of scientific research output and citation performance of ESI Physics in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Physics	Southern University of Science and Technology	395	19.74%	1.81	14.68
Physics	University of Chinese Academy of Sciences	5884	12.06%	0.94	8.55
Physics	Nanyang Technological University	2744	12.10%	1.79	19.39
Physics	Hong Kong University of Science and Technology	1230	14.06%	2.11	22.44
Physics	Pohang University of Science and Technology	1344	17.13%	1.18	10.49
Physics	King Abdullah University of Science & Technology	789	12.64%	2	20.79
Physics	ShanghaiTech University	252	18.79%	2.08	18.65

3.2.3 Materials Science

Table 19 shows the comparison of the seven universities on ESI Materials Science. Regarding the number of publications, University of Chinese Academy of Sciences has much higher publications than the other six universities. Two remaining universities in Chinese Mainland still have a big gap with other four benchmarking universities; ShanghaiTech University has the smallest output, followed by Southern University of Science and Technology. In terms of CNCI, the seven universities are significantly higher than the global average level; CNCI of Southern University of Science and Technology is higher than that of Pohang University of Science and Technology and University of Chinese Academy of Sciences, but lower than other four benchmarking universities. From the perspective of the Percentage of Documents in Top 10%, among the seven universities, Percentage of Documents in Top 10% of Southern University of Science and Technology is higher than that of Pohang University of Science and Technology, University of Chinese Academy of Sciences and ShanghaiTech University, but lower than other three universities.

In terms of publication percentage, Pohang University of Science and Technology is the highest among the seven universities, accounting for nearly one quarter (24.62%); followed by Southern University of Science and Technology, accounting for 18.99%; ShanghaiTech University is the lowest with less than 1/10. Therefore, Materials Science holds a significant share in Pohang University of Science and Technology and Southern University of Science and Technology.

Table 19 Comparison of scientific research output and citation performance of ESI Materials Science in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Materials Science	Southern University of Science and Technology	380	18.99%	1.93	26.58
Materials Science	University of Chinese Academy of Sciences	5196	10.65%	1.79	22.48

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Materials Science	Nanyang Technological University	3073	13.55%	2.41	30.91
Materials Science	Hong Kong University of Science and Technology	951	10.87%	2.57	35.75
Materials Science	Pohang University of Science and Technology	1932	24.62%	1.38	18.06
Materials Science	King Abdullah University of Science & Technology	801	12.83%	2.62	31.96
Materials Science	ShanghaiTech University	125	9.32%	2.02	20

3.2.4 Engineering

Table 20 shows the comparison of the seven universities on ESI Engineering. Based on publication proportion, Southern University of Science and Technology is only higher than ShanghaiTech University and University of Chinese Academy of Sciences among seven universities. In terms of CNCI, Southern University of Science and Technology is at the lower end of the ranking and is only higher than Pohang University of Science and Technology and University of Chinese Academy of Sciences. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is higher than the global average level. Though Southern University of Science and Technology has a relatively low publication proportion, it performs well in citation impact.

Table 20 Comparison of scientific research output and citation performance of ESI Engineering in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Engineering	Southern University of Science and Technology	174	8.70%	1.4	16.67

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Engineering	University of Chinese Academy of Sciences	2983	6.11%	1.24	11.26
Engineering	Nanyang Technological University	4324	19.07%	1.53	18.43
Engineering	Hong Kong University of Science and Technology	1813	20.72%	1.62	17.37
Engineering	Pohang University of Science and Technology	1029	13.11%	1.05	10.01
Engineering	King Abdullah University of Science & Technology	864	13.84%	1.41	15.62
Engineering	ShanghaiTech University	81	6.04%	2.05	16.05

Figure 12 shows the top Web of Science categories based on publication volume on ESI Engineering of Southern University of Science and Technology. According to the Figure, among 174 publications of Engineering, more than half publications are related to ENGINEERING ELECTRICAL ELECTRONIC (89 papers), followed by ENERGY FUELS (29 papers) and TELECOMMUNICATIONS (23 papers).

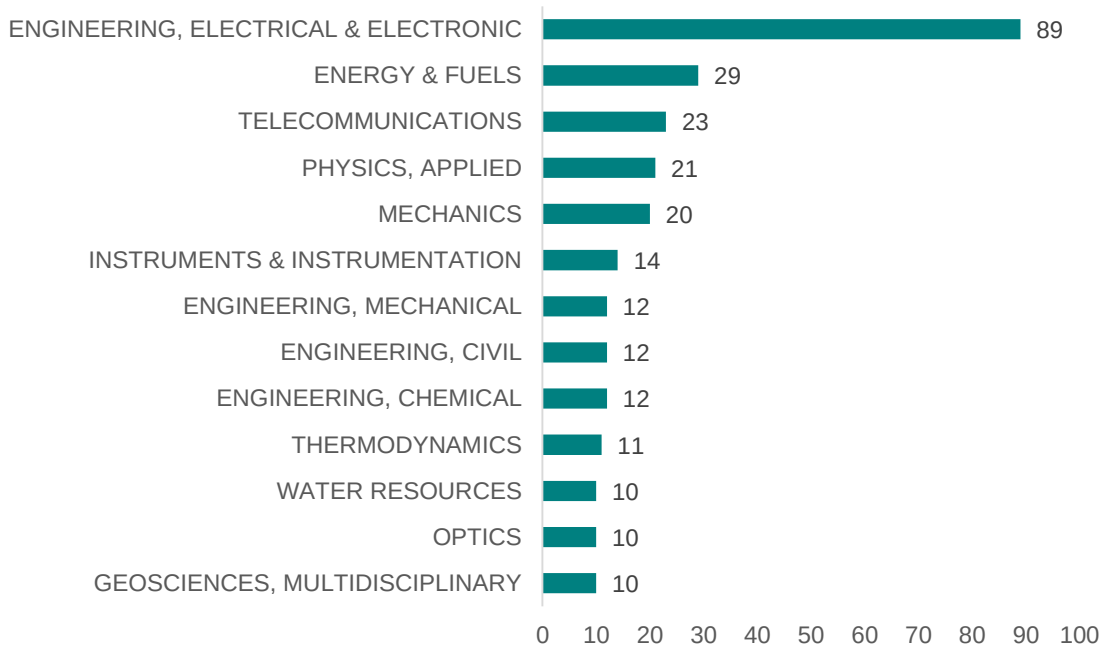

Figure 12 Top Web of Science categories based on publication volume on ESI Engineering of Southern University of Science and Technology

3.2.5 Mathematics

Table 21 shows the comparison of the seven universities on ESI Mathematics. Regarding the publication proportion, Southern University of Science and Technology has the highest proportion among the seven universities. In terms of CNCI, CNCI of Southern University of Science and Technology reaches 1.49, higher than the global average level. Nanyang Technological University has the highest output number, but its CNCI has not reached the global average level yet. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is 16.25%, which is higher than the global average level but significantly lower than King Abdullah University of Science and Technology and ShanghaiTech University.

Table 21 Comparison of scientific research output and citation performance of ESI Mathematics in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Mathematics	Southern University of Science and Technology	80	4.00%	1.49	16.25
Mathematics	University of Chinese Academy of Sciences	297	0.61%	0.94	7.41
Mathematics	Nanyang Technological University	364	1.60%	0.89	5.77
Mathematics	Hong Kong University of Science and Technology	229	2.62%	1.62	13.54
Mathematics	Pohang University of Science and Technology	272	3.47%	1.1	8.82
Mathematics	King Abdullah University of Science & Technology	244	3.91%	2.27	25.41
Mathematics	ShanghaiTech University	4	0.30%	2	25

3.2.6 Biology & Biochemistry

Table 22 shows the comparison of the seven universities on ESI Biology & Biochemistry. Regarding the publication proportion, ShanghaiTech University is the highest, accounting for 13.57%; Hong Kong University of Science and Technology is the lowest, and the other four universities are very close between 3% to 5%. In terms of CNCI, except Southern University of Science and Technology, CNCI of other six universities are higher than the global average level, and that of ShanghaiTech University is the highest. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is the lowest among the seven universities and didn't reach the global average level; all other six universities are higher than the global average level.

Table 22 Comparison of scientific research output and citation performance of ESI Biology & Biochemistry in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Biology & Biochemistry	Southern University of Science and Technology	77	3.85%	0.89	6.49
Biology & Biochemistry	University of Chinese Academy of Sciences	2304	4.72%	1.13	12.11
Biology & Biochemistry	Nanyang Technological University	951	4.19%	1.29	14.83
Biology & Biochemistry	Hong Kong University of Science and Technology	251	2.87%	1.31	15.94
Biology & Biochemistry	Pohang University of Science and Technology	373	4.75%	1.07	12.87
Biology & Biochemistry	King Abdullah University of Science & Technology	266	4.26%	1.66	18.8
Biology & Biochemistry	ShanghaiTech University	182	13.57%	2.21	21.43

3.2.7 Computer Science

Table 23 shows the comparison of the seven universities on ESI Computer Science. Regarding the publication proportion, Southern University of Science and Technology and University of Chinese Academy of Sciences are significantly lower than the other five universities. In terms of CNCI, the seven universities are basically close to or higher than the global average level; ShanghaiTech University's citation performance is the highest, up to 2.54. From the perspective of Percentage of Documents in Top 10%, except University of Chinese Academy of Sciences and Pohang University of Science and Technology, all other five universities are much higher than the global average level.

Table 23 Comparison of scientific research output and citation performance of ESI Computer Science in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Computer Science	Southern University of Science and Technology	57	2.85%	1.27	15.79
Computer Science	University of Chinese Academy of Sciences	891	1.83%	0.82	8.87
Computer Science	Nanyang Technological University	1775	7.83%	1.76	21.92
Computer Science	Hong Kong University of Science and Technology	779	8.90%	1.68	24.26
Computer Science	Pohang University of Science and Technology	242	3.08%	0.91	7.44
Computer Science	King Abdullah University of Science & Technology	478	7.66%	1.41	17.57
Computer Science	ShanghaiTech University	55	4.10%	2.54	18.18

3.2.8 Economics & Business

Table 24 shows the comparison of the seven universities on ESI Economics & Business. Among the seven universities, King Abdullah University of Science and Technology has only 1 publication, while ShanghaiTech University has 2; both Southern University of Science and Technology and Pohang University of Science and Technology have very small publication output. Hong Kong University of Science and Technology has the highest publication proportion, and its CNCI and Percentage of Documents in Top 10% are highest too, indicating that Economics & Business is an important and influential category in Hong Kong University of Science and Technology.

Table 24 Comparison of scientific research output and citation performance of ESI Economics & Business in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Economics & Business	Southern University of Science and Technology	19	0.95%	0.39	0
Economics & Business	University of Chinese Academy of Sciences	80	0.16%	0.82	5
Economics & Business	Nanyang Technological University	359	1.58%	1.12	12.81
Economics & Business	Hong Kong University of Science and Technology	407	4.65%	1.53	19.41
Economics & Business	Pohang University of Science and Technology	35	0.45%	0.6	0
Economics & Business	King Abdullah University of Science & Technology	2	0.03%	0.62	0
Economics & Business	ShanghaiTech University	1	0.07%	0	0

3.2.9 Life Science

Life Science area in this report includes 10 ESI categories, namely, Agricultural Science, Biology & Biochemistry, Clinical Medicine, Immunology, Microbiology, Molecular Biology & Genetics, Neuroscience & Behavior, Pharmacology & Toxicology, Plant & Animal Science, and Psychiatry & Psychology.

Table 25 shows the comparison of the seven universities on Life Science. Regarding the publication proportion, Southern University of Science and Technology is the lowest among the seven universities. In terms of CNCI, Southern University of Science and Technology is close to Nanyang Technological University and both of them are higher than the global average level. From the perspective of Percentage of Documents in Top 10%, Southern

University of Science and Technology is close to Hong Kong University of Science and Technology, but lower than King Abdullah University of Science & Technology and ShanghaiTech University.

Table 25 Comparison of scientific research output and citation performance of Life Science in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Life Science	Southern University of Science and Technology	220	10.99%	1.42	12.73
Life Science	University of Chinese Academy of Sciences	11289	23.14%	1.3	13.49
Life Science	Nanyang Technological University	3651	16.10%	1.48	15.78
Life Science	Hong Kong University of Science and Technology	1104	12.62%	1.24	12.32
Life Science	Pohang University of Science and Technology	1141	14.54%	1.24	15.16
Life Science	King Abdullah University of Science & Technology	897	14.37%	1.85	22.41
Life Science	ShanghaiTech University	509	37.96%	1.94	21.02

3.2.10 Environment & Ecology

Table 26 shows a comparison of the seven universities on ESI Environment & Ecology. In terms of output, University of Chinese Academy of Sciences publishes the most and proportion is also the highest; ShanghaiTech University only has four publications, which is related to its short establishment time. In terms of CNCI, King Abdullah University of Science and Technology has the highest CNCI with1.91; Southern University of Science and Technology reaches

1.48, higher than the global average level and CNCI value in 2013 to 2016 that is 0.93. Besides, it's also higher than University of Chinese Academy of Sciences and Nanyang Technological University; Moreover, Percentage of Documents in Top 10% also improved a lot. In general, Southern University of Science and Technology has a relatively small number of publications, but it grows fast and its citation impact has exceeded the global average level.

Table 26 Comparison of scientific research output and citation performance of ESI Environment & Ecology in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Environment & Ecology	Southern University of Science and Technology	71	3.55%	1.48	21.13
Environment & Ecology	University of Chinese Academy of Sciences	4226	8.66%	1.06	11.38
Environment & Ecology	Nanyang Technological University	396	1.75%	1.44	20.2
Environment & Ecology	Hong Kong University of Science and Technology	378	4.32%	1.62	20.63
Environment & Ecology	Pohang University of Science and Technology	111	1.41%	1.87	19.82
Environment & Ecology	King Abdullah University of Science & Technology	390	6.25%	1.91	27.69
Environment & Ecology	ShanghaiTech University	4	0.30%	2.33	50

3.2.11 Geosciences

Table 27 shows the comparison of the seven universities on ESI Geosciences. Regarding the output number, University of Chinese Academy of Sciences is the highest. Southern University of Science and Technology is

relatively low, with only 55 publications. Comparing with 2013-2016, there is a significant increase, but there is still a large gap between those benchmarking universities. In terms of CNCI, Southern University of Science and Technology has prominent performance, reaching 1.88, much higher than other universities. We analyze the paper level data and found that it is related to one highly cited publication[2] published by Professor Liu Junguo on *Nature* in 2015. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is 16.36%, only lower than Hong Kong University of Science and Technology and Nanyang Technological University. Above analysis indicates that for Geosciences, Southern University of Science and Technology has highly cited publications, but its output is still very small.

Table 27 Comparison of scientific research output and citation performance of ESI Geosciences in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Geosciences	Southern University of Science and Technology	55	2.75%	1.88	16.36
Geosciences	University of Chinese Academy of Sciences	5060	10.37%	0.95	8.72
Geosciences	Nanyang Technological University	517	2.28%	1.6	19.92
Geosciences	Hong Kong University of Science and Technology	259	2.96%	1.46	20.85
Geosciences	Pohang University of Science and Technology	103	1.31%	1.44	14.56
Geosciences	King Abdullah University of Science &	382	6.12%	1.24	14.4

[2] Title of the publication is *Reduced carbon emission estimates from fossil fuel combustion and cement production in China*

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
	Technology				
Geosciences	ShanghaiTech University	2	0.15%	0	0

3.2.12 Molecular Biology & Genetics

Table 28 shows the comparison of the seven universities on ESI Molecular Biology & Genetics. Regarding the output, University of Chinese Academy of Sciences is the highest. However, in terms of the publication proportion, ShanghaiTech University has the highest, accounting for 14.99%. The Southern University of Science and Technology's output is very small with only 57 papers. In terms of CNCI, Southern University of Science and Technology is only higher than University of Chinese Academy of Sciences and Pohang University of Science and Technology, exceeding the global average level. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is 19.3%, only lower than King Abdullah University of Science & Technology and ShanghaiTech University.

Table 28 Comparison of scientific research output and citation performance of ESI Molecular Biology & Genetics in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Molecular Biology & Genetics	Southern University of Science and Technology	57	2.85%	1.24	19.3
Molecular Biology & Genetics	University of Chinese Academy of Sciences	1605	3.29%	1.16	15.08
Molecular Biology & Genetics	Nanyang Technological University	517	2.28%	1.66	16.83
Molecular Biology & Genetics	Hong Kong University of Science and	192	2.19%	1.46	9.9

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
	Technology				
Molecular Biology & Genetics	Pohang University of Science and Technology	201	2.56%	1.02	15.42
Molecular Biology & Genetics	King Abdullah University of Science & Technology	157	2.51%	1.91	26.75
Molecular Biology & Genetics	ShanghaiTech University	201	14.99%	1.59	21.89

3.2.13 Clinical Medicine

Table 29 shows the comparison of the seven universities in ESI Clinical Medicine. Regarding the output, Southern University of Science and Technology's output is very small, with only 33 papers. In terms of CNCI, Southern University of Science and Technology is up to 1.47, higher than the global average level and it's at a medium level among seven universities. From the perspective of Percentage of Documents in Top 10%, Southern University of Science and Technology is 12.12%, ranked fourth among seven universities.

Table 29 Comparison of scientific research output and citation performance of ESI Clinical Medicine in seven universities

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
Clinical Medicine	Southern University of Science and Technology	33	1.65%	1.47	12.12
Clinical Medicine	University of Chinese Academy of Sciences	566	1.60%	2.08	17.67
Clinical Medicine	Nanyang Technological University	742	3.27%	1.92	14.29
Clinical Medicine	Hong Kong University of Science and	193	2.21%	0.96	9.84

Category	Institution	Number of publications	Publication proportion	CNCI	Percentage of Documents in Top 10%
	Technology				
Clinical Medicine	Pohang University of Science and Technology	207	2.64%	1.11	10.63
Clinical Medicine	King Abdullah University of Science & Technology	42	0.67%	1.27	11.9
Clinical Medicine	ShanghaiTech University	42	3.13%	2.69	23.81

3.3 Collaboration analysis of each category

Table 30 shows the collaboration development of 12 ESI categories in Southern University of Science and Technology. Generally, most publications of 12 categories of Southern University of Science and Technology are collaborative publications, indicating that this university has a close collaboration with other institutions in these 12 categories. By comparing the CNCI of all collaborative publications to that of all publications in each category, it can be seen that for Chemistry, Engineering and Molecular Biology & Genetics, their citation performances of collaborative publications are lower than that of overall publications; especially for Chemistry with the largest output, Southern University of Science and Technology itself has outstanding performance in Chemistry.

Table 30 Scientific research collaboration of 12 ESI Categories in Southern University of Science and Technology

Category	Number of publications	CNCI	Number of collaborative publications	CNCI of collaborative publications	Proportion of collaborative publications
Chemistry	519	2.01	439	1.96	84.59%
Physics	395	1.81	367	1.91	92.91%
Materials Science	380	1.93	350	1.95	92.11%
Engineering	174	1.4	163	1.36	93.68%

Category	Number of publications	CNCI	Number of collaborative publications	CNCI of collaborative publications	Proportion of collaborative publications
Mathematics	80	1.49	80	1.49	100.00%
Biology & Biochemistry	77	0.89	66	0.92	85.71%
Environment & Ecology	71	1.48	71	1.48	100.00%
Computer Science	57	1.27	55	1.3	96.49%
Molecular Biology & Genetics	57	1.24	54	1.21	94.74%
Geosciences	55	1.88	55	1.88	100.00%
Clinical Medicine	33	1.47	31	1.53	93.94%
Economics & Business	19	0.39	19	0.39	100.00%

Table 31 shows Top 3 institutions based on collaborative papers with Southern University of Science and Technology in each category and the number of collaborative publications. Generally, among 12 categories, Southern University of Science and Technology has the closest collaboration relationship with Chinese Academy of Sciences, Nanyang Technological University, University of Hong Kong and Peking University.

Table 31 Top collaborative institutions with Southern University of Science and Technology in each ESI category

Category	Collaborative institution 1	Collaborative institution 2	Collaborative institution 3
Chemistry	Chinese Academy of Sciences (52)	Wuhan University (52)	University of Hong Kong (42)
Physics	Nanyang Technological University (65)	Chinese Academy of Sciences (48)	Peking University (37)
Materials Science	Nanyang Technological University (37)	Chinese Academy of Sciences (31)	City University of Hong Kong (31)
Engineering Mathematics	Nanyang Technological University (18)	Tsinghua University (15)	Harbin Institute of Technology (10)
		Peking University (15)	University of Montreal (10)
Biology & Biochemistry	Hong Kong Baptist University (17)	Chinese Academy of Sciences (9)	Yunnan University (7)

Category	Collaborative institution 1	Collaborative institution 2	Collaborative institution 3
Chemistry	Chinese Academy of Sciences (13)	The Chinese University of Hong Kong (10)	University of Hong Kong (7)
Computer Science Computer Science	Nanyang Technological University (6)	City University of Hong Kong (4)	University of Alabama Tuscaloosa (3)
			University of Michigan (3)
		Shenzhen University (4)	Hong Kong University of Science and Technology (3)
			Wuhan University of Technology (3)
		Institute for Infocomm Research (4)	Hong Kong Baptist University (3)
			Jinan University (3)
		Agency for Science,Technology and Research (4)	Chinese Academy of Sciences (3)
Economics & Business	Harbin Institute of Technology (3)	Deakin University (2)	19 universities and colleges such as The Chinese University of Hong Kong (1)
	Hunan University (3)	Symbiosis International University (2)	
Environment & Ecology	Peking University (15)	United States Department of Energy (10)	China University of Geosciences (9)
Geosciences	Peking University (16)	Chinese Academy of Sciences (11)	University of Science and Technology of China (6)
Molecular Biology & Genetics	Chinese Academy of Sciences (10)	University of Pittsburgh (8)	University of Hong Kong (7)
Clinical Medicine	University of Hong Kong (6)	Rush University (5)	University of Pittsburgh (4)

3.4 Potentiality analysis of ESI category

This section analyzes the potential possibilities of 21 ESI categories of Southern Universities of Science and Technology entering global top 1%.

If citations of an institution's publications in a certain category during 2008-2018 rank top 1% of all institutions in the world, we can say that this institution enters global top 1% in this category. The threshold value of each category entering ESI global top 1% can be found in ESI database. If the citations of a category are higher than the threshold value of the category, this category will be in the list of global top 1% institution in this category.

The ratio of total citations of publications in a category during 2008-2018 to the threshold value of ESI global top 1% category is called the potential value entering ESI global top 1%. If the potential value reaches 100%, it's highly possible that this category could be able to become one of global top 1% institutions.

Figure 13 shows the potential value of 19 categories of Southern Universities of Science and Technology during 2008-2018.

Due to that most of Southern University of Science and Technology's publications were published after 2012, calculating the potential value of ESI categories of Southern University of Science and Technology in entering global top 1% through the period between 2008 and 2018 causes that the real potential of Southern Universities of Science and Technology is underestimated. With the rapid growth of Southern University of Science and Technology and the rolling of ESI time statistics window, it is anticipated that the potential value of each category of Southern University of Science and Technology to enter ESI global top 1% can increase quickly.

According to the ESI data updated in July 2018, Southern University of Science and Technology has two ESI global top 1% categories for the first time, namely Chemistry and Materials Science. These two categories are also the most promising in the previous reports. In terms of category ranking, Southern University of Science and Technology ranks 1085 among the 1209 institutions in the world on Chemistry and ranks 702 among 835 institutions in the world on Materials Science. In addition, the distance between the two categories of Chemistry and Materials Science has become 10.49% and 13.33% of ESI global top 1 ‰, and there is a long catch-up distance. From the remaining 19 ESI categories, the current Engineering is the most promising to become the next ESI global 1% category with a potential value of 52.24%, and there is still a certain gap.

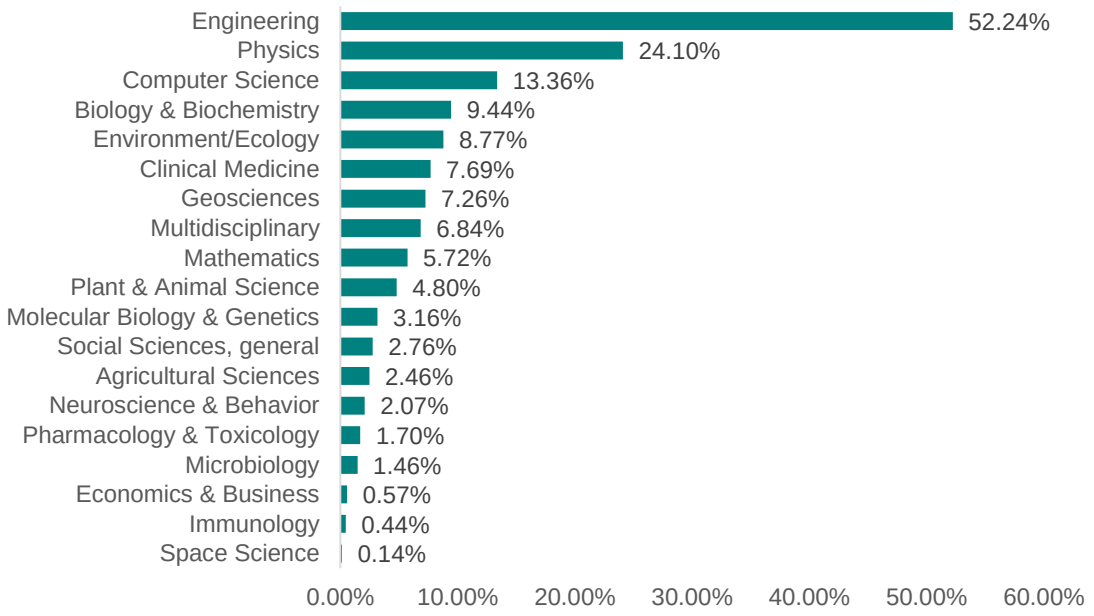

Figure 13 Potential values of 19 categories of Southern Universities of Science and Technology entering ESI global top 1%

Table 32 The potential value entering global 1 ‰ in Chemistry and Materials Science of Southern University of Science and Technology

Category	Citations	ESI Global Top 1% Category ranking	ESI Global Top 1 ‰ Category threshold	Distance to ESI Global Top 1 ‰
Chemistry	9322	1085/1209	88851	10.49%
Materials Science	6707	702/835	50312	13.33%

Chapter IV Analysis on Departments and Scholars of 12 ESI Categories and Life Science Area of Southern Universities of Science and Technology

This chapter will analyze the main departments and scholars of 12 ESI categories for Southern Universities of Science and Technology, as well as their citation contributions; and other citation performance. In this chapter, we only provide analysis based on the publications of each category. However, please bear in mind that publications from a department or a scholar are in several different categories separately.

4.1 Chemistry

4.1.1 Performance of top departments

Table 33 shows the top departments based on publication volume on ESI Chemistry. There are 12 departments that have published papers on ESI Chemistry category, which is one of the top ESI categories based on the number of involved departments, second behind Life Sciences (13 departments). Specifically, major contributors are Department of Chemistry (270 papers) and Department of Materials Science and Engineering （101 papers）, with more than 100 papers and more than 1500 citations. In addition to these 2 departments, Department of Physics also contributes a lot, with 91 papers and 1465 citations. From the perspective of output efficiency which is defined as the ratio of percentage of citations divided by percentage of output to ESI Chemistry, we can see the output efficiency of Department of Chemistry and Department of Physics exceeds 1 which is average baseline. This means the citation impact contributions of above 2 departments is higher than output contribution, which can demonstrate that these 2 departments are the main supporting departments to ESI Chemistry.

Table 33 Top departments based on publication volume on Chemistry of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Chemistry	270	52.02%	4807	58.15%	1.12
Materials Science and Engineering	101	19.46%	1543	18.67%	0.96
Physics	91	17.53%	1465	17.72%	1.01
Electrical and Electronic Engineering	25	4.82%	251	3.04%	0.63
Biology	17	3.28%	157	1.90%	0.58
Materials Characterizat & Preparat Center	7	1.35%	47	0.57%	0.42
Biomedical Engineering	7	1.35%	14	0.17%	0.13
Shenzhen Key Lab Cell Microenvironment	7	1.35%	39	0.47%	0.35
School of Environmental Science and Engineering	6	1.16%	35	0.42%	0.37

Note: the name of the department in this section is based on the corresponding department information in the address field of WOS paper data, the same as below.

4.1.2 Performance of top scholars

Table 34 shows the contribution of scholars with the most publications on ESI Chemistry during 2013-2017 and the citations of scholars for ESI Chemistry. According to the table, scholars with the most publications are from the Department of Chemistry, and some are from Departments of Physics, Departments of Materials Science and Engineering. Whatever in terms of the number of publications or citations, Tan Bin, and Liu Xinyuan, Professors of the Department of Chemistry make the greatest contribution for ESI Chemistry. From the perspective of CNCI, namely Category Normalized Citation Impact, Professor Tan Bin of Department of Chemistry is highest, up to 3.76, far higher than the global average baseline.

Table 34 Top scholars based on publication volume on Chemistry of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Liu Xinyuan	Chemistry	Professor	43	1314	3.52
Zhang Xumu	Chemistry	Chair Professor	38	185	1.26
Tan Bin	Chemistry	Professor	32	1478	3.76
Lu Zhouguang	Materials Science and Engineering	Professor	27	361	2.13
Jiang Wei	Chemistry	Associate Professor	23	437	2.44
Zhong Longhua	Chemistry	Associate Professor	22	569	2.72
Li Pengfei	Chemistry	Assistant Professor	20	246	1.32
Xu hu	Chemistry	Associate Professor	19	72	0.63
He Jiaqing	Chemistry	Professor	19	848	4.50
Wang Jun	Chemistry	Assistant Professor	17	356	1.07

Note: Part of scholars' personal information cannot be found out in the official website or staff list of Southern University of Science and Technology, so their Chinese names are adopted in publications. In addition, the department, academic title and age information of the scholars are based on the staff list from the Southern University of Science and Technology. Pease be noted that administration titles are excluded per client's request. The same as below.

Figure 14 shows that the academic titles of top scholars on ESI Chemistry are mainly professors and the number of them is 4. At the same time, scholars aged between 41-50 are the main research group of this category.

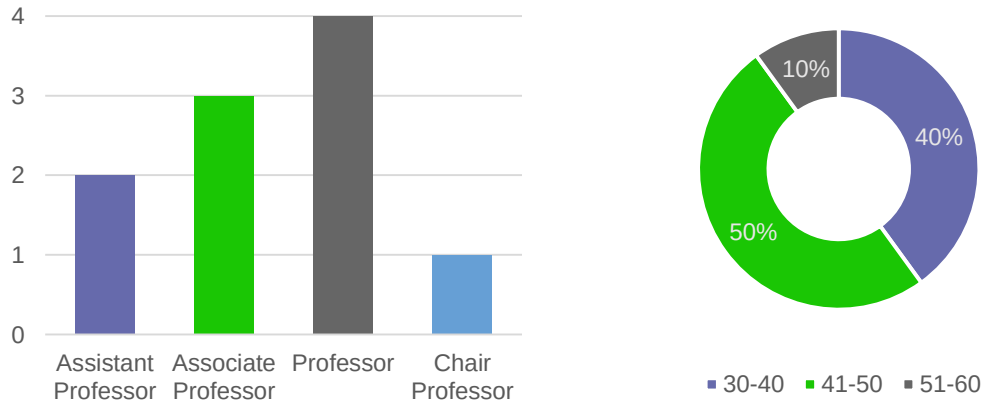

Figure 14 Analysis on academic title and age of top scholars on Chemistry of Southern University of Science and Technology

Table 35 shows the citation contribution of top scholars compared with total citations of ESI Chemistry. According to the table, Professors Tan Bin and Liu Xinyuan, offer the highest contribution for ESI Chemistry, moreover, citations from Professor Tan Bin reaches almost 1/5.

Table 35 Citation contribution of top scholars on Chemistry

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Liu Xinyuan	Chemistry	1314	9078	14.47%
Zhang Xumu	Chemistry	185	9078	2.04%
Tan Bin	Chemistry	1478	9078	16.28%
Lu Zhouguang	Materials Science and Engineering	361	9078	3.98%
Jiang Wei	Chemistry	437	9078	4.81%
Zhong Longhua	Chemistry	569	9078	6.27%
Li Pengfei	Chemistry	246	9078	2.71%
Xu hu	Chemistry	72	9078	0.79%
He Jiaqing	Chemistry	848	9078	9.34%
Wang Jun	Chemistry	356	9078	3.92%

According to Table 36, in terms of ESI Chemistry, scholars from Department of Chemistry are the most, including 7 persons in total. In addition, the other three persons are from Department of Physics and Department of Materials Science and Engineering.

Table 36 Analysis on departments of top scholars on Chemistry of Southern University of Science and Technology

Department name	Number of scholars
Chemistry	7
Physics	2
Materials Science and Engineering	1

4.2 Physics

4.2.1 Performance of top departments

Table 37 shows the top departments based on publication volume on ESI Physics. From the table, it's clear that Department of Physics contributes most in this ESI category, with 185 papers and second is Department of Electrical and Electronic Engineering (119 papers). Based on citation number, Department of Materials Science and Engineering performed outstandingly with 792 citations, much higher than Department of Electrical and Electronic Engineering (691 citations), although the output is less than half of Department of Electrical and Electronic Engineering. Among all the publications of Department of Materials Science and Engineering, one paper from Professor Guo Xugang was cited 515 times which was selected as highly cited papers on ESI Physics category.

Table 37 Top departments based on publication volume on Physics of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Physics	185	46.84%	2424	59.15%	1.26
Electrical and Electronic Engineering	119	30.13%	691	16.86%	0.56
Materials Science and Engineering	43	10.89%	792	19.33%	1.78
Mathematics	18	4.56%	33	0.81%	0.18
Mechanics and Aerospace Engineering	16	4.05%	69	1.68%	0.42
Chemistry	11	2.78%	64	1.56%	0.56

4.2.2 Performance of top scholars

Table 38 shows the contribution of scholars with the most publications on ESI Physics during 2013-2017 and the citations of each scholar as well. According to the table, scholars with the most publications are from Departments of Electrical and Electronic Engineering and Physics.

In terms of CNCI, Lu Haizhou, Professor from Department of Physics, is the highest (6.41), far higher than the global average level.

Table 38 Top scholars based on publication volume on Physics of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Sun, Xiao Wei	Electrical and Electronic Engineering	Chair Professor	37	378	0.90
Lu, Hai-Zhou	Physics	Professor	20	641	6.41
Chen, Rui	Electrical and Electronic Engineering	Associate Professor	18	60	0.88
Wang, Kai	Electrical and Electronic Engineering	Assistant Professor	15	104	1.19
Luo, Dan	Electrical and Electronic Engineering	Assistant Professor	15	37	0.61
Huang, LI	Physics	Assistant Professor	14	96	1.48
Liu, JunFeng	Physics	-	14	31	0.57
Li, Jingzhi	Mathematics	Associate Professor	13	32	0.34
Chen, Shiyi	Mechanics and Aerospace Engineering	Chair Professor	12	41	0.75
Yu, Dapeng	Physics	Chair Professor	12	75	2.51

Figure 15 shows that the academic titles of scholars with the most publications on ESI Physics are mainly assistant professors and chair professors,

with 3 people in each title. At the same time, scholars aged between 30 to 40 are the main research group of this category.

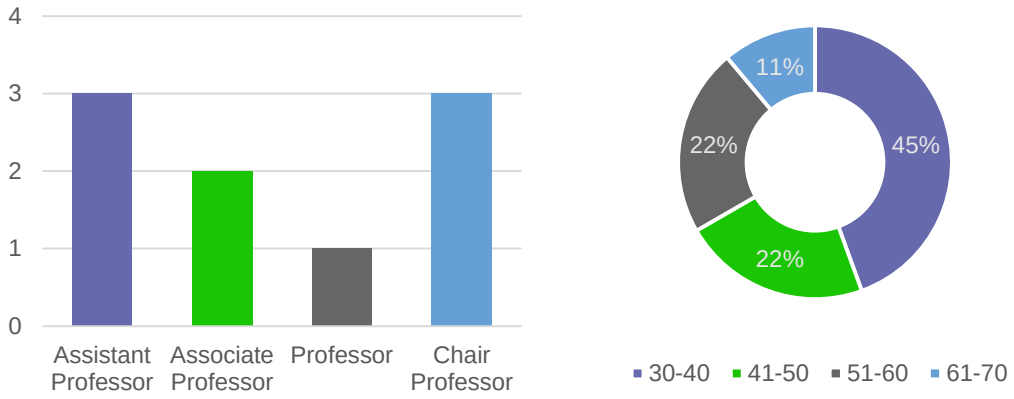

Figure 15 Analysis on academic title and age of top scholars on Physics of Southern University of Science and Technology

Table 39 shows the contribution of scholars with the most publications for total citations of ESI Physics. According to the table, Lu Haizhou, Professor from Department of Physics, occupies the highest proportion (over 14%).

Table 39 Citation contribution of top scholars on Physics

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Sun, Xiao Wei	Electrical and Electronic Engineering	378	4413	8.57%
Lu, Hai-Zhou	Physics	641	4413	14.53%
Chen, Rui	Electrical and Electronic Engineering	60	4413	1.36%
Wang, Kai	Electrical and Electronic Engineering	104	4413	2.36%
Luo, Dan	Electrical and Electronic Engineering	37	4413	0.84%
Huang, LI	Physics	96	4413	2.18%
Liu, JunFeng	Physics	31	4413	0.70%
Li, Jingzhi	Mathematics	32	4413	0.73%
Chen, Shiyi	Mechanics and Aerospace Engineering	41	4413	0.93%
Yu, Dapeng	Physics	75	4413	1.70%

In terms of the departments of top scholars, Department of Physics and Department of Electrical and Electronic Engineering have the most scholars, up to 4.

Table 40 Analysis on departments of top scholars on Physics of Southern University of Science and Technology

Department name	Number of scholars
Physics	4
Electrical and Electronic Engineering	4
Mechanics and Aerospace Engineering	1
Mathematics	1

4.3 Materials Science

4.3.1 Performance of top departments

Table 41 shows the top departments based on publication volume on ESI Materials Science. From the table we can see that this ESI category is mainly contributed by 3 departments, that is Department of Materials Science and Engineering (140 papers), Department of Physics (108 papers) and Department of Electrical and Electronic Engineering (86 papers). From the perspective of output efficiency, Department of Physics, Electrical and Electronic Engineering and Chemistry perform better by exceeding the average baseline 1, which means these 3 departments contribute a lot in this ESI category.

Table 41 Top departments based on publication volume on Materials Science of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Materials Science and Engineering	140	36.84%	1423	31.67%	0.86
Physics	108	28.42%	1480	32.94%	1.16
Electrical and Electronic Engineering	86	22.63%	1281	28.51%	1.26
Chemistry	24	6.32%	296	6.59%	1.04
Mechanical and	10	2.63%	23	0.51%	0.19

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Energy Engineering					
School of Environmental Science and Engineering	7	1.84%	62	1.38%	0.75
Biomedical Engineering	6	1.58%	24	0.53%	0.34

4.3.2 Performance of top scholars

Table 42 shows that, among the scholars with the most publications on Materials Science, Sun Xiaowei, Professor from Department of Electrical and Electronic Engineering, presents the highest publications, totaling 36. In terms of CNCI, Liang Yongye, Associate Professor from Department of Materials Science and Engineering, performs best (5.12). Associate Professor Liang is selected as Highly Cited Researcher from year 2016 to 2018 by Clarivate. Besides, the CNCI of scholars with the most publications on Materials Science is all far higher than the global average level, which indicates that the citation impacts of these scholars perform well.

Table 42 Top scholars based on publication volume on Materials Science of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Sun, Xiao Wei	Electrical and Electronic Engineering	Chair Professor	36	803	3.25
He, Jiaqing	Physics	Professor	35	717	2.59
Lu, Zhouguang	Materials Science and Engineering	Professor	31	572	2.59
Chen, Shuming	Electrical and Electronic Engineering	Assistant Professor	28	361	2.76
Ren, Fuzeng	Materials Science and Engineering	Assistant Professor	19	125	1.23
Deng, Yonghong	Materials Science and Engineering	Associate Professor	12	95	2.03
Liang, Yongye	Materials Science	Associate	12	320	5.12

Name	Department name	Academic title	Number of publications	Citations	CNCI
	and Engineering	Professor			
Wang, Kai	Electrical and Electronic Engineering	Assistant Professor	12	269	4.00
Wu, Haijun	Materials Science and Engineering	-	12	281	2.33
Xu, Zong-Xiang	Chemistry	Associate Professor	12	114	1.65

Figure 16 shows that the academic titles of top scholars on ESI Materials Science are mainly assistant professors and associate professors and the number of each is 3. At the same time, scholars aged 30-40 and 41-50 are the main research group of this category.

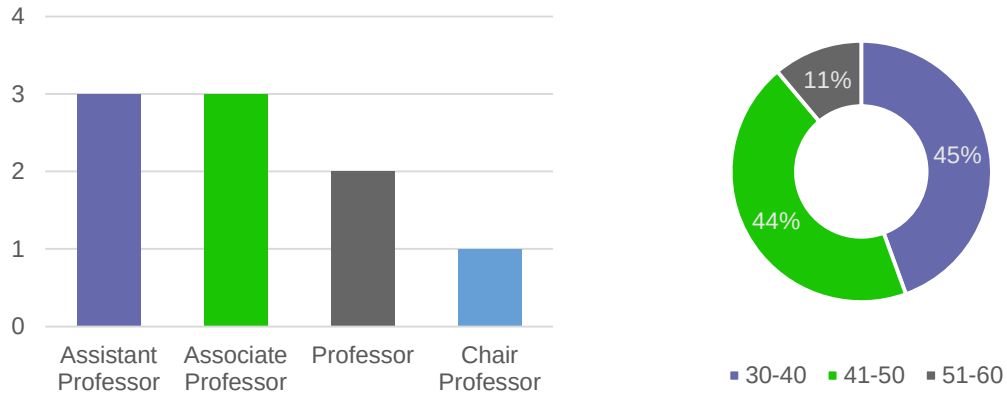

Figure 16 Analysis on academic title and age of top scholars on Materials Science of Southern University of Science and Technology

In terms of the contribution of scholars with the most publications for total citations of ESI Materials Science, Sun Xiaowei, Professor from Department of Electrical and Electronic Engineering, contributes the most, reaching 15.93%.

Table 43 Citation contribution of top scholars on Materials Science

Name	Department name	Citations	Total citations of the category	Citation contribution
Sun, Xiao Wei	Electrical and Electronic Engineering	803	5041	15.93%
He, Jiaqing	Physics	717	5041	14.22%
Lu, Zhouguang	Materials Science and Engineering	572	5041	11.35%
Chen, Shuming	Electrical and Electronic Engineering	361	5041	7.16%
Ren, Fuzeng	Materials Science and Engineering	125	5041	2.48%
Deng, Yonghong	Materials Science and Engineering	95	5041	1.88%
Liang, Yongye	Materials Science and Engineering	320	5041	6.35%
Wang, Kai	Electrical and Electronic Engineering	269	5041	5.34%
Wu, Haijun	Materials Science and Engineering	281	5041	5.57%
Xu, Zong-Xiang	Chemistry	114	5041	2.26%

According to department distribution of high-yielding scholars in Table 44, scholars with the most publications are from four departments, namely, Materials Science and Engineering, Electrical and Electronic Engineering, Physics, and Chemistry.

Table 44 Analysis on departments of top scholars on Materials Science of Southern University of Science and Technology

Department name	Number of scholars
Materials Science and Engineering	5
Electrical and Electronic Engineering	3
Physics	1
Chemistry	1

4.4 Engineering

4.4.1 Performance of top departments

Table 45 shows the top departments based on publication volume on ESI Engineering. The table shows over 50% publications in this category are contributed by only one department that is Department of Electrical and Electronic Engineering. Moreover, the citation impact of this department is much higher than other departments, which can be concluded that the collaborations

between Department of Electrical and Electronic Engineering and others are not very active. In addition, although output from Departments of Finance and Materials Science and Engineering is not very much, their citation impacts perform well. The output efficiency of these 2 departments is 1.80 and 1.81 which is higher than average baseline 1.

Table 45 Top departments based on publication volume on Engineering of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Electrical and Electronic Engineering	91	52.30%	667	66.37%	1.27
School of Environmental Science and Engineering	24	13.79%	87	8.66%	0.63
Mechanics and Aerospace Engineering	20	11.49%	61	6.07%	0.53
Mechanics and Aerospace Engineering	10	5.75%	18	1.79%	0.31
Finance	8	4.60%	83	8.26%	1.80
Materials Science and Engineering	7	4.02%	73	7.26%	1.81
Computer Science and Engineering	6	3.45%	6	0.60%	0.17
Biology	6	3.45%	16	1.59%	0.46

4.4.2 Performance of top scholars

According to 11 scientific researchers on Engineering with the most publications, they mainly come from Department of Electrical and Electronic Engineering. CNCI of 8 scholars is higher than the global average level.

Table 46 Top scholars based on publication volume on Engineering of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Zhang, Qingfeng	Electrical and Electronic	Assistant Professor	24	102	1.12

Name	Department name	Academic title	Number of publications	Citations	CNCI
	Engineering				
Chen, Yifan	Electrical and Electronic Engineering	-	11	48	0.90
Gong, Yi	Electrical and Electronic Engineering	Professor	10	48	1.41
Yu Hongyu	Electrical and Electronic Engineering	Professor	10	100	0.93
Zheng, Chunmiao	School of Environmental Science and Engineering	Chair Professor	7	36	1.46
Wang, Kai	Electrical and Electronic Engineering	Assistant Professor	7	144	2.31
Chen, Shiyi	Mechanics and Aerospace Engineering	Chair Professor	6	23	0.84
Zhang, Zuotai	School of Environmental Science and Engineering	Professor	6	25	1.13
Jian, Linni	Electrical and Electronic Engineering	Assistant Professor	6	91	2.56
Yu, Peng	Materials Science and Engineering	Associate Professor	6	33	2.10
Jiang, Jingjing	Finance	-	6	78	4.15

Figure 17 shows that the academic titles of top scholars on ESI Engineering are mainly assistant professors and professors and the number of each is 3. At the same time, scholars aged between 41 to 50 are the main research group of this category.

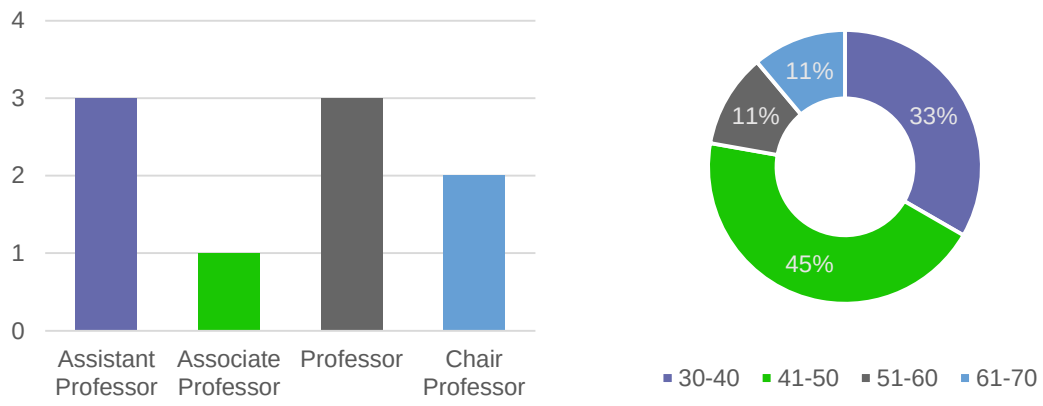

Figure 17 Analysis on academic title and age of top scholars on Engineering of Southern University of Science and Technology

According to the contribution of scholars with the most publications for total citations of ESI Engineering, Wang kai, Professor, is the highest, reaching 12.79%.

Table 47 Citation contribution of top scholars on Engineering

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Zhang, Qingfeng	Electrical and Electronic Engineering	102	1126	9.06%
Chen, Yifan	Electrical and Electronic Engineering	48	1126	4.26%
Gong, Yi	Electrical and Electronic Engineering	48	1126	4.26%
Yu Hongyu	Electrical and Electronic Engineering	100	1126	8.88%
Zheng, Chunmiao	School of Environmental Science and Engineering	36	1126	3.20%
Wang, Kai	Electrical and Electronic Engineering	144	1126	12.79%
Chen, Shiyi	Mechanics and Aerospace Engineering	23	1126	2.04%
Zhang, Zuotai	School of Environmental Science and Engineering	25	1126	2.22%
Jian, Linni	Electrical and Electronic Engineering	91	1126	8.08%
Yu, Peng	Materials Science and Engineering	33	1126	2.93%
Jiang, Jingjing	Finance	78	1126	6.93%

According to department distribution of high-yielding scholars on Engineering, most scholars are from Department of Electrical and Electronic Engineering.

Table 48 Analysis on departments of top scholars on Engineering of Southern University of Science and Technology

Department name	Number of scholars
Electrical and Electronic Engineering	6
School of Environmental Science and Engineering	2
Materials Science and Engineering	1
Mechanics and Aerospace Engineering	1
Finance	1

4.5 Mathematics

4.5.1 Performance of top departments

Table 49 shows the top departments based on publication volume on ESI Mathematics. According to the table, Department of Mathematics, whose publications (62 papers) account for 77.50% of the total amount of publications of ESI Mathematics and produces more than 83% of total citations, has great output and citation performance. Department of Finance with 12 papers, also has a big output. In general, similar to ESI Engineering, cross-disciplinary studies of ESI Mathematics are not very active among other departments.

Table 49 Top departments based on publication volume on Mathematics of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Mathematics	62	77.50%	188	83.19%	1.07
Finance	12	15.00%	22	9.73%	0.65
Electrical and Electronic Engineering	2	2.50%	0	0.00%	0.00
Materials Science and Engineering	2	2.50%	7	3.10%	1.24

4.5.2 Performance of top scholars

According to scientific researchers with the most publications on Mathematics, Li Jingzhi, Associate Professor, has the most publications (20 papers), far higher than other scholars. In terms of CNCI, He Bingsheng, Professor, only has three publications on this category, but the CNCI is higher than the global average level, reaching 6.37.

Table 50 Top scholars based on publication volume on Mathematics of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Li, Jingzhi	Mathematics	Associate Professor	20	122	1.88
Jiang, Xuejun	Mathematics	Assistant Professor	11	8	0.25
Tang, Tao	Mathematics	Chair Professor	9	43	3.42
Li, Cai Heng	Mathematics	Chair Professor	5	0	0.00
Chen, Anyue	Mathematics	Chair Professor	4	2	0.18
Wang, Rong	Mathematics	Teacher	4	17	1.50
He, Bingsheng	Mathematics	Professor	3	34	6.37
Wang, Yong	Mathematics	Assistant Professor	3	0	0.00

Figure 18 shows that the academic titles of top scholars on ESI Mathematics are mainly chair professors and the number of them is 3. At the same time, scholars aged between 41 and 50 are the main research group of this category.

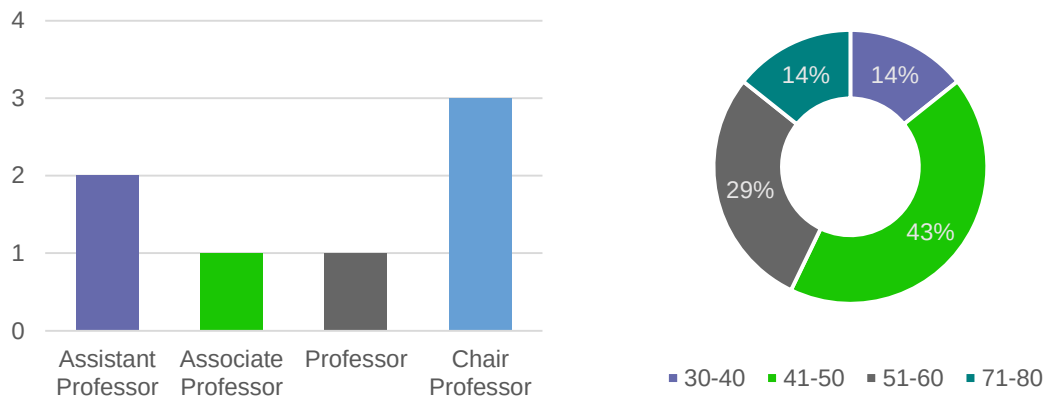

Figure 18 Analysis on academic title and age of top scholars on Mathematics of Southern University of Science and Technology

In terms of the citation contribution of top scholars, Li Jingzhi, Associate Professor from Department of Mathematics, is the highest, reaching 48.80%.

Table 51 Citation contribution of top scholars on Mathematics

Name	Department name	Citations	Total citations of the category	Citation contribution
Li, Jingzhi	Mathematics	122	250	48.80%
Jiang, Xuejun	Mathematics	8	250	3.20%
Tang, Tao	Mathematics	43	250	17.20%
Li, Cai Heng	Mathematics	0	250	0.00%
Chen, Anyue	Mathematics	2	250	0.80%
Wang, Rong	Mathematics	17	250	6.80%
He, Bingsheng	Mathematics	34	250	13.60%
Wang, Yong	Mathematics	0	250	0.00%

According to department distribution of top scholars, most of them are from Department of Mathematics.

Table 52 Analysis on departments of top scholars on Mathematics of Southern University of Science and Technology

Department name	Number of scholars

Department name	Number of scholars
Mathematics	8

4.6 Biology & Biochemistry

4.6.1 Performance of top departments

Table 53 shows the top departments based on publication volume on ESI Biology & Biochemistry. According to the table, Departments of Biology is the main involved department with 40 papers and 274 citations in this category, which is far higher than other departments.

Table 53 Top departments based on publication volume on Biology & Biochemistry of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Biology	40	51.95%	274	56.85%	1.09
Chemistry	13	16.88%	88	18.26%	1.08
Shenzhen Key Lab Cell Microenvironment	9	11.69%	56	11.62%	0.99
Electrical and Electronic Engineering	7	9.09%	23	4.77%	0.52
Materials Science and Engineering	5	6.49%	19	3.94%	0.61
Physics	5	6.49%	48	9.96%	1.53

4.6.2 Performance of top scholars

Table 54 shows that top scholars based on publications volume on Biology & Biochemistry, Wei Zhiyi, Associate Professor, has the most publications (7 papers). In general, the number of papers published by all scholars of Biology &

Biochemistry is not very high. In terms of CNCI, CNCI of only 4 scholars are higher than the global average level.

Table 54 Top scholars based on publication volume on Biology & Biochemistry of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Wei, Zhiyi	Biology	Associate Professor	7	120	1.41
Zhu, Bao-Ting	Biology	-	6	16	0.32
Deng, Yi	Biology	Associate Professor	5	78	1.26
Chen, Yifan	Electrical and Electronic Engineering	-	4	22	0.74
He, Jiankui	Biology（Leave without pay）	Associate Professor	4	22	0.59
Ng, Alan Man Ching	Physics	-	4	44	0.88
Chen, Fei	Electrical and Electronic Engineering	Associate Professor	3	1	0.13
Chen, Yonglong	Biology	Associate Professor	3	31	1.42
Guo, Mu Yao	Physics	-	3	20	0.69
Li, Zhoufang	Biology	-	3	21	0.73
Xiao, Guozhi	Biology	Professor	3	14	1.32

Figure 19 shows that the academic titles of top scholars on ESI Biology & Biochemistry are mainly associate professors and the number of them is 5. At the same time, there are 2 scholars in each of the 3 age groups that are 30-40, 41-50 and 51-60.

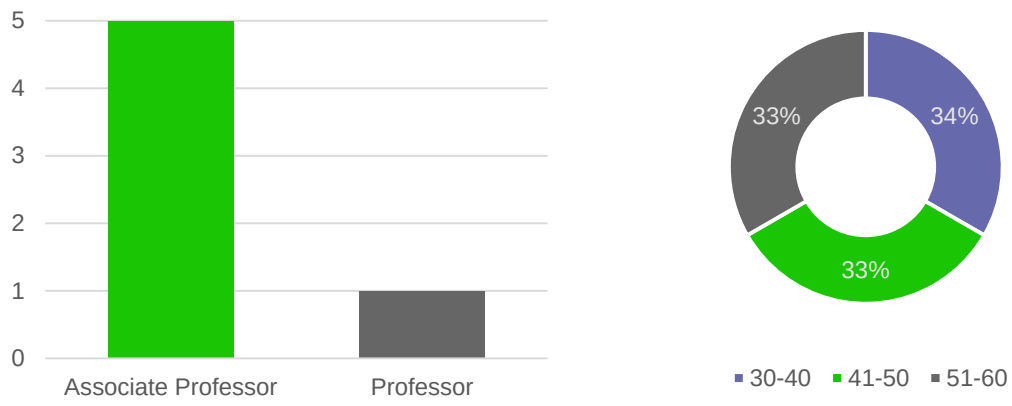

Figure 19 Analysis on academic title and age of top scholars on Biology & Biochemistry of Southern University of Science and Technology

According to the citation contribution of top scholars, Wei Zhiyi, Associate Professor, is still the highest, reaching 26.97% (over 1/4).

Table 55 Citation contribution of top scholars on Biology & Biochemistry

Name	Department name	Citations	Total citations of the category	Citation contribution
Wei, Zhiyi	Biology	120	445	26.97%
Zhu, Bao-Ting	Biology	16	445	3.60%
Deng, Yi	Biology	78	445	17.53%
Chen, Yifan	Electrical and Electronic Engineering	22	445	4.94%
He, Jiankui	Biology (Leave without pay)	22	445	4.94%
Ng, Alan Man Ching	Physics	44	445	9.89%
Chen, Fei	Electrical and Electronic Engineering	1	445	0.22%
Chen, Yonglong	Biology	31	445	6.97%
Guo, Mu Yao	Physics	20	445	4.49%
Li, Zhoufang	Biology	21	445	4.72%
Xiao, Guozhi	Biology	14	445	3.15%

According to department distribution of top scholars, most of them are from Department of Biology.

Table 56 Analysis on departments of top scholars on Biology & Biochemistry of Southern University of Science and Technology

Department name	Number of scholars

Department name	Number of scholars
Biology	7
Electrical and Electronic Engineering	2
Physics	2

4.7 Computer Science

4.7.1 Performance of top departments

Table 57 shows the top departments based on publication volume on ESI Computer Science. According to the table, the overall output of this category is relatively small. Department of Electrical and Electronic Engineering is the main contributor with 25 papers and 304 citations. Meanwhile, its citation performance is also great. Besides, Department of Computer Science and Engineering with 11 papers, also performs well on output. However, for this department, its citation impact needs to be improved considering it only has 19 citations.

Table 57 Top departments based on publication volume on Computer Science of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Electrical and Electronic Engineering	25	43.86%	304	76.96%	1.75
Computer Science and Engineering	11	19.30%	19	4.81%	0.25
Finance	8	14.04%	25	6.33%	0.45
Mathematics	6	10.53%	34	8.61%	0.82
Physics	2	3.51%	0	0.00%	0.00
Mechanics and Aerospace Engineering	2	3.51%	5	1.27%	0.36

4.7.2 Performance of top scholars

Table 58 shows top scholars based on publication volume on ESI Computer Science as well as their citation contributions for ESI Computer Science. Gong Yi, Professor from Department of Electrical and Electronic Engineering, devotes most publications (9 papers), and its CNCI is higher than the global average level. Top researchers on Computer Science are from 3 departments that are, Department of Electrical and Electronic Engineering, Computer Science and Engineering and Finance.

Table 58 Top scholars based on publication volume on Computer Science of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Gong, Yi	Electrical and Electronic Engineering	Professor	9	87	1.39
Wang, Rui	Electrical and Electronic Engineering	Associate Professor	8	17	0.52
Chen, Yifan	Electrical and Electronic Engineering	-	6	14	0.74
Wang, Huaiqing	Finance	-	6	23	0.45
Zhao, Hong	Electrical and Electronic Engineering	-	5	45	1.07
Chen, Kun	Finance	Assistant Professor	4	3	0.13
Shi, Yuhui	Computer Science and Engineering	Chair Professor	3	7	1.27
Wang, QI	Computer Science and Engineering	Assistant Professor	3	6	1.08
Yao, Xin	Computer Science and Engineering	Chair Professor	3	5	0.90
Zhang, Jin	Computer Science and Engineering	Assistant Professor	3	6	0.77

Figure 20 shows that the academic titles of scholars with the most publications on ESI Computer Science are mainly assistant professors and the number is 3. At the same time, scholars aged between 30 and 40 are the main research group of this category.

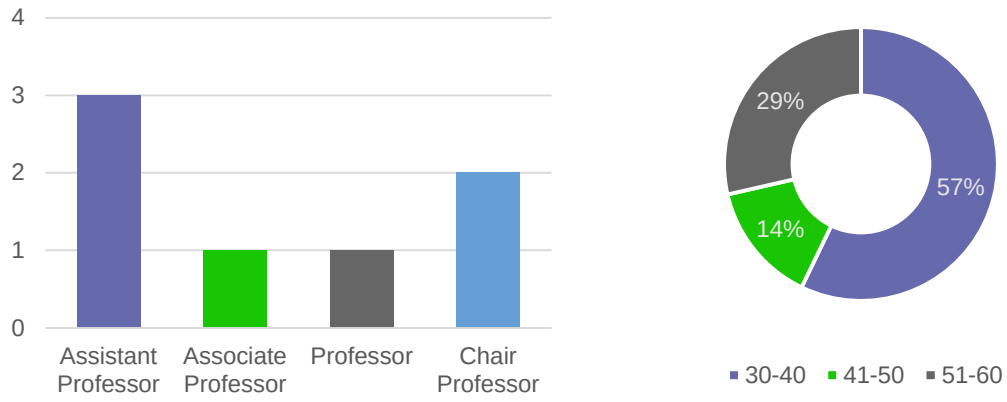

Figure 20 Analysis on academic title and age of top scholars on Computer Science of Southern University of Science and Technology

From the citation contribution of top scholars, Professor Gong Yi from the Department of Electronics and Electrical Engineering contributes the most, reaching 20.19%.

Table 59 Citation contribution of top scholars on Computer Science

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Gong, Yi	Electrical and Electronic Engineering	87	431	20.19%
Wang, Rui	Electrical and Electronic Engineering	17	431	3.94%
Chen, Yifan	Electrical and Electronic Engineering	14	431	3.25%
Wang, Huaiqing	Finance	23	431	5.34%
Zhao, Hong	Electrical and Electronic Engineering	45	431	10.44%
Chen, Kun	Finance	3	431	0.70%
Shi, Yuhui	Computer Science and Engineering	7	431	1.62%
Wang, Ql	Computer Science and Engineering	6	431	1.39%
Yao, Xin	Computer Science and Engineering	5	431	1.16%
Zhang, Jin	Computer Science and Engineering	6	431	1.39%

In terms of department distribution of high-yielding scholars, most are concentrated on 2 departments, that is Department of Computer Science and Engineering and Department of Electrical and Electronic Engineering.

Table 60 Analysis on departments of top scholars on Computer Science of Southern University of Science and Technology

Department name	Number of scholars
Computer Science and Engineering	4
Electrical and Electronic Engineering	4
Finance	2

4.8 Economics & Business

4.8.1 Performance of top departments

Table 61 shows the top departments based on publication volume on ESI Economics & Business. According to the table, Department of Finance is the main involved department with 14 papers and 12 citations in this category. Second is Department of Mathematics with 3 papers and 7 citations.

Table 61 Top departments based on publication volume on Economics & Business of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Finance	14	73.68%	12	60.00%	0.81
Mathematics	3	15.79%	7	35.00%	2.22
Computer Science and Engineering	2	10.53%	1	5.00%	0.48

4.8.2 Performance of top scholars

Table 62 analyzes the top scholars based on publications volume on Economics & Business. According to the table, Associate Professor Yang Zhaojun and Assistant Professor Chen Kun, who contribute most publications. In terms of CNCI, each scholar's citation impact on Economics & Business is lower than global average level, only Luo Zongwei and Jiang Shan, their citation impacts are close to the global average level.

Table 62 Top scholars based on publication volume on Economics & Business of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Chen, Kun	Finance	Assistant Professor	4	8	0.61
Yang, Zhaojun	Finance	Associate Professor	4	1	0.23
Chao, Chi Chur	Finance	-	2	1	0.18
Jiang, Shan	Computer Science and Engineering	-	2	2	0.90
Jiang, Xuejun	Mathematics	Assistant Professor	2	7	0.50
Luo, Zongwei	Electrical and Electronic Engineering	Associate Professor	2	2	0.90
Sun, Bianxia	Finance	Lecture	2	0	0.00

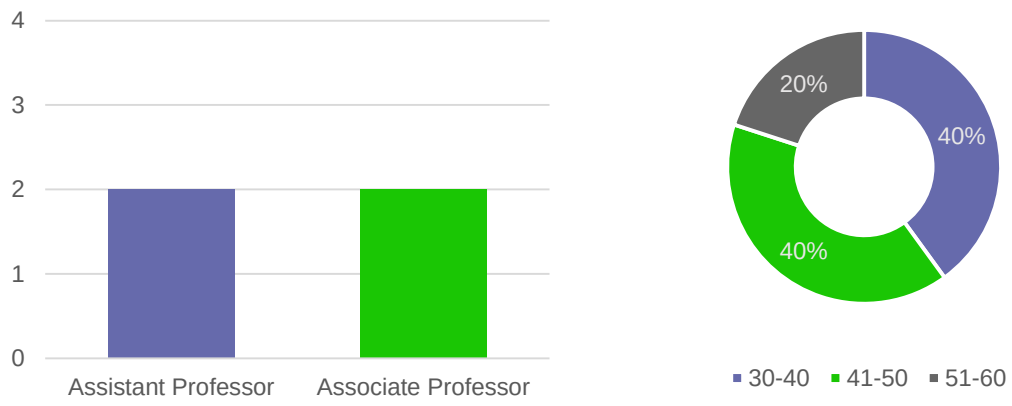

Figure 21 Analysis on academic title and age of top scholars on Economics & Business of Southern University of Science and Technology

Figure 21 shows that the academic titles of scholars with the most publications on ESI Economics & Business are mainly assistant professors and associate professors and the number of each is 2. At the same time, scholars aged 30-40 and 41-50 are the main research group of this category.

In terms of the citation contribution of top scholars for Economics & Business, Chen Kun, Assistant Professor from Department of Finance, is the highest, reaching 36.36%.

Table 63 Citation contribution of top scholars on Economics & Business

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Chen, Kun	Finance	8	22	36.36%
Yang, Zhaojun	Finance	1	22	4.55%
Chao, Chi Chur	Finance	1	22	4.55%
Jiang, Shan	Computer Science and Engineering	2	22	9.09%
Jiang, Xuejun	Mathematics	7	22	31.82%
Luo, Zongwei	Electrical and Electronic Engineering	2	22	9.09%
Sun, Bianxia	Finance	0	22	0.00%

In terms of department distribution of top scholars, we can see that high-yielding scholars of Economics & Business are mainly from Department of Finance.

Table 64 Analysis on departments of top scholars on Economics & Business of Southern University of Science and Technology

Department name	Number of scholars
Finance	4
Mathematics	1
Electrical and Electronic Engineering	1
Computer Science and Engineering	1

4.9 Life Science

4.9.1 Performance of top departments

Life Science area in this report includes 10 ESI categories, namely, Agricultural Science, Biology & Biochemistry, Clinical Medicine, Immunology, Microbiology, Molecular Biology & Genetics, Neuroscience & Behavior, Pharmacology & Toxicology, Plant & Animal Science, and Psychiatry & Psychology.

Table 65 shows the top departments based on publication volume on Life Science. In terms of the number of publications, Department of Biology has an absolute advantage with 138 papers and 968 citations in the past five years. Other performing well departments include Shenzhen Key Lab Cell Microenvironment (35 papers), contributing more than 12% to the output and citations of Life Science category. Regarding the output efficiency, Department of Materials Science and Engineering reaches 1.85, whose citation performance is the best.

Table 65 Top departments based on publication volume on Life Science of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Biology	138	62.73%	968	65.23%	1.04
Shenzhen Key Lab Cell Microenvironment	35	15.91%	189	12.74%	0.80
Chemistry	18	8.18%	120	8.09%	0.99
Electrical and Electronic Engineering	16	7.27%	83	5.59%	0.77
Materials Science and Engineering	14	6.36%	175	11.79%	1.85
Biomedical Engineering	9	4.09%	27	1.82%	0.44
School of Environmental Science and Engineering	8	3.64%	35	2.36%	0.65
Physics	5	2.27%	48	3.23%	1.42

4.9.2 Performance of top scholars

Table 66 shows the top 12 scholars based on publications volume on Life Science. Professor Xiao Guozhi and Associate Professor Wei Zhiyi from Department of Biology devote more publications and higher CNCI than other scholars, and the CNCI is also higher than the global average level.

Table 66 Top scholars based on publication volume on Life Science of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Xiao, Guozhi	Biology	Professor	12	72	1.06
Wei, Zhiyi	Biology	Associate Professor	11	194	1.44
Chen, Fei	Electrical and Electronic Engineering	Associate Professor	10	19	0.30
Zhu, Bao-Ting	Biology	-	9	26	0.37
Wu, Chuanyue	Biology	Associate Professor	8	41	0.96

Name	Department name	Academic title	Number of publications	Citations	CNCI
He, Jiankui	Biology（Leave without pay）	Chair Professor	8	36	0.53
Deng, Yi	Biology	Associate Professor	8	86	1.28
Chen, Wei	Biology	Chair Professor	8	104	2.54
Chen, Fangyi	Biology	Associate Professor	7	26	0.70
Wang, Guanyu	Biology	Associate Professor	6	16	0.32
Li, Zhoufang	Biology	-	6	35	0.67
Guo, Hongwei	Biology	Chair Professor	6	59	3.83

Figure 22 shows that the academic titles of top scholars are mainly associate professors and the number is 6. At the same time, scholars aged between 41 and 50 are the main research group of this category.

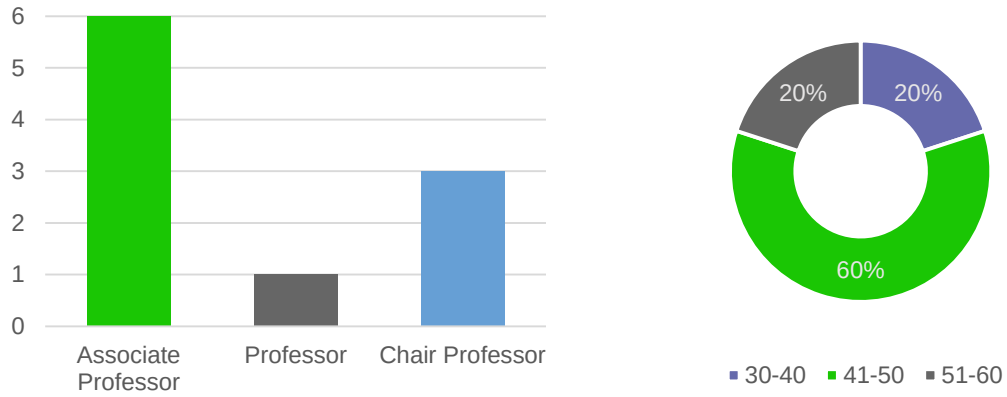

Figure 22 Analysis on academic title and age of top scholars on Life Science of Southern University of Science and Technology

In terms of the citation contribution of top 12 scholars, Wei Yizhi, Associate Professor from Department of Biology, is obviously higher than other scholars, reaching 12.41%.

Table 67 Citation contribution of top scholars on Life Science

Name	Department name	Citations	Total citations of the category	Citation contribution
Xiao, Guozhi	Biology	72	1563	4.61%
Wei, Zhiyi	Biology	194	1563	12.41%
Chen, Fei	Electrical and Electronic Engineering	19	1563	1.22%
Zhu, Bao-Ting	Biology	26	1563	1.66%
Wu, Chuanyue	Biology	41	1563	2.62%
He, Jiankui	Biology (Leave without pay)	36	1563	2.30%
Deng, Yi	Biology	86	1563	5.50%
Chen, Wei	Biology	104	1563	6.65%
Chen, Fangyi	Biology	26	1563	1.66%
Wang, Guanyu	Biology	16	1563	1.02%
Li, Zhoufang	Biology	35	1563	2.24%
Guo, Hongwei	Biology	59	1563	3.77%

Table 68 shows that top scholars on Life Science are concentrated from Department of Biology, and only 1 is from another department, that is Department of Electrical and Electronic Engineering.

Table 68 Analysis on departments of top scholars on Life Science of Southern University of Science and Technology

Department name	Number of scholars
Biology	11
Electrical and Electronic Engineering	1

4.10 Environment & Ecology

4.10.1 Performance of top departments

Table 69 shows the top departments based on publication volume on ESI Environment & Ecology. As can be seen from the table, a total of 6 departments contribute to this category. Among them, School of Environmental Science and Engineering has published 64 papers, accounting for 90.14% of the total number in this category, and the citation impact far exceeds that of other departments,

indicating that both output and citations of ESI Environment & Ecology are mainly supported by School of Environmental Science and Engineering.

Table 69 Top departments based on publication volume on Environment & Ecology of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
School of Environmental Science and Engineering	64	90.14%	269	89.67%	0.99
Materials Science and Engineering	2	2.82%	2	0.67%	0.24
Biology	1	1.41%	1	0.33%	0.24
Finance	1	1.41%	11	3.67%	2.60
Chemistry	1	1.41%	12	4.00%	2.84
Ocean Science and Engineering	1	1.41%	1	0.33%	0.24

4.10.2 Performance of top scholars

Table 70 shows the top scholars based on publication volume on Environment & Ecology. According to the table, Zheng Chunmiao and Liu Junguo, Professors from School of Environmental Science and Engineering, have far more publications than other scholars. In terms of CNCI, 7 scholars with the most publications also have excellent performance, whose CNCI are all close to or higher than the global average level.

Table 70 Top scholars based on publication volume on Environment & Ecology of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Zheng, Chunmiao	School of Environmental Science and Engineering	Chair Professor	15	91	1.43
Liu, Junguo	School of Environmental Science and Engineering	Professor	10	93	2.01

Name	Department name	Academic title	Number of publications	Citations	CNCI
Liu, Chongxuan	School of Environmental Science and Engineering	Chair Professor	8	19	0.93
Zheng, Yi	School of Environmental Science and Engineering	Professor	5	14	0.74
Wang, Hong	Materials Science and Engineering	Chair Professor	4	12	1.33
Hu, Qing	School of Environmental Science and Engineering	Professor	3	14	1.23
Liao, Peng	School of Environmental Science and Engineering	-	3	27	4.00
Cai, Ximing	School of Environmental Science and Engineering	Professor	2	1	0.22
Jeong, Su-Jong	School of Environmental Science and Engineering	-	2	11	2.45
Jiang, Jingjing	Finance	-	2	17	3.27
Jiang, Jiping	School of Environmental Science and Engineering	Assistant Professor	2	1	0.22
Tian, Yong	School of Environmental Science and Engineering	Assistant Professor	2	3	0.67
Zhang, Juan	School of Environmental Science and Engineering	-	2	8	0.89

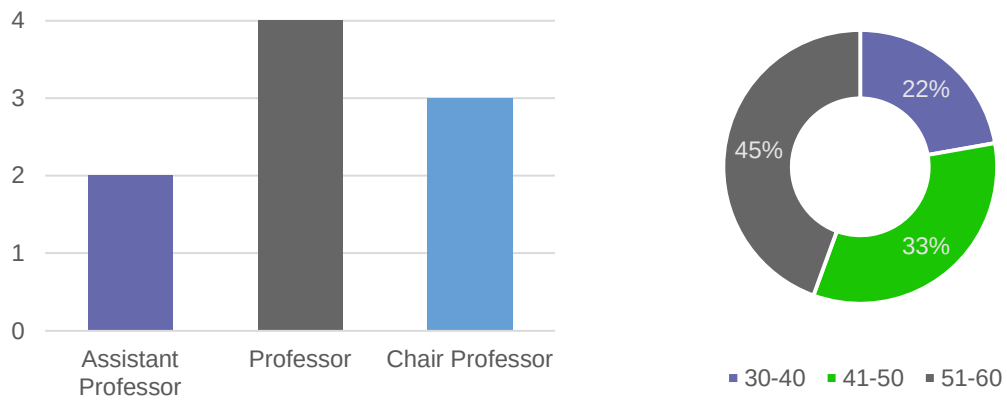

Figure 23 Analysis on academic title and age of top scholars on Environment & Ecology of Southern University of Science and Technology

Figure 23 shows that the academic titles of scholars with the most publications on ESI Environment & Ecology are mainly professors and the number of them is 4. At the same time, scholars aged between 51 and 60 are the main research group of this category.

In terms of the citation contribution of top scholars on Environment & Ecology, Professors Zheng Chunmiao and Liu Junguo are the highest, their citations account for nearly 1/2 of the whole category.

Table 71 Citation contribution of top scholars on Environment & Ecology

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Zheng, Chunmiao	School of Environmental Science and Engineering	91	348	26.15%
Liu, Junguo	School of Environmental Science and Engineering	93	348	26.72%
Liu, Chongxuan	School of Environmental Science and Engineering	19	348	5.46%
Zheng, Yi	School of Environmental Science and Engineering	14	348	4.02%
Wang, Hong	Materials Science and Engineering	12	348	3.45%
Hu, Qing	School of Environmental Science and Engineering	14	348	4.02%
Liao, Peng	School of Environmental Science and Engineering	27	348	7.76%
Cai, Ximing	School of Environmental Science and Engineering	1	348	0.29%
Jeong, Su-Jong	School of Environmental Science and Engineering	11	348	3.16%
Jiang, Jingjing	Finance	17	348	4.89%
Jiang, Jiping	School of Environmental Science and Engineering	1	348	0.29%
Tian, Yong	School of Environmental Science and Engineering	3	348	0.86%
Zhang, Juan	School of Environmental Science and Engineering	8	348	2.30%

In terms of departments of top scholars, School of Environmental Science and Engineering has absolute predominance, which has 11 scholars among total 13 ones, and the other two scholars are from Departments of Biology and Chemistry. Accordingly, the data indicates that the development of Environment & Ecology of Southern University of Science & Technology is mainly owed to the contribution of researchers from School of Environmental Science and Engineering.

Table 72 Analysis on departments of top scholars on Environment & Ecology of Southern University of Science and Technology

Department name	Number of scholars
School of Environmental Science and Engineering	11
Materials Science and Engineering	1
Finance	1

4.11 Geosciences

4.11.1 Performance of top departments

Table 73 shows the top departments based on publication volume on ESI Geosciences. It can be seen that although the overall publication scale of Geosciences is small, there are 5 departments participating in this category. Among them, Department of Ocean Science and Engineering is the most important one, with 25 papers and 76 citations. In terms of output efficiency, School of Environmental Science and Engineering performs well, reaching 2.11. Among all its publications, there is one highly cited paper from Professor Liu Junguo which has been cited 289 times. Generally speaking, ESI Geosciences is

supported by Department of Ocean Science and Engineering and School of Environmental Science and Engineering.

Table 73 Top departments based on publication volume on Geosciences of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Ocean Science and Engineering	25	45.45%	76	19.54%	0.43
School of Environmental Science and Engineering	19	34.55%	283	72.75%	2.11
Earth and Space Sciences	9	16.36%	7	1.80%	0.11
Physics	1	1.82%	18	4.63%	2.54
Mechanics and Aerospace Engineering	1	1.82%	5	1.29%	0.71

4.11.2 Performance of top scholars

Table 74 shows top scholars based on publications volume on Geosciences. Among them, Professor Zheng Chunmiao is the scholar with most publications on Environment & Ecology. However, as a whole, the number of publications on Geosciences is not high. In terms of CNCI, Professor Liu Junguo reaches 9.97, which is related to one of his highly cited papers[3] on *Nature* in 2015, which has been cited 289 times up to now.

Table 74 Top scholars based on publication volume on Geosciences of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Chen, Yongshun John	Ocean Science and Engineering	Chair Professor	10	39	1.12

[3] Title of the publication is *Reduced carbon emission estimates from fossil fuel combustion and cement production in China*

Name	Department name	Academic title	Number of publications	Citations	CNCI
Chen, Xiaofei	Earth and Space Sciences	Chair Professor	7	5	0.34
Zheng, Chunmiao	School of Environmental Science and Engineering	Chair Professor	7	28	0.97
Liu, Qingsong	Ocean Science and Engineering	Professor	6	20	1.58
Jeong, Su-Jong	School of Environmental Science and Engineering	-	5	25	2.37
Zhang, Wei	Earth and Space Sciences	Professor	5	3	0.28
Liu, Junguo	School of Environmental Science and Engineering	Professor	4	252	9.97
Guo, Zhen	Ocean Science and Engineering	Assistant Professor	2	6	1.42
Xu, Jiankuan	Academy for Advanced Interdisciplinary Studies	Assistant Professor	2	1	0.47
Yang, Ting	Ocean Science and Engineering	Professor	2	5	1.18
Zhang, You-kuan	School of Environmental Science and Engineering	Chair Professor	2	6	1.42
Zhang, Zhenguo	Earth and Space Sciences	Assistant Professor	2	2	0.47

Figure 24 shows that the academic titles of scholars with the most publications on ESI Geosciences are mainly professors and chair professors and the number of each is 4. At the same time, scholars aged between 41 and 50 are the main research group of this category.

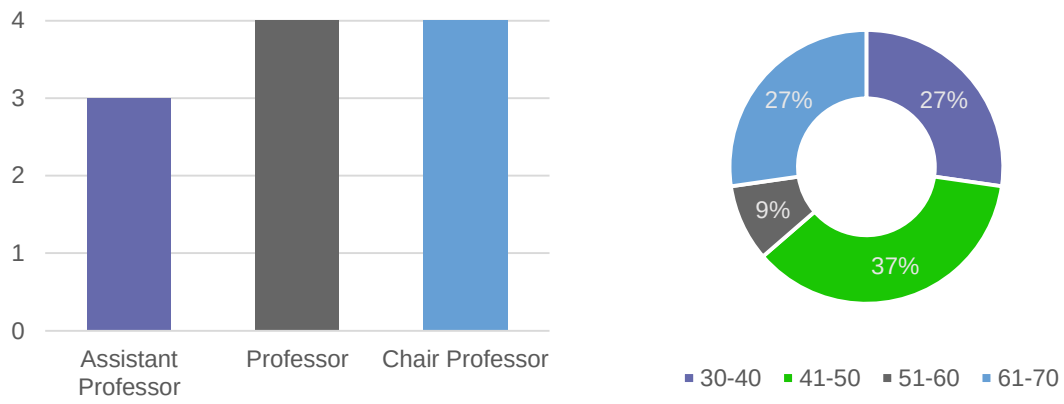

Figure 24 Analysis on academic title and age of top scholars on Geosciences of Southern University of Science and Technology

From the perspective of the citation contribution top scientific researchers in Geosciences, the citations of Professor Liu Junguo's highly cited papers is nearly three-fifths of the whole category. It demonstrates that a highly cited paper can usually promote and drive the rapid development of an ESI category.

Table 75 Citation contribution of top scholars on Geosciences

Name	Department name	Citations	Total citations of the category	Contribution to citation frequency
Chen, Yongshun John	Ocean Science and Engineering	39	442	8.82%
Chen, Xiaofei	Earth and Space Sciences	5	442	1.13%
Zheng, Chunmiao	School of Environmental Science and Engineering	28	442	6.33%
Liu, Qingsong	Ocean Science and Engineering	20	442	4.52%
Jeong, Su-Jong	School of Environmental Science and Engineering	25	442	5.66%
Zhang, Wei	Earth and Space Sciences	3	442	0.68%
Liu, Junguo	School of Environmental Science and Engineering	252	442	57.01%
Guo, Zhen	Ocean Science and Engineering	6	442	1.36%
Xu, Jiankuan	Academy for Advanced Interdisciplinary Studies	1	442	0.23%
Yang, Ting	Ocean Science and Engineering	5	442	1.13%
Zhang, You-kuan	School of Environmental Science and Engineering	6	442	1.36%
Zhang, Zhenguo	Earth and Space Sciences	2	442	0.45%

In terms of the department distribution of top scholars, there are four departments participating in Geosciences at present, representing the diversity of participants.

Table 76 Analysis on departments of top scholars on Geosciences of Southern University of Science and Technology

Department name	Number of scholars
School of Environmental Science and Engineering	4
Ocean Science and Engineering	4
Earth and Space Sciences	3
Academy for Advanced Interdisciplinary Studies	1

4.12 Molecular Biology & Genetics

4.12.1 Performance of top departments

Table 77 shows the top departments based on publication volume on ESI Molecular Biology & Genetics. As can be seen from the table, the major participating department is still from Department of Biology, with 44 papers and 288 citations. In addition, Shenzhen Key Lab Cell Microenvironment has published 16 papers. In terms of citation impact, although Department of Materials Science and Engineering only has 4 papers, it has obtained 72 citations, and output efficiency is 2.58, indicating that this department has made more citation contributions to Molecular Biology & Genetics.

Table 77 Top departments based on publication volume on Molecular Biology & Genetics of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Biology	44	77.19%	288	72.36%	0.94
Shenzhen Key Lab Cell Microenvironment	16	28.07%	82	20.60%	0.73

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Materials Science and Engineering	4	7.02%	72	18.09%	2.58
Academy for Advanced Interdisciplinary Studies	3	5.26%	1	0.25%	0.05
Biomedical Engineering	2	3.51%	12	3.02%	0.86
Chemistry	2	3.51%	20	5.03%	1.43

4.12.2 Performance of top scholars

Table 78 shows that in general, the number of papers published by all scholars in the Molecular Biology & Genetics is not too high. Among them, Wu Chuanyue, Professor of Department of Biology, is the highest-ranking scholar in the field of Molecular Biology & Genetics based on publication volume. According to CNCI, CNCI of 3 scholars exceed the global average level.

Table 78 Top scholars based on publication volume on Molecular Biology & Genetics of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Wu, Chuanyue	Biology	Chair Professor	7	37	0.82
Chen, Wei	Biology	Chair Professor	4	57	1.98
Xiao, Guozhi	Biology	Professor	4	30	0.57
He, Jiankui	Biology（Leave without pay）	Associate Professor	3	4	0.29
Hutchins, Andrew P.	Biology	Assistant Professor	3	9	0.93
Tang, Bin	Biomedical Engineering	Associate Professor	3	57	1.70
Wang, Guanyu	Biology	Associate Professor	3	4	0.29
Wang, Xingshun	Biology	-	3	13	0.42
Wei, Zhiyi	Biology	Associate Professor	3	54	1.16

Name	Department name	Academic title	Number of publications	Citations	CNCI
You, Jin	Biology	-	3	13	0.42
Zhang, Yandong	Biology	Assistant Professor	3	13	0.42

Figure 25 shows that the academic titles of scholars with the most publications on ESI Molecular Biology & Genetics are mainly associate professors and the number of them is 4. At the same time, scholars aged between 41 and 50 are the main research group of this category.

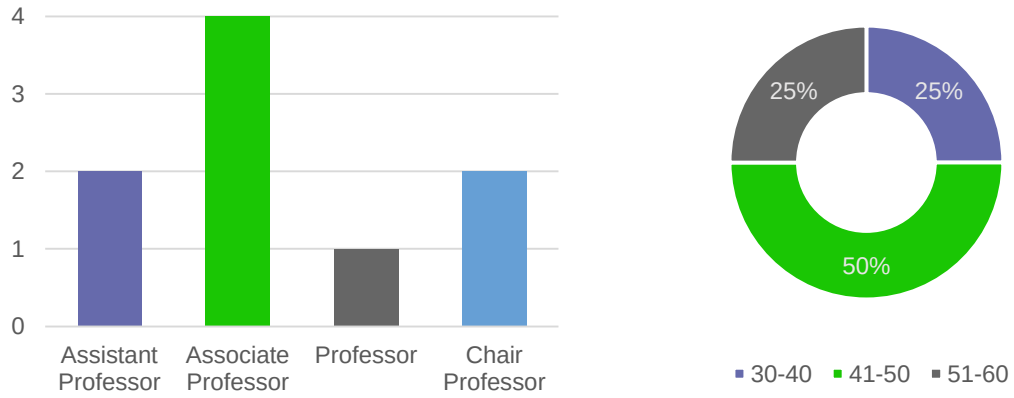

Figure 25 Analysis on academic title and age of top scholars on Molecular Biology & Genetics of Southern University of Science and Technology

From the citation contributions of top researchers, Chair Professor Chen Wei and Associate Professor Tang Bin contribute most.

Table 79 Citation contribution of top scholars on Molecular Biology & Genetics

Name	Department name	Citations	Total citations of the category	Citation contribution
Wu, Chuanyue	Biology	37	434	8.53%
Chen, Wei	Biology	57	434	13.13%
Xiao, Guozhi	Biology	30	434	6.91%
He, Jiankui	Biology (Leave without pay)	4	434	0.92%
Hutchins, Andrew P.	Biology	9	434	2.07%
Tang, Bin	Biomedical Engineering	57	434	13.13%
Wang, Guanyu	Biology	4	434	0.92%
Wang, Xingshun	Biology	13	434	3.00%
Wei, Zhiyi	Biology	54	434	12.44%
You, Jin	Biology	13	434	3.00%
Zhang, Yandong	Biology	13	434	3.00%

From the distribution of participating departments of top scholars, Department of Biology are the main participants.

Table 80 Analysis on departments of top scholars on Molecular Biology & Genetics of Southern University of Science and Technology

Department name	Number of scholars
Biology	10
Biomedical Engineering	1

4.13 Clinical Medicine

4.13.1 Performance of top departments

Table 81 shows the top departments based on publication volume on ESI Clinical Medicine. In terms of the number of publications, the papers of Clinical Medicine are mainly contributed by Department of Biology (20 papers), followed by Shenzhen Key Lab Cell Microenvironment (8 papers) and Department of Electrical and Electronic Engineering (7 papers). In terms of citation impact, Department of Biology still has the most citations (94 citations). In addition, despite the small output of Department of Materials Science and Engineering and

Academy for Advanced Interdisciplinary Studies, citations per paper perform well which indicates their publications have high impact. From the perspective of department distribution, we can see different departments have collaborated together which indicates that research in this category is a bit interdisciplinary. Based on the data, it is suggested that Southern University of Science and Technology can pay attention to such papers and identify more scientific researchers with interdisciplinary research background and ability.

Table 81 Top departments based on publication volume on Clinical Medicine of Southern University of Science and Technology

Department name	Number of publications	Percentage of papers	Citations	Percentage of citations	Percentage of citations / Percentage of papers
Biology	20	60.61%	94	54.97%	0.91
Shenzhen Key Lab Cell Microenvironment	8	24.24%	40	23.39%	0.96
Electrical and Electronic Engineering	7	21.21%	19	11.11%	0.52
Materials Science and Engineering	3	9.09%	52	30.41%	3.35
Biology	2	6.06%	6	3.51%	0.58
Biomedical Engineering	2	6.06%	6	3.51%	0.58
Academy for Advanced Interdisciplinary Studies	1	3.03%	12	7.02%	2.32

4.13.2 Performance of top scholars

Table 82 shows that in general, the number of papers published by all scholars in Clinical Medicine is not too high. Among them, Professor Xiao Guozhi from Department of Biology contributes most. According to CNCI, CNCI of 6 scholars exceed the global average level. Associate Professor Liang Yongye from Department of Materials Science and Engineering and Chair Professor

Chen Wei from Department of Biology have far more than 4-5 times the global average level.

Table 82 Top scholars based on publication volume on Clinical Medicine of Southern University of Science and Technology

Name	Department name	Academic title	Number of publications	Citations	CNCI
Xiao, Guozhi	Biology	Professor	7	41	1.14
Chen, Fei	Electrical and Electronic Engineering	Associate Professor	6	15	0.37
Zhu, Shufeng	Electrical and Electronic Engineering	-	3	6	0.28
Chen, Fangyi	Biology	Associate Professor	2	2	0.30
Chen, Wei	Biology	Chair Professor	2	19	4.67
Deng, Yi	Biology	Associate Professor	2	8	1.97
Liang, Yongye	Materials Science and Engineering	Associate Professor	2	22	5.40
Tian, Ruijun	Chemistry	Associate Professor	2	7	1.29
Zhang, Jian	Medicine	Professor	2	7	1.72

Figure 26 shows that the academic titles of scholars with the most publications on ESI Clinical Medicine are mainly associate professors and the number of them is 5. At the same time, scholars aged between 41 and 50 are the main research group of this category.

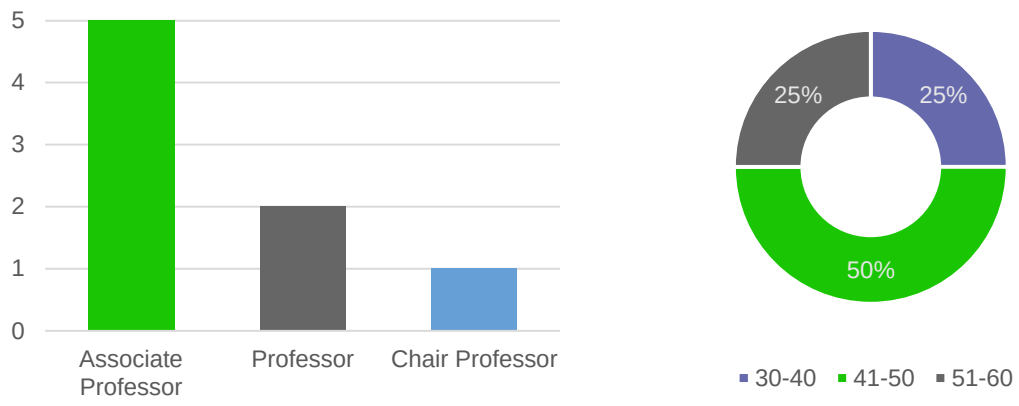

Figure 26 Analysis on academic title and age of top scholars on Clinical Medicine of Southern University of Science and Technology

From the citation contributions of top researchers on Clinical Medicine, the papers published by Professor Xiao Guozhi from Department of Biology have the most citations.

Table 83 Citation contribution of top scholars on Clinical Medicine

Name	Department name	Citations	Total citations of the category	Citation contribution
Xiao, Guozhi	Biology	41	192	21.35%
Chen, Fei	Electrical and Electronic Engineering	15	192	7.81%
Zhu, Shufeng	Electrical and Electronic Engineering	6	192	3.13%
Chen, Fangyi	Biology	2	192	1.04%
Chen, Wei	Biology	19	192	9.90%
Deng, Yi	Biology	8	192	4.17%
Liang, Yongye	Materials Science and Engineering	22	192	11.46%
Tian, Ruijun	Chemistry	7	192	3.65%
Zhang, Jian	Medicine	7	192	3.65%

From the perspective of the department distribution, the ESI Clinical Medicine are mainly concentrated in Department of Biology, and scholars from Department of Electronics and Electrical Engineering, Materials Science and Engineering, Chemistry, and Medicine also contribute to this category.

Table 84 Analysis on departments of top scholars on Clinical Medicine of Southern University of Science and Technology

Department name	Number of scholars
Biology	5
Electrical and Electronic Engineering	2
Materials Science and Engineering	1
Chemistry	1
Medicine	1

4.14 High-yielding scholars in Southern University of Science and Technology

Table 85 shows the top 20 scholars with the most publications in Southern University of Science and Technology on all categories. Firstly, in terms of publication volume, Sun Xiaowei, Professor from Department of Electrical and Electronic Engineering, and Lu Zhouguang, Professor from Department of Materials Science and Engineering, have most publications. Secondly, in terms CNCI, the CNCI of most high-yielding scholars are higher than global average level 1; that of Liang Yongye, Associate Professor from Department of Materials Science and Engineering, reaches 5.71, which indicates his research has attracted lots of attention in this area. Combined with publications and the citation impact (Figure 27), Professor He Jiaqing from Department of Physics is the scholar with outstanding academic performance in Southern University of Science and Technology. Finally, as can be seen from Figure 28, the academic titles of top 20 scholars with the most publications are distributed evenly, mainly including associate professors (6 persons), assistant professors (5 persons) and professors (5 persons). Scholars aged 30-40 and 41-50 are the main research group of the university.

Table 85 Top 20 scholars based on publication volume in Southern University of Science and Technology

Name	Department name	Number of publications	Citations	CNCI
Sun Xiaowei	Electrical and Electronic Engineering	77	1,200	2.13
Lu Zhouguang	Materials Science and Engineering	63	1,122	2.32
He Jiaqing	Physics	56	2,040	4.65
Chen Shuming	Electrical and Electronic Engineering	45	474	2.20
Liu Xinyuan	Chemistry	43	1314	3.52
Zhang Xumu	Chemistry	38	185	1.22
Li Jingzhi	Mathematics	36	177	1.23
Wang Kai	Electrical and Electronic Engineering	35	549	2.43
Xu Hu	Physics	34	215	1.04
Yu Hongyu	Electrical and Electronic Engineering	34	465	0.97
Tan Bin	Chemistry	32	1478	3.76
Luo Dan	Electrical and Electronic Engineering	31	125	0.82
Zheng Chunmiao	School of Environmental Science and Engineering	31	185	1.53
Huang Li	Physics	30	262	1.61
NG, Alan Man-Ching	Physics	29	603	1.52
Deng Yinghong	Materials Science and Engineering	27	228	2.40
Liang Yongye	Materials Science and Engineering	27	1124	5.71
Xu Zongxiang	Chemistry	27	221	1.62
Zhang Qingfeng	Electrical and Electronic Engineering	26	108	1.12
Chen Rui	Electrical and Electronic Engineering	26	173	1.15
Chen Wei	Biology	26	374	2.92

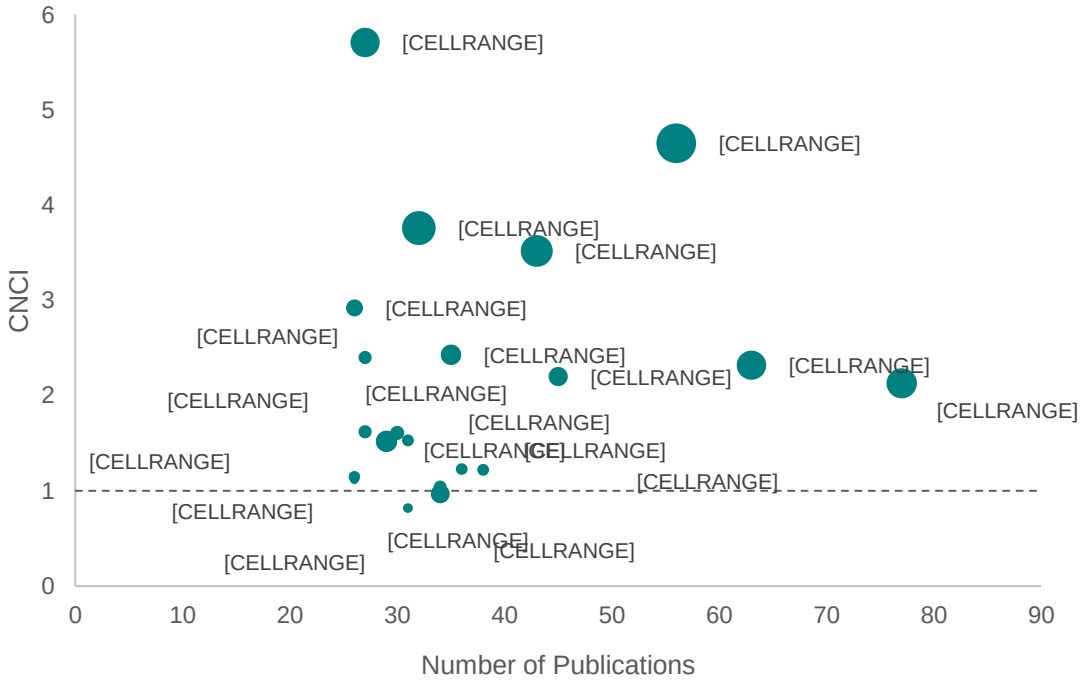

Figure 27 Number of publications and CNCI of top 20 scholars of Southern University of Science and Technology

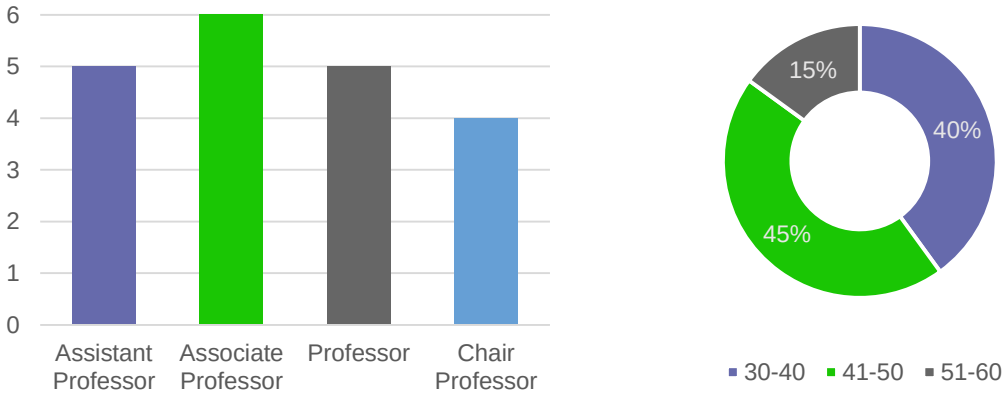

Figure 28 Analysis on academic title and age of top 20 scholars of Southern University of Science and Technology

Chapter V Journal analysis on 12 ESI Categories of Southern Universities of Science and Technology

This chapter will analyze the journals of Southern University of Science and Technology on 12 ESI categories. Through the analysis on the journals, we can examine whether a university's publications on a certain category are on the important journals within the category, and check the differences in the category research direction.

5.1 Top journals on Chemistry

Tables in this section provide top 10 journals with the most publications of seven universities on ESI Chemistry respectively. Indicator “percentile” means journal impact factor’s relative location on journals of the same category (Segment category of Web of Science). If the percentile of journal impact factor is 90, it indicates that its impact factor is higher than 90% journals in the same category. The definition of JNCI is similar to that of CNCI, CNCI refers to the comparison of citations between a publication and other publications of the same year, category and document type, and JNCI refers to the comparison of citations between a publication and other publications of the same year, journal and document type. If JNCI is higher than 1, it shows that the citation performance of the publication is higher than average citation performance of publication on the same journal. “Number of publications” in Table 86 means the number of publications of Southern University of Science and Technology on the corresponding journals, and JNCI means JNCI of publications of Southern University of Science and Technology on this journal.

Table 86 to Table 92 provide the journals with the most publications of seven universities on ESI Chemistry respectively. On the whole, the major publication journals on ESI Chemistry of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI

Chemistry have been widely recognized by the international academic community. On the aspect of the number of publications, *RSC Advances* belongs to Q2, and is also one of the most publication journals on ESI Chemistry of seven universities including Southern University of Science and Technology (44 papers), University of Chinese Academy of Sciences (1097 papers), Nanyang Technological University (295 papers), Hong Kong University of Science and Technology (88 papers), and Pohang University of Science and Technology (101 papers), King Abdullah University of Science and Technology (66 papers), ShanghaiTech University (13 papers). In addition, *CHEMICAL COMMUNICATIONS*, *ANGEWANDTE CHEMIE-INTERNATIONAL EDITION*, *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY* and *JOURNAL OF PHYSICAL CHEMISTRY CA* also published many papers, and these four journals are also in the top 10 publication journals of the seven universities. In terms of JNCI, the JNCI of papers of Nanyang Technological University in its top 10 publication journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received more attention in the same journal. Pohang University of Science and Technology needs to be promoted because of the citation performance of papers published in 6 journals, which is lower than the average citation performance of papers published in the same journal.

Table 86 Top journals on Chemistry of Southern University of Science and Technology

Journal	Impact factor	Quartile[4]	Percentile[5]	Number of publications	JNCI
RSC ADVANCES	2.936	Q2	58.772	44	1.3
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	38	1.07
ORGANIC LETTERS	6.492	Q1	95.614	34	1.15
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	30	1.01
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	28	1.43
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	24	1
CHEMISTRY-A EUROPEAN JOURNAL	5.16	Q1	78.655	18	1.61
CHEMICAL SCIENCE	9.063	Q1	89.766	16	0.99
ACS NANO	13.709	Q1	95.965	13	0.73
ORGANIC CHEMISTRY FRONTIERS	5.455	Q1	92.105	13	0.86
ACS CATALYSIS	11.384	Q1	91.438	12	1.3
PHYSICAL CHEMISTRY CHEMICAL PHYSICS	3.906	Q1	76.389	12	1.2

Table 87 Top journals on Chemistry of University of Chinese Academy of Sciences

[4] When a journal belongs to multiple categories (Web of Science) at the same time, only the better quartile in multiple categories will be shown. Similarly hereinafter.

[5] When a journal belongs to multiple categories (Web of Science) at the same time, only the highest percentile in multiple categories will be shown. Similarly hereinafter.

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
RSC ADVANCES	2.936	Q2	58.772	1097	0.98
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	438	1.15
DALTON TRANSACTIONS	4.099	Q1	87.778	220	1.10
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	208	1.76
ORGANIC LETTERS	6.492	Q1	95.614	194	1.20
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	192	2.25
ELECTROCHIMICA ACTA	5.116	Q1	83.929	191	1.16
ANALYTICAL CHEMISTRY	6.042	Q1	95.625	186	1.19
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	185	1.21
INORGANIC CHEMISTRY	4.7	Q1	90.000	179	1.27
PHYSICAL CHEMISTRY CHEMICAL PHYSICS	3.906	Q1	76.389	179	1.21

Table 88 Top journals on Chemistry of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
RSC ADVANCES	2.936	Q2	58.772	295	1.14
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	221	1.79
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	172	1.43
ACS NANO	13.709	Q1	95.965	155	1.66
CHEMISTRY-A EUROPEAN JOURNAL	5.16	Q1	78.655	136	1.25
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	127	1.42

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MEMBRANE SCIENCE	6.578	Q1	97.126	113	1.32
PHYSICAL CHEMISTRY CHEMICAL PHYSICS	3.906	Q1	76.389	111	1.12
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	111	1.3
ELECTROCHIMICA ACTA	5.116	Q1	83.929	90	1.03

Table 89 Top journals on Chemistry of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
RSC ADVANCES	2.936	Q2	58.772	88	0.92
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	75	1.43
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	45	1.4
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	44	1.47
INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH	3.141	Q1	76.277	44	1.16
ACS NANO	13.709	Q1	95.965	43	1.28
CHEMISTRY-A EUROPEAN JOURNAL	5.16	Q1	78.655	43	1.32
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	43	2.2
POLYMER CHEMISTRY	4.927	Q1	91.379	42	1
ELECTROCHIMICA ACTA	5.116	Q1	83.929	42	1.31

Table 90 Top journals on Chemistry of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
RSC ADVANCES	2.936	Q2	58.772	101	0.87
ACS NANO	13.709	Q1	95.965	89	0.95
SCIENTIFIC REPORTS	4.122	Q1	82.031	58	1.68
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	55	0.96
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	53	0.66
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	52	1.15
MACROMOLECULES	5.914	Q1	94.828	51	0.91
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	48	1.24
PHYSICAL CHEMISTRY CHEMICAL PHYSICS	3.906	Q1	76.389	39	1.11
ENERGY & ENVIRONMENTAL SCIENCE	30.067	Q1	99.793	29	1.03

Table 91 Top journals on Chemistry of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	83	1.76
JOURNAL OF MEMBRANE SCIENCE	6.578	Q1	97.126	79	1.53
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	78	1.04
RSC ADVANCES	2.936	Q2	58.772	66	1.05
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	53	0.84
ACS NANO	13.709	Q1	95.965	46	1.48
PHYSICAL CHEMISTRY CHEMICAL PHYSICS	3.906	Q1	76.389	45	1.28

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	43	1.59
ACS CATALYSIS	11.384	Q1	91.438	42	0.78
CHEMISTRY-A EUROPEAN JOURNAL	5.16	Q1	78.655	38	1.23

Table 92 Top journals on Chemistry of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	14.357	Q1	95.614	18	1.44
RSC ADVANCES	2.936	Q2	58.772	13	1.08
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	12.102	Q1	92.105	13	1.07
ORGANIC LETTERS	6.492	Q1	95.614	12	1.47
JOURNAL OF MEDICINAL CHEMISTRY	6.253	Q1	95.763	12	0.61
CHEMICAL COMMUNICATIONS	6.29	Q1	83.918	10	1.2
PHYSICAL CHEMISTRY CHEMICAL PHYSICS	3.906	Q1	76.389	10	0.6
JOURNAL OF PHYSICAL CHEMISTRY C	4.484	Q1	81.228	10	1.2
ACS CATALYSIS	11.384	Q1	91.438	9	1.16
SCIENTIFIC REPORTS	4.122	Q1	82.031	7	1.51

5.2 Top journals on Physics

Table 93 to Table 99 provide the journals with the most publications of seven universities on ESI Physics respectively. On the whole, the major publication journals on ESI Physics of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI

Physics have been widely recognized by the international academic community. On the aspect of the number of publications, *SCIENTIFIC REPORTS* belongs to Q1, and is also one of the most publication journals on ESI Physics of seven universities including Southern University of Science and Technology (38 papers), University of Chinese Academy of Sciences (11 papers), Nanyang Technological University (165 papers), Hong Kong University of Science and Technology (56 papers), Pohang University of Science and Technology (83 papers), King Abdullah University of Science and Technology (70 papers), ShanghaiTech University (14 papers). In addition, *APPLIED PHYSICS LETTERS* and *NANOSCALE* also published many publications, and these two journals are also in the top 10 publication journals of the seven universities. In terms of JNCI, the JNCI of papers of Hong Kong University of Science and Technology in 9 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received more attention in the same journal. Pohang University of Science and Technology need to be promoted because of the citation performance of papers published in 10 journals, which is lower than the average citation performance of papers published in the same journal.

Table 93 Top journals on Physics of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PHYSICAL REVIEW B	3.813	Q2	73.881	67	1.04
SCIENTIFIC REPORTS	4.122	Q1	82.031	38	1.11
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	34	0.77
OPTICS EXPRESS	3.356	Q1	80.319	21	0.71
JOURNAL OF APPLIED PHYSICS	2.176	Q2	60.616	15	0.83
NANOSCALE	7.233	Q1	90.068	13	1.11

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ORGANIC ELECTRONICS	3.68	Q1	81.164	13	1.16
NATURE COMMUNICATIONS	12.353	Q1	96.094	12	2.41
NANO LETTERS	12.08	Q1	94.178	9	1.51
NANOSCALE RESEARCH LETTERS	3.125	Q1	77.740	8	0.44
PHYSICAL REVIEW LETTERS	8.839	Q1	92.949	8	1

Table 94 Top journals on Physics of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ACTA PHYSICA SINICA	0.669	Q4	18.590	313	0.94
NANOSCALE	7.233	Q1	90.068	294	1.29
CHINESE PHYSICS B	1.321	Q3	42.949	289	0.79
OPTICS EXPRESS	3.356	Q1	80.319	259	0.90
PHYSICAL REVIEW D	4.394	Q1	78.030	236	0.86
APPLIED OPTICS	1.791	Q3	48.404	222	0.79
CHINESE PHYSICS C	3.298	Q2	67.500	215	0.77
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	208	0.85
CHINESE PHYSICS LETTERS	0.847	Q4	23.718	194	1.11
SCIENTIFIC REPORTS	4.122	Q1	82.031	139	1.10

Table 95 Top journals on Physics of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
NANOSCALE	7.233	Q1	90.068	281	1.26
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	263	1.28
OPTICS EXPRESS	3.356	Q1	80.319	235	1.59
SCIENTIFIC REPORTS	4.122	Q1	82.031	165	1.14
PHYSICAL REVIEW B	3.813	Q2	73.881	163	1.12
JOURNAL OF APPLIED PHYSICS	2.176	Q2	60.616	105	1.1
PHYSICAL REVIEW A	2.909	Q1	76.064	91	0.84
NANO LETTERS	12.08	Q1	94.178	81	1.59
OPTICS LETTERS	3.589	Q1	85.638	78	1.12
PHYSICAL REVIEW LETTERS	8.839	Q1	92.949	63	1.12

Table 96 Top journals on Physics of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF HIGH ENERGY PHYSICS	5.541	Q1	87.931	113	1.42
EUROPEAN PHYSICAL JOURNAL C	5.172	Q1	84.483	88	2.35
PHYSICAL REVIEW B	3.813	Q2	73.881	86	1.29
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	83	1.36
PHYSICAL REVIEW LETTERS	8.839	Q1	92.949	71	1.01
PHYSICAL REVIEW D	4.394	Q1	78.030	65	1.57

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENTIFIC REPORTS	4.122	Q1	82.031	56	0.99
NANOSCALE	7.233	Q1	90.068	55	1.08
PHYSICS LETTERS B	4.254	Q1	82.500	52	1.92
PHYSICAL REVIEW E	2.284	Q1	88.182	41	1.1

Table 97 Top journals on Physics of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PHYSICAL REVIEW B	3.813	Q2	73.881	150	0.87
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	89	0.85
JOURNAL OF THE KOREAN PHYSICAL SOCIETY	0.493	Q4	4.487	87	0.62
SCIENTIFIC REPORTS	4.122	Q1	82.031	83	0.95
NANOSCALE	7.233	Q1	90.068	73	0.74
PHYSICAL REVIEW LETTERS	8.839	Q1	92.949	60	0.75
NANO LETTERS	12.08	Q1	94.178	41	0.9
JOURNAL OF APPLIED PHYSICS	2.176	Q2	60.616	33	0.83
NATURE COMMUNICATIONS	12.353	Q1	96.094	33	0.99
JOURNAL OF HIGH ENERGY PHYSICS	5.541	Q1	87.931	31	0.59

Table 98 Top journals on Physics of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	98	1.36
PHYSICAL REVIEW B	3.813	Q2	73.881	72	1.64
SCIENTIFIC REPORTS	4.122	Q1	82.031	70	1.17
NANOSCALE	7.233	Q1	90.068	59	1.08
JOURNAL OF APPLIED PHYSICS	2.176	Q2	60.616	44	1.26
NANO LETTERS	12.08	Q1	94.178	36	1.44
OPTICS EXPRESS	3.356	Q1	80.319	36	1.9
JOURNAL OF COMPUTATIONAL PHYSICS	2.864	Q1	95.455	24	1.22
EPL	1.834	Q2	54.487	23	0.94
IEEE PHOTONICS JOURNAL	2.627	Q2	71.809	19	1.67
NATURE COMMUNICATIONS	12.353	Q1	96.094	19	2.04

Table 99 Top journals on Physics of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PHYSICAL REVIEW B	3.813	Q2	73.881	25	2.13
PHYSICAL REVIEW C	3.304	Q2	72.500	20	0.83
OPTICS EXPRESS	3.356	Q1	80.319	17	1.03
SCIENTIFIC REPORTS	4.122	Q1	82.031	14	1.63
APPLIED PHYSICS LETTERS	3.495	Q1	80.479	13	0.57
NANOSCALE	7.233	Q1	90.068	11	0.73

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
NATURE COMMUNICATIONS	12.353	Q1	96.094	11	2.02
PHYSICAL REVIEW LETTERS	8.839	Q1	92.949	10	0.81
CHINESE OPTICS LETTERS	1.948	Q2	53.723	8	0.91
NUCLEAR SCIENCE AND TECHNIQUES	1.085	Q3	46.970	7	1.5
NANO LETTERS	12.08	Q1	94.178	7	0.91

5.3 Top journals on Materials Science

Table 100 to Table 106 provide the journals with the most publications of seven universities on ESI Materials Science respectively. On the whole, the major publication journals on ESI Material Science of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Material Science have been widely recognized by the international academic community. On the aspect of the number of publications, *ACS APPLIED MATERIALS & INTERFACES* belongs to Q1, and is also one of the most publication journals on ESI Materials Science of seven universities——Southern University of Science and Technology (43 papers), University of Chinese Academy of Sciences (555 papers), Nanyang Technological University (257 papers), Hong Kong University of Science and Technology (81 papers), Pohang University of Science and Technology (156 papers), King Abdullah University of Science and Technology (90 papers), Shanghaitech University (10 papers). In addition, *JOURNAL OF MATERIALS CHEMISTRY A* and *ADVANCED MATERIALS* also published many publications, and these two journals are also in the top 10 publication journals of the seven universities. In terms of JNCI, the JNCI of papers of Nanyang Technological University and the Hong Kong University of Science and Technology in 10 journals are all higher

than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and it is the papers that received more attention in the same journal. ShanghaiTech University needs to be promoted because of the citation performance of papers published in 9 journals, which is lower than the average citation performance of the same journal.

Table 100 Top journals on Materials Science of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	43	1.15
JOURNAL OF MATERIALS CHEMISTRY C	5.976	Q1	86.644	24	1.38
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	24	1.06
ADVANCED MATERIALS	21.95	Q1	98.973	17	1.04
NANOTECHNOLOGY	3.404	Q1	79.795	16	0.81
JOURNAL OF ALLOYS AND COMPOUNDS	3.779	Q1	95.333	15	1.42
APPLIED SURFACE SCIENCE	4.439	Q1	97.368	14	1.06
AIP ADVANCES	1.653	Q3	44.863	13	0.54
CHEMISTRY OF MATERIALS	9.89	Q1	92.807	12	1.36
ADVANCED FUNCTIONAL MATERIALS	13.325	Q1	96.233	12	1.47

Table 101 Top journals on Materials Science of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	555	1.19

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	446	0.99
JOURNAL OF MATERIALS CHEMISTRY C	5.976	Q1	86.644	278	1.20
ADVANCED MATERIALS	21.95	Q1	98.973	224	1.45
JOURNAL OF ALLOYS AND COMPOUNDS	3.779	Q1	95.333	201	0.91
CERAMICS INTERNATIONAL	3.057	Q1	94.444	188	0.84
JOURNAL OF POWER SOURCES	6.945	Q1	91.237	158	1.09
APPLIED SURFACE SCIENCE	4.439	Q1	97.368	154	1.02
MATERIALS LETTERS	2.687	Q2	70.205	137	0.99
SMALL	9.598	Q1	93.493	134	0.88

Table 102 Top journals on Materials Science of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	257	1.13
SMALL	9.598	Q1	93.493	224	1.63
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	208	1.45
ADVANCED MATERIALS	21.95	Q1	98.973	189	1.47
ADVANCED FUNCTIONAL MATERIALS	13.325	Q1	96.233	92	1.37
JOURNAL OF POWER SOURCES	6.945	Q1	91.237	76	1.34
JOURNAL OF MATERIALS CHEMISTRY C	5.976	Q1	86.644	75	1.41
NANO ENERGY	13.12	Q1	95.548	75	1.04

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ADVANCED ENERGY MATERIALS	21.875	Q1	98.288	70	1.35
JOURNAL OF ALLOYS AND COMPOUNDS	3.779	Q1	95.333	62	1.13

Table 103 Top journals on Materials Science of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	82	1.14
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	81	1.29
JOURNAL OF MATERIALS CHEMISTRY C	5.976	Q1	86.644	67	1.36
CONSTRUCTION AND BUILDING MATERIALS	3.485	Q1	91.797	62	1.8
JOURNAL OF POWER SOURCES	6.945	Q1	91.237	61	1.21
ADVANCED MATERIALS	21.95	Q1	98.973	59	1.37
ADVANCED FUNCTIONAL MATERIALS	13.325	Q1	96.233	33	1.18
NANO ENERGY	13.12	Q1	95.548	29	1.17
JOURNAL OF MATERIALS CHEMISTRY B	4.776	Q1	77.273	24	1.61
SMALL	9.598	Q1	93.493	20	1.81
ADVANCED ENERGY MATERIALS	21.875	Q1	98.288	20	1.17

Table 104 Top journals on Materials Science of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	156	0.77
METALLURGICAL AND MATERIALS TRANSACTIONS A-PHYSICAL METALLURGY AND MATERIALS SCIENCE	1.887	Q2	75.333	117	1.27
MATERIALS SCIENCE AND ENGINEERING A-STRUCTURAL MATERIALS PROPERTIES MICROSTRUCTURE AND PROCESSING	3.414	Q1	91.333	113	1.12
METALS AND MATERIALS INTERNATIONAL	1.952	Q1	82.000	82	1.31
ADVANCED MATERIALS	21.95	Q1	98.973	75	0.83
CHEMISTRY OF MATERIALS	9.89	Q1	92.807	62	1
ISIJ INTERNATIONAL	1.35	Q2	56.667	61	0.84
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	58	0.6
JOURNAL OF MATERIALS CHEMISTRY C	5.976	Q1	86.644	56	0.61
JOURNAL OF NANOSCIENCE AND NANOTECHNOLOGY	1.354	Q3	33.626	54	0.48

Table 105 Top journals on Materials Science of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	90	0.98
ADVANCED MATERIALS	21.95	Q1	98.973	79	0.88
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	67	1.03
CHEMISTRY OF MATERIALS	9.89	Q1	92.807	64	1.08

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MATERIALS CHEMISTRY C	5.976	Q1	86.644	44	0.97
ADVANCED FUNCTIONAL MATERIALS	13.325	Q1	96.233	38	0.78
ADVANCED ENERGY MATERIALS	21.875	Q1	98.288	35	0.93
SMALL	9.598	Q1	93.493	24	0.73
NANO ENERGY	13.12	Q1	95.548	23	1.1
ACS ENERGY LETTERS	12.277	Q1	98.214	16	1.88

Table 106 Top journals on Materials Science of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MATERIALS CHEMISTRY A	9.931	Q1	94.330	16	0.99
ADVANCED MATERIALS	21.95	Q1	98.973	13	0.86
ACS APPLIED MATERIALS & INTERFACES	8.097	Q1	91.053	10	1.08
MICROPOROUS AND MESOPOROUS MATERIALS	3.649	Q1	83.803	9	0.85
AIP ADVANCES	1.653	Q3	44.863	5	0.7
APPLIED SURFACE SCIENCE	4.439	Q1	97.368	5	0.63
CHEMISTRY OF MATERIALS	9.89	Q1	92.807	4	0.72
JOURNAL OF POWER SOURCES	6.945	Q1	91.237	4	0.89
CERAMICS INTERNATIONAL	3.057	Q1	94.444	4	0.36
NANO ENERGY	13.12	Q1	95.548	3	1.18
JOURNAL OF THE AMERICAN CERAMIC SOCIETY	2.956	Q1	90.741	3	1.47

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
NATURE MATERIALS	39.235	Q1	99.658	3	1.36
JOURNAL OF THE EUROPEAN CERAMIC SOCIETY	3.794	Q1	98.148	3	0.73

5.4 Top journals on Engineering

Table 107 to Table 113 provide the journals with the most publications of seven universities on ESI Engineering respectively. On the whole, the major publication journals on ESI Engineering of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Engineering have been widely recognized by the international academic community. On the aspect of the number of publications, *APPLIED ENERGY* belongs to Q1, and is also one of the most publication journals on ESI Physics of four universities including Southern University of Science and Technology (5 papers), University of Chinese Academy of Sciences (38 papers), Nanyang Technological University (59 papers), Hong Kong University of Science and Technology (33 papers). In addition, *IEEE TRANSACTIONS ON ELECTRON DEVICES*, *IEEE ACCESS*, *IEEE ELECTRON DEVICE LETTERS* and *INTERNATIONAL JOURNAL OF HYDROGEN ENERGY* also published many publications, and these four journals are also in the top 10 publication journals of three universities. Among the major publication journals on ESI Engineering in seven universities, the journals of IEEE are more impressive. Six of the top 10 publication journals of Nanyang University of Technology are IEEE journals, as well as seven of top 10 journals in Hong Kong University of Science and Technology, and nine of top 14 journals in ShanghaiTech University. In terms of JNCI, the JNCI of papers of University of Chinese Academy of Sciences and Hong Kong University of Science and Technology in 8 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received more attention in the same journal. ShanghaiTech

University needs to be promoted because of the citation performance of papers published in 5 journals, which is lower than the average citation performance of papers published in the same journal.

Table 107 Top journals on Engineering of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF HYDROLOGY	3.727	Q1	94.922	10	0.82
IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS	2.169	Q2	58.269	8	0.82
IEEE TRANSACTIONS ON ELECTRON DEVICES	2.62	Q2	68.151	8	0.8
IEEE ACCESS	3.557	Q1	84.122	7	1.8
IEEE ELECTRON DEVICE LETTERS	3.433	Q1	79.808	6	0.61
JOURNAL OF FLUID MECHANICS	2.893	Q1	88.433	6	0.73
APPLIED ENERGY	7.9	Q1	97.445	5	1.34
IEEE ANTENNAS AND WIRELESS PROPAGATION LETTERS	3.448	Q1	80.192	5	1.58
INTERNATIONAL JOURNAL OF HYDROGEN ENERGY	4.229	Q1	75.773	5	2.44
IET COMMUNICATIONS	1.443	Q3	38.654	5	3

Table 108 Top journals on Engineering of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ENERGY & FUELS	3.024	Q2	74.088	139	1.28
CHEMICAL ENGINEERING JOURNAL	6.735	Q1	95.255	129	1.06
INTERNATIONAL JOURNAL OF HYDROGEN ENERGY	4.229	Q1	75.773	103	1.04

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
FUEL	4.908	Q1	90.876	97	1.30
APPLIED THERMAL ENGINEERING	3.771	Q1	92.910	87	1.10
JOURNAL OF HAZARDOUS MATERIALS	6.434	Q1	94.813	84	1.05
APPLIED ENERGY	7.9	Q1	97.445	83	0.99
TRIBOLOGY INTERNATIONAL	3.246	Q1	87.891	82	1.18
OPTICAL ENGINEERING	0.993	Q4	20.745	80	0.60
JOURNAL OF HYDROLOGY	3.727	Q1	94.922	66	1.16

Table 109 Top journals on Engineering of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON IMAGE PROCESSING	5.071	Q1	92.045	102	1.32
IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS	7.05	Q1	99.180	71	1.41
IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY	4.432	Q1	92.857	68	0.75
IEEE TRANSACTIONS ON VERY LARGE SCALE INTEGRATION (VLSI) SYSTEMS	1.744	Q2	60.577	62	1.09
AUTOMATICA	6.126	Q1	95.902	61	1.52
APPLIED ENERGY	7.9	Q1	97.445	59	1.26
APPLIED THERMAL ENGINEERING	3.771	Q1	92.910	58	1.09
IEEE SIGNAL PROCESSING LETTERS	2.813	Q2	70.962	55	1.44
IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS	2.823	Q2	71.731	54	0.8
CHEMICAL ENGINEERING JOURNAL	6.735	Q1	95.255	53	0.97

Table 110 Top journals on Engineering of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON SIGNAL PROCESSING	4.203	Q1	87.885	96	1.27
IEEE ELECTRON DEVICE LETTERS	3.433	Q1	79.808	66	1.28
IEEE TRANSACTIONS ON ELECTRON DEVICES	2.62	Q2	68.151	66	1.65
CANADIAN GEOTECHNICAL JOURNAL	2.565	Q2	70.833	51	1.57
TRANSPORTATION RESEARCH PART B-METHODOLOGICAL	4.081	Q1	97.266	41	1.22
IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING	2.775	Q1	75.379	35	0.94
APPLIED ENERGY	7.9	Q1	97.445	33	1.27
IEEE JOURNAL OF SOLID-STATE CIRCUITS	4.075	Q1	87.115	31	1.37
IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY	4.432	Q1	92.857	29	0.96
IEEE TRANSACTIONS ON AUTOMATIC CONTROL	5.007	Q1	90.577	29	1.55

Table 111 Top journals on Engineering of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE ELECTRON DEVICE LETTERS	3.433	Q1	79.808	30	1.15
INTERNATIONAL JOURNAL OF PLASTICITY	5.502	Q1	98.828	28	0.93
ELECTRONICS LETTERS	1.232	Q3	29.423	24	1.02
CHEMICAL ENGINEERING JOURNAL	6.735	Q1	95.255	24	0.89

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
INTERNATIONAL JOURNAL OF HYDROGEN ENERGY	4.229	Q1	75.773	23	0.57
IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS	7.05	Q1	99.180	22	0.99
INTERNATIONAL JOURNAL OF HEAT AND MASS TRANSFER	3.891	Q1	93.657	21	1.09
IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES	3.176	Q1	77.500	20	1.39
MICROELECTRONIC ENGINEERING	2.02	Q2	57.192	19	1.13
IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS	2.169	Q2	58.269	18	0.83
JOURNAL OF NUCLEAR MATERIALS	2.447	Q1	95.455	18	0.78
NUCLEAR ENGINEERING AND DESIGN	1.19	Q2	56.061	18	1.19

Table 112 Top journals on Engineering of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
COMBUSTION AND FLAME	4.494	Q1	95.930	76	1.48
DESALINATION AND WATER TREATMENT	1.383	Q3	41.971	46	1.71
PROCEEDINGS OF THE COMBUSTION INSTITUTE	5.336	Q1	98.047	39	1.16
IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY	4.432	Q1	92.857	32	0.73
FUEL	4.908	Q1	90.876	28	1.1
JOURNAL OF FLUID MECHANICS	2.893	Q1	88.433	25	0.99
IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION	4.13	Q1	87.500	21	0.85
MICROELECTRONIC ENGINEERING	2.02	Q2	57.192	21	1.01

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE ACCESS	3.557	Q1	84.122	20	0.69
COMBUSTION SCIENCE AND TECHNOLOGY	1.132	Q3	40.116	18	1.19
IEEE TRANSACTIONS ON SIGNAL PROCESSING	4.203	Q1	87.885	18	0.8

Table 113 Top journals on Engineering of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON SIGNAL PROCESSING	4.203	Q1	87.885	9	0.56
IEEE TRANSACTIONS ON IMAGE PROCESSING	5.071	Q1	92.045	6	3.12
IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY	4.432	Q1	92.857	6	1.23
IEEE SIGNAL PROCESSING LETTERS	2.813	Q2	70.962	5	1.46
INTERNATIONAL JOURNAL OF COMPUTER VISION	11.541	Q1	99.621	4	0.65
IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS	2.743	Q1	84.302	3	3.4
IEEE SENSORS JOURNAL	2.617	Q1	77.869	3	1.46
CHEMICAL ENGINEERING JOURNAL	6.735	Q1	95.255	3	2.55
IEEE ACCESS	3.557	Q1	84.122	3	0.2
IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY	3.558	Q1	82.115	2	0.15
INTERNATIONAL JOURNAL OF OPTOMECHATRONICS	0.882	Q4	20.703	2	1.71
AUTOMATICA	6.126	Q1	95.902	2	0.41
JOURNAL OF PROCESS CONTROL	2.787	Q2	71.311	2	1.8
IEEE TRANSACTIONS ON ELECTRON DEVICES	2.62	Q2	68.151	2	1.61

5.5 Top journals on Mathematics

Table 114 to Table 120 provide the journals with the most publications of seven universities on ESI Mathematics respectively. On the whole, the major publication journals on ESI Mathematics of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Mathematics have been widely recognized by the international academic community. On the aspect of the number of publications, *JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS* belongs to Q1, and is also one of the most publication journals on ESI Mathematics of three universities including Southern University of Science and Technology (2 papers), Nanyang Technological University (7 papers), Pohang University of Science and Technology (13 papers). In addition, *SIAM JOURNAL ON NUMERICAL ANALYSIS* and *JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS* also published many publications, and these two journals are also in the top 10 publication journals of three universities. The papers of ShanghaiTech University on ESI Mathematics are only published in three Q1 journals. In terms of JNCI, the JNCI of papers of Southern University of Science and Technology in twelve of 22 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received more attention in the same journal. Nanyang Technological University needs to be promoted because of the citation performance of papers published in 8 journals, which is lower than the average citation performance of the same journal.

Table 114 Top journals on Mathematics of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF SCIENTIFIC COMPUTING	1.814	Q1	84.722	4	1.36
APPLICABLE ANALYSIS	0.963	Q3	48.214	3	2.4
SIAM JOURNAL ON APPLIED MATHEMATICS	1.698	Q1	82.341	3	1.29
DISCRETE AND CONTINUOUS DYNAMICAL SYSTEMS	0.976	Q1	75.890	3	2.18
NONLINEARITY	1.926	Q1	87.103	3	0
JOURNAL OF DIFFERENTIAL EQUATIONS	1.782	Q1	94.660	3	1.8
COMMUNICATIONS IN STATISTICS-THEORY AND METHODS	0.353	Q4	3.659	3	0
INVERSE PROBLEMS AND IMAGING	1.465	Q1	75.992	2	1.35
STATISTICS & PROBABILITY LETTERS	0.533	Q4	14.228	2	0.36
FRONTIERS OF MATHEMATICS IN CHINA	0.377	Q4	9.871	2	0
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS	1.138	Q1	83.010	2	0.32
JOURNAL OF COMBINATORIAL THEORY SERIES B	0.878	Q2	68.123	2	0
NUMERICAL MATHEMATICS-THEORY METHODS AND APPLICATIONS	0.695	Q3	49.676	2	2.8
COMMUNICATIONS IN MATHEMATICAL SCIENCES	1.451	Q1	75.595	2	1.61
JOURNAL OF COMPUTATIONAL MATHEMATICS	1.026	Q1	79.450	2	1.64
JOURNAL OF APPLIED PROBABILITY	0.83	Q3	37.805	2	0.46
JOURNAL OF INVERSE AND ILL-POSED PROBLEMS	0.941	Q2	73.301	2	1.04
COMPUTERS & MATHEMATICS WITH APPLICATIONS	1.86	Q1	86.706	2	0.68
SIAM JOURNAL ON NUMERICAL ANALYSIS	2.047	Q1	89.881	2	2.2
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS	1.632	Q1	80.754	2	1.03
SCIENCE CHINA-MATHEMATICS	1.206	Q1	85.275	2	0

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF COMBINATORIAL THEORY SERIES A	0.93	Q2	72.006	2	0

Table 115 Top journals on Mathematics of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF SYSTEMS SCIENCE & COMPLEXITY	0.53	Q4	11.165	22	0.73
SCIENCE CHINA-MATHEMATICS	1.206	Q1	85.275	17	1.33
APPLIED MATHEMATICS AND COMPUTATION	2.3	Q1	91.865	10	1.22
JOURNAL OF APPLIED MATHEMATICS（2013）	0.72	Q3	48.406	10	1.58
COMPUTATIONAL AND MATHEMATICAL METHODS IN MEDICINE	1.545	Q3	41.525	9	2.66
ACTA MATHEMATICA SINICA-ENGLISH SERIES	0.527	Q3	25.728	6	0.39
APPLIED MATHEMATICS LETTERS	2.462	Q1	94.643	6	0.68
ACTA MATHEMATICA SCIENTIA	0.661	Q3	44.498	6	1.06
ADVANCES IN MATHEMATICS	1.372	Q1	89.806	6	0.89
ACTA MATHEMATICAE APPLICATAE SINICA-ENGLISH SERIES	0.273	Q4	1.389	6	1.12
APPLIED MATHEMATICS & INFORMATION SCIENCES	-	-	-	6	0.27

Table 116 Top journals on Mathematics of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MULTIVARIATE ANALYSIS	1.009	Q3	49.187	13	0.95

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ABSTRACT AND APPLIED ANALYSIS*	-	-	-	11	0.52
FINITE FIELDS AND THEIR APPLICATIONS	1.077	Q1	82.362	11	1.49
COMPUTATIONAL STATISTICS & DATA ANALYSIS	1.181	Q2	58.130	11	0.96
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS	1.632	Q1	80.754	11	0.34
ADVANCES IN MATHEMATICS OF COMMUNICATIONS	0.564	Q4	14.087	8	1.06
STATISTICS & PROBABILITY LETTERS	0.533	Q4	14.228	7	0.5
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS	1.138	Q1	83.010	7	0.88
BOUNDARY VALUE PROBLEMS	1.156	Q1	83.981	7	0.52
JOURNAL OF COMBINATORIAL THEORY SERIES A	0.93	Q2	72.006	7	0.99

Note*：For journals that are no longer included in the 2017 JCR, the relevant indicators are indicated by "-", the same below.

Table 117. Top journals on Mathematics of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
FINITE FIELDS AND THEIR APPLICATIONS	1.077	Q1	82.362	12	3.81
ADVANCES IN MATHEMATICS	1.372	Q1	89.806	7	0.87
INVERSE PROBLEMS AND IMAGING	1.465	Q1	75.992	6	1.4
SIAM JOURNAL ON APPLIED MATHEMATICS	1.698	Q1	82.341	6	1.56
DISCRETE MATHEMATICS	0.738	Q2	55.178	6	4.81
STATISTICA SINICA	0.886	Q3	42.683	6	0.57
SIAM JOURNAL ON SCIENTIFIC COMPUTING	2.046	Q1	89.484	5	0.59

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF SCIENTIFIC COMPUTING	1.814	Q1	84.722	5	0.6
JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION	2.297	Q1	87.398	4	0.17
ELECTRONIC JOURNAL OF STATISTICS	0.814	Q3	32.927	4	0.14
JOURNAL OF MULTIVARIATE ANALYSIS	1.009	Q3	49.187	4	3.89
MATHEMATICS OF OPERATIONS RESEARCH	1.078	Q2	59.325	4	1.7
APPLIED AND COMPUTATIONAL HARMONIC ANALYSIS	2.833	Q1	95.833	4	2.48
COMPUTATIONAL STATISTICS & DATA ANALYSIS	1.181	Q2	58.130	4	1.04
ARCHIVE FOR RATIONAL MECHANICS AND ANALYSIS	2.448	Q1	94.246	4	2.48

Table 118 Top journals on Mathematics of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS	1.138	Q1	83.010	13	0.36
APPLIED MATHEMATICS AND COMPUTATION	2.3	Q1	91.865	9	2.33
JOURNAL OF STATISTICAL COMPUTATION AND SIMULATION	0.869	Q3	40.244	7	2.33
INTERNATIONAL MATHEMATICS RESEARCH NOTICES	1.145	Q1	83.333	7	0.79
NONLINEAR ANALYSIS-THEORY METHODS & APPLICATIONS	1.291	Q1	87.864	7	1.23
COMMUNICATIONS IN STATISTICS-SIMULATION AND COMPUTATION	0.501	Q4	11.789	6	1.76
TRANSACTIONS OF THE AMERICAN MATHEMATICAL SOCIETY	1.496	Q1	91.748	6	1.05
PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY	0.707	Q2	50.647	6	0.27

JOURNAL OF DIFFERENTIAL EQUATIONS	1.782	Q1	94.660	6	2.09
JOURNAL OF PURE AND APPLIED ALGEBRA	0.72	Q2	52.589	6	0.98

Table 119 Top journals on Mathematics of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SIAM JOURNAL ON SCIENTIFIC COMPUTING	2.046	Q1	89.484	20	1.27
COMPUTERS & MATHEMATICS WITH APPLICATIONS	1.86	Q1	86.706	15	0.98
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS	1.632	Q1	80.754	11	1.61
MULTISCALE MODELING & SIMULATION	2.277	Q1	84.545	10	1.51
APPLICABLE ANALYSIS	0.963	Q3	48.214	8	1.04
JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION	2.297	Q1	87.398	6	1.45
SIAM JOURNAL ON NUMERICAL ANALYSIS	2.047	Q1	89.881	6	0.79
NUMERISCHE MATHEMATIK	2.37	Q1	93.056	6	1.37
BIT NUMERICAL MATHEMATICS	1.425	Q2	74.008	5	1.69
STATISTICAL SCIENCE	2.324	Q1	89.024	5	2.51
SPATIAL STATISTICS	1.026	Q2	50.813	5	0.89
JOURNAL OF MULTIVARIATE ANALYSIS	1.009	Q3	49.187	5	1.32
ARCHIVE FOR RATIONAL MECHANICS AND ANALYSIS	2.448	Q1	94.246	5	0.5

Table 120 Top journals on Mathematics of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SIAM JOURNAL ON OPTIMIZATION	2.183	Q1	91.071	2	1.32
SIAM JOURNAL ON SCIENTIFIC COMPUTING	2.046	Q1	89.484	1	0
SIAM JOURNAL ON NUMERICAL ANALYSIS	2.047	Q1	89.881	1	0.83

5.6 Top journals on Biology & Biochemistry

Table 121 to Table 127 provide the journals with the most publications of seven universities on ESI Biology & Biochemistry respectively. On the whole, the major publication journals on ESI Biology & Biochemistry of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Biology & Biochemistry have been widely recognized by the international academic community. On the aspect of the number of publications, *SCIENTIFIC REPORTS* belongs to Q1, and is also one of the most publication journals on ESI Biology & Biochemistry of seven universities including Southern University of Science and Technology (4 papers), University of Chinese Academy of Sciences (100 papers), Nanyang Technological University (19 papers), Hong Kong University of Science and Technology (19 papers), Pohang University of Science and Technology (24 papers), King Abdullah University of Science and Technology (24 papers), ShanghaiTech University (9 papers). In addition, *JOURNAL OF BIOLOGICAL CHEMISTRY*, *PLOS ONE*, *BIORESOURCE TECHNOLOGY* and *NUCLEIC ACIDS RESEARCH* also published many publications, and these four journals are also in the top 10 publication journals of six universities. In terms of JNCI, the JNCI of papers of ShanghaiTech University in 8 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal and that it is the papers that received more attention in the same journal. Hong Kong University of Science and

Technology needs to be promoted because of the citation performance of papers published in 9 journals, which is lower than the average citation performance of papers published in the same journal.

Table 121 Top journals on Biology & Biochemistry of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF BIOLOGICAL CHEMISTRY	4.01	Q2	74.486	11	0.83
ORGANIC & BIOMOLECULAR CHEMISTRY	3.423	Q2	72.807	7	0.99
PLOS ONE	2.766	Q1	77.344	5	0.57
IEEE TRANSACTIONS ON NANOBIOSCIENCE	2.158	Q3	42.405	4	1.27
SCIENTIFIC REPORTS	4.122	Q1	82.031	4	1.06
COLLOIDS AND SURFACES B-BIOINTERFACES	3.997	Q1	82.639	3	1.49
BIORESOURCE TECHNOLOGY	5.807	Q1	96.429	3	0.87
NUCLEIC ACIDS RESEARCH	11.561	Q1	96.747	3	0.27
FASEB JOURNAL	5.595	Q1	91.176	2	1.82
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	3.34	Q2	71.563	2	0.85
CELL AND BIOSCIENCE	3.219	Q2	58.733	2	1.07
ELIFE	7.616	Q1	95.882	2	0.23
CELL CHEMICAL BIOLOGY	5.592	Q1	85.445	2	0.35
BIOMED RESEARCH INTERNATIONAL	2.583	Q2	60.313	2	0
JOURNAL OF PHOTOCHEMISTRY AND PHOTOBIOLOGY B-BIOLOGY	3.165	Q2	68.750	2	1.27
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	2.559	Q2	52.083	2	0.78

Table 122 Top journals on Biology & Biochemistry of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BIORESOURCE TECHNOLOGY	5.807	Q1	96.429	190	1.07
SCIENTIFIC REPORTS	4.122	Q1	82.031	100	0.87
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	3.34	Q2	71.563	93	0.89
JOURNAL OF BIOLOGICAL CHEMISTRY	4.011	Q2	74.486	85	0.83
PROGRESS IN BIOCHEMISTRY AND BIOPHYSICS	0.288	Q4	0.694	83	1.16
PLOS ONE	2.766	Q1	77.344	74	0.99
APPLIED AND ENVIRONMENTAL MICROBIOLOGY	3.633	Q2	75.938	67	0.85
PROTEIN & CELL	6.228	Q1	80.789	66	0.68
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	2.559	Q2	52.083	65	0.52
SCIENCE CHINA-LIFE SCIENCES	3.085	Q1	77.059	64	1.13
NUCLEIC ACIDS RESEARCH	11.561	Q1	96.747	64	0.82

Table 123 Top journals on Biology & Biochemistry of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PLOS ONE	2.766	Q1	77.344	59	0.75
SCIENTIFIC REPORTS	4.122	Q1	82.031	53	0.75
NUCLEIC ACIDS RESEARCH	11.561	Q1	96.747	51	0.58
JOURNAL OF BIOLOGICAL CHEMISTRY	4.01	Q2	74.486	45	1.16
BIORESOURCE TECHNOLOGY	5.807	Q1	96.429	43	0.93

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ORGANIC & BIOMOLECULAR CHEMISTRY	3.423	Q2	72.807	35	1.35
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	3.34	Q2	71.563	22	1.21
COLLOIDS AND SURFACES B-BIOINTERFACES	3.997	Q1	82.639	21	0.79
BIOMACROMOLECULES	5.738	Q1	93.860	21	1.3
BIOTECHNOLOGY AND BIOENGINEERING	3.952	Q1	80.938	18	1.28

Table 124 Top journals on Biology & Biochemistry of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF BIOLOGICAL CHEMISTRY	4.01	Q2	74.486	20	0.86
SCIENTIFIC REPORTS	4.122	Q1	82.031	19	0.84
PLOS ONE	2.766	Q1	77.344	18	0.72
JOURNAL OF PROTEOME RESEARCH	3.95	Q1	82.911	12	1.05
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	3.34	Q2	71.563	11	0.57
BIOMED RESEARCH INTERNATIONAL	2.583	Q2	60.313	8	3.27
NUCLEIC ACIDS RESEARCH	11.561	Q1	96.747	8	0.19
ORGANIC & BIOMOLECULAR CHEMISTRY	3.423	Q2	72.807	7	2.15
BIOMEDICAL OPTICS EXPRESS	3.482	Q1	84.574	7	0.77
STRUCTURE	4.907	Q1	85.417	6	0.37
BIOINFORMATICS	5.481	Q1	95.763	6	0.47
PROTEOMICS	3.532	Q2	74.051	6	0.35

Table 125 Top journals on Biology & Biochemistry of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BIORESOURCE TECHNOLOGY	5.807	Q1	96.429	37	1.06
SCIENTIFIC REPORTS	4.122	Q1	82.031	24	0.58
PLOS ONE	2.766	Q1	77.344	15	1.11
JOURNAL OF BIOLOGICAL CHEMISTRY	4.01	Q2	74.486	13	0.72
BIOTECHNOLOGY AND BIOPROCESS ENGINEERING	1.226	Q4	15.313	13	1.1
BIOMACROMOLECULES	5.738	Q1	93.860	13	0.98
BIOMEDICAL OPTICS EXPRESS	3.482	Q1	84.574	13	0.61
EXPERIMENTAL AND MOLECULAR MEDICINE	5.584	Q1	89.098	12	1.19
MOLECULES AND CELLS	3.077	Q2	53.938	11	0.93
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	2.559	Q2	52.083	11	0.51

Table 126 Top journals on Biology & Biochemistry of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BIOINFORMATICS	5.481	Q1	95.763	24	0.45
SCIENTIFIC REPORTS	4.122	Q1	82.031	24	1.67
NUCLEIC ACIDS RESEARCH	11.561	Q1	96.747	24	0.59
PLOS ONE	2.766	Q1	77.344	19	1.34

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BIORESOURCE TECHNOLOGY	5.807	Q1	96.429	16	0.96
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	3.34	Q2	71.563	9	1.29
APPLIED AND ENVIRONMENTAL MICROBIOLOGY	3.633	Q1	75.938	7	1.64
FEBS LETTERS	2.999	Q2	61.806	6	1.43
ORGANIC & BIOMOLECULAR CHEMISTRY	3.423	Q2	72.807	6	0.76
JOURNAL OF BIOMEDICAL SEMANTICS	1.6	Q3	46.610	6	1.34

Table 127 Top journals on Biology & Biochemistry of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF BIOLOGICAL CHEMISTRY	4.01	Q2	74.486	24	1.08
NUCLEIC ACIDS RESEARCH	11.561	Q1	96.747	10	0.39
SCIENTIFIC REPORTS	4.122	Q1	82.031	9	0.8
ORGANIC & BIOMOLECULAR CHEMISTRY	3.423	Q2	72.807	8	1.25
NATURE	41.577	Q1	99.219	8	1.47
ELIFE	7.616	Q1	95.882	6	0.88
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	2.559	Q2	52.083	6	0.74
BIORESOURCE TECHNOLOGY	5.807	Q1	96.429	5	1.09
FREE RADICAL BIOLOGY AND MEDICINE	6.02	Q1	88.462	4	2.09
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	4	1.07
RNA BIOLOGY	5.216	Q1	84.075	4	4.72

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PROTEIN & CELL	6.228	Q1	80.789	4	1.11
NATURE COMMUNICATIONS	12.353	Q1	96.094	4	0.67

5.7 Top journals on Computer Science

Table 128 to Table 134 provide the journals with the most publications of seven universities on ESI Computer Science respectively. On the whole, the major publication journals on ESI Computer Science of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Computer Science have been widely recognized by the international academic community. On the aspect of the number of publications, *IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS* belongs to Q1, and is also one of the most publication journals on ESI Computer Science of six universities including Southern University of Science and Technology (2 papers), Nanyang Technological University (58 papers), Hong Kong University of Science and Technology (75 papers), Pohang University of Science and Technology (10 papers), King Abdullah University of Science and Technology (61 papers), ShanghaiTech University (4 papers). In addition, *IEEE TRANSACTIONS ON COMMUNICATIONS* and *IEEE TRANSACTIONS ON INFORMATION THEORY* also published many publications, and these two journals are also in the top 10 publication journals of five universities. Among the major publication journals on ESI Computer Science in seven universities, the journals of IEEE are more impressive. Seven of the top 10 publication journals of Nanyang University of Technology are IEEE journals, as well as nine of top 10 journals in Hong Kong University of Science and Technology and six of top 9 journals in ShanghaiTech University. In terms of JNCI, the JNCI of papers of Hong Kong University of Science and Technology 's in 8 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received

more attention in the same journal. University of Chinese Academy of Sciences needs to be promoted because of the citation performance of papers published in 9 journals, which is lower than the average citation performance of papers published in the same journal.

Table 128 Top journals on Computer Science of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY	5.824	Q1	95.631	5	1.08
CHINA COMMUNICATIONS	1.514	Q3	38.506	3	0.67
APPLIED SOFT COMPUTING	3.907	Q1	90.000	3	1.4
SIAM JOURNAL ON IMAGING SCIENCES	2.361	Q1	92.262	3	1.38
IEEE TRANSACTIONS ON MOBILE COMPUTING	4.098	Q1	90.878	2	0.83
PLOS ONE	2.766	Q1	77.344	2	0.61
MULTIMEDIA TOOLS AND APPLICATIONS	1.541	Q2	60.096	2	1.31
IEEE COMMUNICATIONS LETTERS	2.723	Q2	64.943	2	0.44
JOURNAL OF COMPUTATIONAL SCIENCE	1.925	Q2	71.359	2	0.59
IEEE TRANSACTIONS ON EVOLUTIONARY COMPUTATION	8.124	Q1	99.515	2	0.46
IEEE TRANSACTIONS ON COMMUNICATIONS	4.671	Q1	90.230	2	0.29
IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS	5.888	Q1	92.885	2	0.28
IEEE TRANSACTIONS ON INFORMATION THEORY	2.187	Q2	60.473	2	0.23

Table 129 Top journals on Computer Science of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
NEUROCOMPUTING	3.241	Q1	79.924	90	0.88
JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY	0.878	Q4	22.596	49	0.71
SCIENCE CHINA-INFORMATION SCIENCES	2.188	Q2	61.149	37	0.85
INTERNATIONAL JOURNAL OF DISTRIBUTED SENSOR NETWORKS	1.787	Q2	53.716	24	0.46
SECURITY AND COMMUNICATION NETWORKS	0.904	Q4	17.905	22	0.96
VISUAL COMPUTER	1.036	Q3	36.058	21	0.68
COMPUTERS & GEOSCIENCES	2.567	Q2	67.460	20	0.75
MULTIMEDIA TOOLS AND APPLICATIONS	1.541	Q2	60.096	20	1.06
INFORMATION SCIENCES	4.305	Q1	92.230	20	0.70
KNOWLEDGE-BASED SYSTEMS	4.396	Q1	89.773	20	0.96

Table 130 Top journals on Computer Science of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
NEUROCOMPUTING	3.241	Q1	79.924	71	1.67
IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS	5.888	Q1	92.885	58	1.11
IEEE TRANSACTIONS ON INFORMATION THEORY	2.187	Q2	60.473	56	0.78
IEEE TRANSACTIONS ON MULTIMEDIA	3.977	Q1	95.673	55	1.67
IEEE TRANSACTIONS ON CYBERNETICS	8.803	Q1	99.180	51	0.99
IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING	7.982	Q1	98.544	45	1.08

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SYSTEMS					
INFORMATION SCIENCES	4.305	Q1	92.230	42	1.58
IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS	3.971	Q1	92.718	41	0.98
IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY	5.824	Q1	95.631	41	1.42
IEEE COMMUNICATIONS LETTERS	2.723	Q2	64.943	32	1.14

Table 131 Top journals on Computer Science of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS	5.888	Q1	92.885	75	1.1
IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS	3.971	Q1	92.718	40	1.19
IEEE TRANSACTIONS ON MOBILE COMPUTING	4.098	Q1	90.878	37	1.5
IEEE TRANSACTIONS ON INFORMATION THEORY	2.187	Q2	60.473	34	1.22
IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS	3.078	Q1	92.788	28	1.24
COMPUTERS AND GEOTECHNICS	3.138	Q1	90.278	25	1.33
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS	7.172	Q1	95.577	24	1.37
IEEE-ACM TRANSACTIONS ON NETWORKING	3.11	Q1	89.423	23	1.22
IEEE TRANSACTIONS ON COMMUNICATIONS	4.671	Q1	90.230	20	0.99
IEEE COMMUNICATIONS MAGAZINE	9.27	Q1	98.654	15	0.9

Table 132 Top journals on Computer Science of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
INFORMATION SCIENCES	4.305	Q1	92.230	18	0.5
IEEE COMMUNICATIONS LETTERS	2.723	Q2	64.943	15	0.42
IEEE TRANSACTIONS ON COMMUNICATIONS	4.671	Q1	90.230	12	0.57
IEEE TRANSACTIONS ON INFORMATION THEORY	2.187	Q2	60.473	11	0.49
IEEE TRANSACTIONS ON HAPTICS	1.869	Q2	65.909	11	0.97
IEICE TRANSACTIONS ON INFORMATION AND SYSTEMS	0.5	Q4	7.212	10	0.33
IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS	5.888	Q1	92.885	10	1.59
WIRELESS PERSONAL COMMUNICATIONS	1.2	Q4	21.264	7	0.66
KNOWLEDGE-BASED SYSTEMS	4.396	Q1	89.773	6	0.38
INTERNATIONAL JOURNAL OF NETWORK MANAGEMENT	1.34	Q3	35.473	6	1.22

Table 133 Top journals on Computer Science of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS	5.888	Q1	92.885	61	0.85
IEEE TRANSACTIONS ON COMMUNICATIONS	4.671	Q1	90.230	37	1.09
ACM TRANSACTIONS ON GRAPHICS	4.384	Q1	97.596	32	1.23
COMPUTER GRAPHICS FORUM	2.046	Q1	79.327	28	1.4
IEEE COMMUNICATIONS LETTERS	2.723	Q2	64.943	27	1.2

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING	4.441	Q1	98.544	26	0.94
IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS	3.078	Q1	92.788	14	0.62
IEEE WIRELESS COMMUNICATIONS LETTERS	3.096	Q1	79.392	13	1.75
WIRELESS COMMUNICATIONS & MOBILE COMPUTING	0.869	Q4	19.038	11	0.47
COMPUTER AIDED GEOMETRIC DESIGN	1.522	Q1	77.183	9	1.13

Table 134 Top journals on Computer Science of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS	5.888	Q1	92.885	16	0.6
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS	7.172	Q1	95.577	4	1.7
NEUROCOMPUTING	3.241	Q1	79.924	3	0.85
IEEE TRANSACTIONS ON INFORMATION THEORY	2.187	Q2	60.473	3	0.32
FRONTIERS OF INFORMATION TECHNOLOGY & ELECTRONIC ENGINEERING	0.91	Q4	24.519	2	2.51
IEEE COMMUNICATIONS MAGAZINE	9.27	Q1	98.654	2	5.22
IEEE-ACM TRANSACTIONS ON COMPUTATIONAL BIOLOGY AND BIOINFORMATICS	2.428	Q1	90.650	2	0.26
IEEE TRANSACTIONS ON COMMUNICATIONS	4.671	Q1	90.230	2	0.39
JOURNAL OF CHEMINFORMATICS	3.893	Q1	89.527	2	1.22

5.8 Top journals on Economics & Business

Table 135 to Table 140 provide the journals with the most publications of six universities on ESI Economics & Business respectively. On the whole, the major publication journals on ESI Economics & Business of six universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Economics & Business have been widely recognized by the international academic community. On the aspect of the number of publications, *ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS* belongs to Q2, and is also one of the most publication journals on ESI Economics & Business of three universities including Southern University of Science and Technology (2 papers), University of Chinese Academy of Sciences (2 papers), Nanyang Technological University (7 papers). In terms of JNCI, the JNCI of papers of Hong Kong University of Science and Technology in 7 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received more attention in the same journal. University of Chinese Academy of Sciences and Nanyang Technological University need to be promoted because of the citation performance of papers published in 7 journals, which is lower than the average citation performance of papers published in the same journal. Southern University of Science and Technology has only published four papers on ESI Economics & Business with no journals in Q1 and two journals in Q2.

Table 135 Top journals on Economics & Business of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BUSINESS PROCESS MANAGEMENT JOURNAL	1.308	Q3	26.071	2	1.02
FINANCE RESEARCH LETTERS	1.085	Q3	33.854	2	1

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
INTERNATIONAL REVIEW OF ECONOMICS & FINANCE	1.318	Q2	60.213	2	0.3
ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS	2.582	Q2	67.230	2	0.47

Table 136 Top journals on Economics & Business of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ECONOMIC MODELLING	1.696	Q2	71.246	6	1.34
DISCRETE DYNAMICS IN NATURE AND SOCIETY	0.757	Q3	32.031	5	0.69
CHINA & WORLD ECONOMY	0.946	Q3	39.518	4	1.60
CHINA ECONOMIC REVIEW	1.8	Q2	72.946	4	0.13
INSURANCE MATHEMATICS & ECONOMICS	1.265	Q2	63.008	3	1.01
R & D MANAGEMENT	1.857	Q3	40.357	3	0.90
SOCIO-ECONOMIC PLANNING SCIENCES	1.61	Q2	52.410	2	1.03
ECONOMETRIC REVIEWS	1.218	Q2	61.382	2	0.00
APPLIED ECONOMICS	0.75	Q3	29.320	2	0.00
ECONOMIC SYSTEMS RESEARCH	2.429	Q1	83.994	2	0.88
ENERGY ECONOMICS	3.91	Q1	94.476	2	1.79
CREATIVITY AND INNOVATION MANAGEMENT	1.553	Q3	39.286	2	1.20
INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	0.869	Q3	27.326	2	2.59
ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS	2.582	Q2	67.230	2	0.42

Table 137 Top journals on Economics & Business of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SINGAPORE ECONOMIC REVIEW	0.533	Q4	17.139	18	0.57
JOURNAL OF CORPORATE FINANCE	2.215	Q1	85.204	10	0.7
JOURNAL OF FINANCIAL ECONOMICS	5.162	Q1	98.469	9	1.28
STRATEGIC MANAGEMENT JOURNAL	5.482	Q1	91.786	8	0.82
ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES	2.259	Q2	58.333	7	1.78
PUBLIC MANAGEMENT REVIEW	3.152	Q1	75.952	7	0.87
ENERGY ECONOMICS	3.91	Q1	94.476	7	0.88
ACCOUNTING REVIEW	2.245	Q1	87.245	7	1.21
REVIEW OF ACCOUNTING STUDIES	-	-	-	7	0.78
ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS	2.582	Q2	67.230	7	0.57
INTERNATIONAL JOURNAL OF SHIPPING AND TRANSPORT LOGISTICS	0.928	Q4	14.516	7	2.29

Table 138 Top journals on Economics & Business of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
MANAGEMENT SCIENCE	3.544	Q1	87.349	21	1.35
JOURNAL OF ECONOMETRICS	1.632	Q2	63.592	15	0.95
JOURNAL OF CONSUMER RESEARCH	3.535	Q1	76.786	13	0.67
ACADEMY OF MANAGEMENT JOURNAL	6.7	Q1	95.357	13	1.24
JOURNAL OF FINANCIAL ECONOMICS	5.162	Q1	98.469	10	0.64

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
M&SOM-MANUFACTURING & SERVICE OPERATIONS MANAGEMENT	1.795	Q2	59.639	9	1.72
JOURNAL OF DEVELOPMENT ECONOMICS	2.205	Q1	81.445	9	1.24
JOURNAL OF MANAGEMENT	8.08	Q1	97.500	9	1.07
JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS	2.049	Q1	78.045	8	1.07
JOURNAL OF ECONOMIC BEHAVIOR & ORGANIZATION	1.296	Q2	59.348	8	0.78
ACCOUNTING REVIEW	2.245	Q1	87.245	8	1.42

Table 139 Top journals on Economics & Business of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
FINANCE RESEARCH LETTERS	1.085	Q3	40.306	4	0.6
SERVICE BUSINESS	2.11	Q2	54.048	4	1.7
APPLIED STOCHASTIC MODELS IN BUSINESS AND INDUSTRY	1.062	Q2	52.439	3	1.3
JOURNAL OF BANKING & FINANCE	1.931	Q1	76.062	3	0.75
ASIA-PACIFIC JOURNAL OF FINANCIAL STUDIES	0.355	Q4	4.592	2	4.55
INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	0.869	Q3	27.326	2	1.13
JOURNAL OF EMPIRICAL FINANCE	0.946	Q3	33.163	2	0.59
QUANTITATIVE FINANCE	1.17	Q3	47.087	2	1.12

Table 140 Top journals on Economics & Business of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF BUSINESS ETHICS	2.917	Q1	95.192	1	0
JOURNAL OF EMPIRICAL FINANCE	0.946	Q3	33.163	1	2.38

5.9 Top journals on Environment & Ecology

Table 141 to Table 147 provide the journals with the most publications of seven universities on ESI Environment & Ecology respectively. On the whole, the major publication journals on ESI Environment & Ecology of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Environment & Ecology have been widely recognized by the international academic community. On the aspect of the number of publications, *ENVIRONMENTAL SCIENCE & TECHNOLOGY* belongs to Q1, and is also one of the most publication journals on ESI Environment & Ecology of six universities including Southern University of Science and Technology (9 papers), University of Chinese Academy of Sciences (177 papers), Nanyang Technological University (34 papers), Hong Kong University of Science and Technology (46 papers), Pohang University of Science and Technology (34 papers), King Abdul University of Science and Technology (23 papers). In addition, *CHEMOSPHERE*, *SCIENCE OF THE TOTAL ENVIRONMENT*, *ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH* and *SCIENTIFIC REPORTS* also published many publications, and these four journals are also in the top 10 publication journals of five universities. In terms of JNCI, the JNCI of papers of Nanyang Technological University and Hong Kong University of Science and Technology in 6 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal, and that it is the papers that received more attention in the same journal. Southern University of Science and

Technology needs to be promoted because of the citation performance of papers published in 10 journals, which is lower than the average citation performance of papers published in the same journal.

Table 141 Top journals on Environment & Ecology of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ENVIRONMENTAL SCIENCE & TECHNOLOGY	6.653	Q1	95.643	9	1.07
WATER RESOURCES RESEARCH	4.361	Q1	97.500	9	1.5
CHEMOSPHERE	4.427	Q1	86.100	4	0.8
SCIENCE OF THE TOTAL ENVIRONMENT	4.61	Q1	89.004	3	0.95
HYDROLOGICAL SCIENCES JOURNAL-JOURNAL DES SCIENCES HYDROLOGIQUES	2.061	Q2	60.556	3	1.79
SUSTAINABILITY	2.075	Q2	50.415	3	0.66
ECOLOGICAL MODELLING	2.507	Q2	62.975	2	0.69
PLOS ONE	2.766	Q1	77.344	2	0
ENVIRONMENTAL POLLUTION	4.358	Q1	84.025	2	0.91
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	2.8	Q2	66.183	2	0.59
WATER AIR AND SOIL POLLUTION	1.769	Q3	49.444	2	0
ENVIRONMENTAL EARTH SCIENCES	1.435	Q3	34.232	2	0.32
SCIENTIFIC REPORTS	4.122	Q1	82.031	2	0.58
WATER	2.069	Q2	62.778	2	1.35

Table 142 Top journals on Environment & Ecology of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENCE OF THE TOTAL ENVIRONMENT	4.61	Q1	89.004	247	1.15
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	2.8	Q2	66.183	235	1.01

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
CHINESE JOURNAL OF OCEANOLOGY AND LIMNOLOGY	0.717	Q4	19.531	199	1.04
ENVIRONMENTAL SCIENCE & TECHNOLOGY	6.653	Q1	95.643	177	1.16
CHEMOSPHERE	4.427	Q1	86.100	166	1.18
SUSTAINABILITY	2.075	Q2	50.415	162	0.96
ENVIRONMENTAL POLLUTION	4.358	Q1	84.025	153	0.97
ENVIRONMENTAL EARTH SCIENCES	1.435	Q3	34.232	133	0.94
SCIENTIFIC REPORTS	4.122	Q1	82.031	130	0.79
PLOS ONE	2.766	Q1	77.344	122	0.89

Table 143 Top journals on Environment & Ecology of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
WATER RESEARCH	7.051	Q1	99.444	67	1.09
ENVIRONMENTAL SCIENCE & TECHNOLOGY	6.653	Q1	95.643	34	1.1
CHEMOSPHERE	4.427	Q1	86.100	27	1.02
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	2.8	Q2	66.183	15	0.82
JOURNAL OF ENVIRONMENTAL SCIENCES	3.12	Q2	71.162	11	0.87
SCIENCE OF THE TOTAL ENVIRONMENT	4.61	Q1	89.004	10	0.9
ENVIRONMENTAL TECHNOLOGY	1.666	Q3	40.871	10	0.8
SCIENTIFIC REPORTS	4.122	Q1	82.031	8	1.27
OCEAN & COASTAL MANAGEMENT	2.276	Q2	72.656	7	1.84
ENVIRONMENTAL MICROBIOLOGY	4.974	Q1	83.600	7	1.15

Table 144 Top journals on Environment & Ecology of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
WATER RESEARCH	7.051	Q1	99.444	61	1.28
ENVIRONMENTAL SCIENCE & TECHNOLOGY	6.653	Q1	95.643	46	1.29
SCIENCE OF THE TOTAL ENVIRONMENT	4.61	Q1	89.004	24	1.3
ENVIRONMENTAL POLLUTION	4.358	Q1	84.025	19	0.74
SCIENTIFIC REPORTS	4.122	Q1	82.031	15	0.72
MARINE POLLUTION BULLETIN	3.241	Q1	91.981	15	0.69
ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY	3.179	Q2	72.407	13	0.64
CHEMOSPHERE	4.427	Q1	86.100	13	1.07
BIOGEOSCIENCES	3.441	Q1	83.333	12	0.46
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	2.8	Q2	66.183	11	0.76

Table 145 Top journals on Environment & Ecology of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ENVIRONMENTAL SCIENCE & TECHNOLOGY	6.653	Q1	95.643	34	1.29
SCIENCE OF THE TOTAL ENVIRONMENT	4.61	Q1	89.004	10	1.01
CHEMOSPHERE	4.427	Q1	86.100	10	1.23
ENVIRONMENTAL POLLUTION	4.358	Q1	84.025	7	0.73
WATER RESEARCH	7.051	Q1	99.444	6	1.66
BIOGEOSCIENCES	3.441	Q1	83.333	4	0.53
SUSTAINABILITY	2.075	Q2	50.415	4	0.68
ENVIRONMENTAL RESEARCH LETTERS	4.541	Q1	90.116	3	0.72
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	2.8	Q2	66.183	3	1.21

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
MARINE POLLUTION BULLETIN	3.241	Q1	91.981	3	0.49

Table 146 Top journals on Environment & Ecology of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
WATER RESEARCH	7.051	Q1	99.444	62	1.12
SCIENTIFIC REPORTS	4.122	Q1	82.031	23	1.56
ENVIRONMENTAL SCIENCE & TECHNOLOGY	6.653	Q1	95.643	23	1.53
MOLECULAR ECOLOGY	6.131	Q1	93.987	19	1.28
MARINE POLLUTION BULLETIN	3.241	Q1	91.981	16	0.91
MARINE ECOLOGY PROGRESS SERIES	2.276	Q2	74.057	14	1.23
LIMNOLOGY AND OCEANOGRAPHY	3.595	Q1	94.531	14	0.86
WATER RESOURCES RESEARCH	4.361	Q1	97.500	11	0.86
BIOGEOSCIENCES	3.441	Q1	83.333	10	0.92
MARINE BIODIVERSITY	2.077	Q2	69.340	10	0.72
CONSERVATION GENETICS RESOURCES	0.742	Q4	24.545	10	0.59
GLOBAL CHANGE BIOLOGY	8.997	Q1	99.091	10	1

Table 147 Top journals on Environment & Ecology of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ENVIRONMENTAL HEALTH PERSPECTIVES	8.309	Q1	98.548	2	1.86
ENVIRONMENTAL SCIENCE-WATER RESEARCH & TECHNOLOGY	3.649	Q1	91.667	1	0.47
GREENHOUSE GASES-SCIENCE AND TECHNOLOGY	1.991	Q3	48.755	1	0.5

5.10 Top journals on Geosciences

Table 148 to Table 154 provide the journals with the most publications of seven universities on ESI Geosciences respectively. On the whole, the major publication journals on ESI Geosciences of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Geosciences have been widely recognized by the international academic community. On the aspect of the number of publications, *GEOPHYSICAL RESEARCH LETTERS* belongs to Q2, and is also one of the most publication journals on ESI Geosciences of four universities including Southern University of Science and Technology (6 papers), University of Nanyang Technological University (25 papers), Pohang University of Science and Technology (16 papers), King Abdullah University of Science and Technology (8 papers). In addition, *JOURNAL OF GEOPHYSICAL RESEARCH-SOLID EARTH* and *ATMOSPHERIC ENVIRONMENT* also published many publications, and these two journals are also in the top 10 publication journals of three universities. In terms of JNCI, the JNCI of papers of Nanyang Technological University in 9 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal and that it is the papers that received more attention in the same journal. ShanghaiTech University has only 2 papers on ESI Geosciences which are both published in Q1 journals, making it difficult to reflect its competitiveness and level due to the small number of papers.

Table 148 Top journals on Geosciences of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
GEOPHYSICAL RESEARCH LETTERS	4.339	Q1	94.444	6	0.65
GEOPHYSICAL JOURNAL INTERNATIONAL	2.528	Q2	59.412	4	0.46

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
TECTONOPHYSICS	2.686	Q2	62.941	3	1.39
JOURNAL OF GEOPHYSICAL RESEARCH-SOLID EARTH	3.482	Q1	75.882	3	0.95
EARTH AND PLANETARY SCIENCE LETTERS	4.581	Q1	91.176	3	0.47
ACTA GEOLOGICA SINICA-ENGLISH EDITION	2.506	Q2	66.402	2	2.88
JOURNAL OF HYDROMETEOROLOGY	3.79	Q1	84.302	2	1.16
HYDROLOGY AND EARTH SYSTEM SCIENCES	4.256	Q1	95.000	2	1.96
GEOCHEMISTRY GEOPHYSICS GEOSYSTEMS	2.981	Q2	71.176	2	1.62
SCIENTIFIC REPORTS	4.122	Q1	82.031	2	1.18
JOURNAL OF GEOPHYSICAL RESEARCH-BIOGEOSCIENCES	3.484	Q1	83.862	2	0.48

Table 149 Top journals on Geosciences of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
CHINESE JOURNAL OF GEOPHYSICS-CHINESE EDITION	0.88	Q4	15.882	282	0.92
REMOTE SENSING	3.406	Q2	75.000	264	0.90
SCIENCE CHINA-EARTH SCIENCES	2.058	Q2	52.646	182	0.95
ACTA PETROLOGICA SINICA	1.238	Q3	50.000	172	0.97
JOURNAL OF ASIAN EARTH SCIENCES	2.866	Q2	73.810	141	1.09
JOURNAL OF GEOGRAPHICAL SCIENCES	1.623	Q3	31.633	136	1.29
ATMOSPHERIC ENVIRONMENT	3.708	Q1	81.977	111	1.04
ADVANCES IN ATMOSPHERIC SCIENCES	1.869	Q3	44.767	109	1.03
QUATERNARY INTERNATIONAL	2.163	Q2	55.291	100	1.00
LITHOS	3.857	Q1	87.931	99	1.21

Table 150 Top journals on Geosciences of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
JOURNAL OF GEOPHYSICAL RESEARCH-SOLID EARTH	3.482	Q1	75.882	32	1.35
ROCK MECHANICS AND ROCK ENGINEERING	2.819	Q1	79.167	28	1.46
GEOPHYSICAL RESEARCH LETTERS	4.339	Q1	94.444	25	0.61
ENGINEERING GEOLOGY	3.1	Q1	87.500	23	1.04
EARTH AND PLANETARY SCIENCE LETTERS	4.581	Q1	91.176	23	1.24
JOURNAL OF VOLCANOLOGY AND GEOTHERMAL RESEARCH	2.368	Q2	62.169	17	1.4
IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING	4.662	Q1	93.529	15	1.24
QUATERNARY SCIENCE REVIEWS	4.334	Q1	93.915	14	1.52
NATURAL HAZARDS	1.901	Q2	56.111	11	1.43
BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA	2.343	Q2	57.059	11	1.08

Table 151 Top journals on Geosciences of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ATMOSPHERIC ENVIRONMENT	3.708	Q1	81.977	30	1.23
ENGINEERING GEOLOGY	3.1	Q1	87.500	30	1.85
JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES	3.38	Q1	79.651	23	0.91
ATMOSPHERIC CHEMISTRY AND PHYSICS	5.509	Q1	95.930	21	0.95
LANDSLIDES	3.811	Q1	98.611	14	1.1
JOURNAL OF GEOPHYSICAL RESEARCH-OCEANS	2.711	Q1	83.594	11	0.67
ACTA GEOTECHNICA	2.779	Q2	73.611	9	0.81
DEEP-SEA RESEARCH PART II-TOPICAL STUDIES IN OCEANOGRAPHY	2.451	Q1	80.469	7	1.16

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BULLETIN OF ENGINEERING GEOLOGY AND THE ENVIRONMENT	1.825	Q2	51.389	6	1.04
INTERNATIONAL JOURNAL FOR NUMERICAL AND ANALYTICAL METHODS IN GEOMECHANICS	2.219	Q2	68.284	6	1.81

Table 152 Top journals on Geosciences of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
CLIMATE DYNAMICS	3.774	Q1	83.140	19	1.06
GEOPHYSICAL RESEARCH LETTERS	4.339	Q1	94.444	16	0.89
ASIA-PACIFIC JOURNAL OF ATMOSPHERIC SCIENCES	1.344	Q4	25.000	12	1.53
JOURNAL OF CLIMATE	4.661	Q1	92.442	11	0.75
JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES	3.38	Q1	79.651	4	0.61
GLOBAL BIOGEOCHEMICAL CYCLES	4.457	Q1	94.974	4	1.62
DEEP-SEA RESEARCH PART I-OCEANOGRAPHIC RESEARCH PAPERS	2.384	Q1	77.344	3	0.7
BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY	7.804	Q1	97.093	3	0.34
IEEE GEOSCIENCE AND REMOTE SENSING LETTERS	2.892	Q2	75.926	2	1.15
ATMOSPHERIC ENVIRONMENT	3.708	Q1	81.977	2	0.98
MARINE CHEMISTRY	3.337	Q1	92.969	2	0.64
TERRESTRIAL ATMOSPHERIC AND OCEANIC SCIENCES	0.543	Q4	10.156	2	0.6
SCIENTIFIC REPORTS	4.122	Q1	82.031	2	0.16
NATURE GEOSCIENCE	14.391	Q1	99.735	2	1.78
NATURE COMMUNICATIONS	12.353	Q1	96.094	2	1.66

Table 153 Top journals on Geosciences of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
GEOPHYSICS	2.368	Q2	58.235	51	0.9
GEOPHYSICAL JOURNAL INTERNATIONAL	2.528	Q2	59.412	32	1.23
JOURNAL OF GEOPHYSICAL RESEARCH-OCEANS	2.711	Q1	83.594	23	1.03
GEOPHYSICAL PROSPECTING	1.744	Q3	50.000	20	0.78
HYDROLOGY AND EARTH SYSTEM SCIENCES	4.256	Q1	95.000	11	2.7
JOURNAL OF GEOPHYSICAL RESEARCH-SOLID EARTH	3.482	Q1	75.882	11	0.76
ATMOSPHERIC CHEMISTRY AND PHYSICS	5.509	Q1	95.930	10	1.25
MONTHLY WEATHER REVIEW	3.247	Q1	77.326	10	0.67
INTERPRETATION-A JOURNAL OF SUBSURFACE CHARACTERIZATION	0.937	Q4	19.412	9	0.58
JOURNAL OF APPLIED GEOPHYSICS	1.646	Q2	62.500	8	0.81
GEOPHYSICAL RESEARCH LETTERS	4.339	Q1	94.444	8	0.77
BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA	2.343	Q2	57.059	8	1.58

Table 154 Top journals on Geosciences of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PLOS ONE	2.766	Q1	77.344	1	0
IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING	4.662	Q1	93.529	1	0

5.11 Top journals on Molecular Biology & Genetics

Table 155 to Table 161 provide the journals with the most publications of seven universities on ESI Molecular Biology & Genetics respectively. On the whole, the major publication journals on ESI Molecular Biology & Genetics of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Molecular Biology & Genetics have

been widely recognized by the international academic community. On the aspect of the number of publications, *PLOS ONE* belongs to Q1, and is also one of the most publication journals on ESI Molecular Biology & Genetics of seven universities including Southern University of Science and Technology (5 papers), University of Chinese Academy of Sciences (100 papers), University of Nanyang Technological University (35 papers), Hong Kong University of Science and Technology (9 papers), Pohang University of Science and Technology (15 papers), King Abdullah University of Science and Technology (11 papers), Shanghai Tech University (8 papers). In addition, *ONCOTARGET* and *SCIENTIFIC REPORTS* also published many publications, and these two journals are also in the top 10 publication journals of the seven universities. In terms of JNCI, the citation performance of papers of the seven universities on ESI Molecular Biology & Genetics has not been outstanding, the JNCI of papers of Nanyang Technological University in 2 (out of the top 10) journals are higher than 1, while University of Chinese Academy of Sciences in 4 journals, Nanyang Technological University in 4 journals, Hong Kong University of Science and Technology in 3 journals, Pohang University of Science and Technology in 2 journals and Shanghai Tech University in 3 journals. It is relatively better that the JNCI of papers of King Abdullah University of Science and Technology in 7 (out of the top 12) journals exceed 1. It indicates that the seven universities need to be improved in terms of the citation performance of papers.

Table 155 Top journals on Molecular Biology & Genetics of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	6	0.7
PLOS ONE	2.766	Q1	77.344	5	0.38
ONCOTARGET	-	-	-	5	0.94
SCIENTIFIC REPORTS	4.122	Q1	82.031	4	1.42

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
NATURE COMMUNICATIONS	12.353	Q1	96.094	4	0.26
CELL RESEARCH	15.393	Q1	95.000	3	0.86
MOLECULAR AND CELLULAR BIOLOGY	3.813	Q2	71.062	3	0.56
STEM CELLS	5.587	Q1	90.938	2	1.92
GENE	2.498	Q3	46.491	2	0.18
MOLECULAR SYSTEMS BIOLOGY	8.5	Q1	92.979	2	0.59

Table 156 Top journals on Molecular Biology & Genetics of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ONCOTARGET	-	-	-	103	0.84
PLOS ONE	2.766	Q1	77.344	100	1.16
SCIENTIFIC REPORTS	4.122	Q1	82.031	95	0.87
MITOCHONDRIAL DNA PART A	0.575	Q4	7.310	72	0.86
BMC GENOMICS	3.73	Q1	76.563	62	1.04
CELL RESEARCH	15.393	Q1	95.000	55	1.13
PLOS GENETICS	5.54	Q1	87.427	47	0.96
GENE	2.498	Q3	46.491	45	1.22
NATURE COMMUNICATIONS	12.353	Q1	96.094	45	0.79
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	40	0.80

Table 157 Top journals on Molecular Biology & Genetics of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENTIFIC REPORTS	4.122	Q1	82.031	40	0.72
PLOS ONE	2.766	Q1	77.344	35	0.95
ONCOTARGET	-	-	-	25	0.47
BMC GENOMICS	3.73	Q1	76.563	20	0.76
CELL REPORTS	8.032	Q1	85.526	20	0.69
JOURNAL OF MECHANICS IN MEDICINE AND BIOLOGY	0.875	Q4	10.897	20	1.66
NATURE COMMUNICATIONS	12.353	Q1	96.094	12	0.61
TISSUE ENGINEERING PART A	3.508	Q2	53.421	10	1.09
STEM CELLS	5.587	Q1	90.938	10	1.31
MOLECULAR & CELLULAR PROTEOMICS	5.232	Q1	89.241	9	0.63
NATURE GENETICS	27.125	Q1	99.123	9	2.13
CELL DEATH & DISEASE	5.638	Q1	78.684	9	0.96

Table 158 Top journals on Molecular Biology & Genetics of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
ONCOTARGET	-	-	-	20	1.22
PLOS ONE	2.766	Q1	77.344	9	0.72
SCIENTIFIC REPORTS	4.122	Q1	82.031	9	0.54
DEVELOPMENTAL CELL	9.616	Q1	98.810	7	1.01

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
CELL REPORTS	8.032	Q1	85.526	5	0.58
CELLULAR PHYSIOLOGY AND BIOCHEMISTRY	5.5	Q1	90.964	5	0.26
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	4	0.38
MOLECULAR BIOLOGY OF THE CELL	3.512	Q2	54.474	4	1.25
NATURE COMMUNICATIONS	12.353	Q1	96.094	4	0.42
MOLECULAR REPRODUCTION AND DEVELOPMENT	3.113	Q1	81.034	4	0.38

Table 159 Top journals on Molecular Biology & Genetics of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENTIFIC REPORTS	4.122	Q1	82.031	21	0.93
ONCOTARGET	-	-	-	16	0.94
PLOS ONE	2.766	Q1	77.344	15	0.85
NATURE COMMUNICATIONS	12.353	Q1	96.094	10	0.92
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	9	0.58
CELLULAR SIGNALLING	3.487	Q2	53.421	8	0.51
TISSUE ENGINEERING PART A	3.508	Q2	53.421	7	1.28
TISSUE ENGINEERING AND REGENERATIVE MEDICINE	1.216	Q4	23.718	7	1.43
CELL REPORTS	8.032	Q1	85.526	6	0.32
MOLECULAR AND CELLULAR BIOLOGY	3.813	Q2	71.062	6	0.47

Table 160 Top journals on Molecular Biology & Genetics of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BMC GENOMICS	3.73	Q1	76.563	21	1.73
PLOS ONE	2.766	Q1	77.344	11	1.22
SCIENTIFIC REPORTS	4.122	Q1	82.031	11	0.51
MOLECULAR PHYLOGENETICS AND EVOLUTION	4.412	Q1	80.612	8	0.96
GENE	2.498	Q3	46.491	8	1.1
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	5	1.17
MOLECULAR BIOLOGY AND EVOLUTION	10.217	Q1	96.939	5	0.68
PLOS GENETICS	5.54	Q1	87.427	5	1.36
GENOME BIOLOGY AND EVOLUTION	3.94	Q1	75.731	5	1.39
GENOME BIOLOGY	13.214	Q1	97.953	5	0.8
NATURE	41.577	Q1	99.219	5	2.21
ONCOTARGET	-	-	-	5	0.54

Table 161 Top journals on Molecular Biology & Genetics of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
CELL RESEARCH	15.393	Q1	95.000	20	1.24
SCIENTIFIC REPORTS	4.122	Q1	82.031	19	0.69
ONCOTARGET	-	-	-	12	0.66
NATURE COMMUNICATIONS	12.353	Q1	96.094	11	0.84
CELL REPORTS	8.032	Q1	85.526	9	0.84
JOURNAL OF MOLECULAR CELL BIOLOGY	5.595	Q1	78.158	9	0.81
CELL	31.398	Q1	99.486	8	1.04
PLOS ONE	2.766	Q1	77.344	7	0.82
CELL DISCOVERY	4.462	Q2	68.684	7	1.2

5.12 Top journals on Clinical Medicine

Table 162 to Table 168 provide the journals with the most publications of seven universities on ESI Clinical Medicine respectively. On the whole, the major publication journals on ESI Clinical Medicine of seven universities are high-impact journals in related fields, indicating that the scientific research achievements on ESI Clinical Medicine have been widely recognized by the international academic community. On the aspect of the number of publications, *PLOS ONE* belongs to Q1, and is also one of the most publication journals on ESI Clinical Medicine of six universities including Southern University of Science and Technology (5 papers), University of Chinese Academy of Sciences (30 papers), Nanyang Technological University (42 papers), Hong Kong University of Science and Technology (10 papers), Pohang University of Science and Technology (23 papers), King Abdullah University of Science and Technology (2 papers). In addition, *SCIENTIFIC REPORTS* also published many publications, and it is also in the top 10 publication journals by five universities. In terms of JNCI, the JNCI of papers of Nanyang Technological University in 9 journals are all higher than 1, showing that the citation performance of these papers all exceed the average citation performance of papers published in the same journal and that it is the papers that received more attention in the same journal. Four of the top 5 publication journals of Southern University of Science and Technology belong to Q1, however, the citation performance of papers in the 5 journals are lower than the average in the same journal, indicating that the researchers in Southern University of Science and Technology published most of their papers in high-impact journals, and that Southern University of Science and Technology needs to be improved because of the citation performance

Table 162 Top journals on Clinical Medicine of Southern University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PLOS ONE	2.766	Q1	77.344	5	0.93

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
OSTEOARTHRITIS AND CARTILAGE	5.454	Q1	98.052	2	0.72
INTERNATIONAL JOURNAL OF PEDIATRIC OTORHINOLARYNGOLOGY	1.305	Q3	35.366	2	0.48
CARCINOGENESIS	5.072	Q1	79.054	2	0.92
BLOOD	15.132	Q1	97.887	2	0.38

Table 163 Top journals on Clinical Medicine of University of Chinese Academy of Sciences

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENTIFIC REPORTS	4.122	Q1	79.954	39	1.09
PLOS ONE	2.766	Q1	77.344	30	0.85
THERANOSTICS	8.537	Q1	94.361	23	1.06
CANCER LETTERS	6.491	Q1	87.613	16	0.83
BIOLOGY OF REPRODUCTION	3.184	N/A	84.483	14	1.12
CANCER RESEARCH	9.13	Q1	92.568	10	0.73
JOURNAL OF BIOMEDICAL OPTICS	2.367	Q2	64.362	10	0.60
ONCOLOGY REPORTS	2.976	Q3	44.820	10	0.84
HYPERTENSION	6.823	Q1	96.154	10	0.92
EBIOMEDICINE	6.183	Q1	90.602	9	0.96

Table 164 Top journals on Clinical Medicine of Nanyang Technological University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENTIFIC REPORTS	4.122	Q1	82.031	43	1.03

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PLOS ONE	2.766	Q1	77.344	42	1.01
JOURNAL OF BIOMEDICAL OPTICS	2.367	Q2	64.362	26	1.97
BIOMEDICAL MICRODEVICES	2.077	Q2	51.923	13	1.57
NANOMEDICINE	5.005	Q1	86.563	12	0.8
INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE	3.388	Q1	85.593	10	0.31
BMJ OPEN	2.413	Q2	72.403	10	0.72
JOURNAL OF MEDICAL IMAGING AND HEALTH INFORMATICS	0.549	Q4	5.859	10	1.7
THERANOSTICS	8.537	Q1	94.361	10	1.98
LANCET	53.254	Q1	99.026	9	2.88
DIABETOLOGIA	6.023	Q1	89.161	9	0.64
JOURNAL OF TRAVEL MEDICINE	1.8	Q2	58.117	9	1.61
JOURNAL OF STRENGTH AND CONDITIONING RESEARCH	2.325	Q2	64.815	9	0.5
COCHRANE DATABASE OF SYSTEMATIC REVIEWS	6.754	Q1	92.532	9	1.04

Table 165 Top journals on Clinical Medicine of Hong Kong University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
EVIDENCE-BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE	2.064	Q2	64.815	22	1.35
MOLECULAR MEDICINE REPORTS	1.922	Q3	32.707	17	1.82
ONCOLOGY LETTERS	1.664	Q4	13.288	15	0.85
PLOS ONE	2.766	Q1	77.344	10	1.16
TUMOR BIOLOGY	-	-	-	9	1.19

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
BMC CANCER	3.288	Q2	52.477	6	0.79
MEDICAL ENGINEERING & PHYSICS	1.923	Q3	44.231	4	0.77
INTERNATIONAL JOURNAL OF CLINICAL AND EXPERIMENTAL PATHOLOGY	1.396	Q3	29.747	4	2.18
SCIENTIFIC REPORTS	4.122	Q1	82.031	4	0.41
JOURNAL OF BIOMEDICAL OPTICS	2.367	Q2	64.362	4	0.62

Table 166 Top journals on Clinical Medicine of Pohang University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
SCIENTIFIC REPORTS	4.122	Q1	82.031	27	1.01
PLOS ONE	2.766	Q1	77.344	23	0.88
JOURNAL OF BIOMEDICAL OPTICS	2.367	Q2	64.362	13	0.77
JOURNAL OF PHYSICAL THERAPY SCIENCE	-	-	-	9	0.8
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.504	Q1	92.969	5	0.58
ULTRASONICS	2.377	Q2	72.581	5	1.11
THERANOSTICS	8.537	Q1	94.361	5	0.81
NANOMEDICINE	5.005	Q1	86.563	4	1.21
MEDICAL ENGINEERING & PHYSICS	1.923	Q3	44.231	3	1.34
MEDICINE AND SCIENCE IN SPORTS AND EXERCISE	4.291	Q1	91.975	3	0.57
ARCHIVES OF DERMATOLOGICAL RESEARCH	2.148	Q2	62.698	3	1.17
JOURNAL OF KOREAN MEDICAL SCIENCE	1.588	Q2	51.623	3	0.83
DIABETES	7.273	Q1	93.357	3	0.61
JOURNAL OF INVESTIGATIVE DERMATOLOGY	6.448	Q1	96.032	3	0.97

Table 167 Top journals on Clinical Medicine of King Abdullah University of Science and Technology

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
PLOS ONE	2.766	Q1	77.344	6	0.49
BIOMEDICAL MICRODEVICES	2.077	Q2	51.923	2	0.29
BMC COMPLEMENTARY AND ALTERNATIVE MEDICINE	2.109	Q2	72.222	2	0.73
WOUND REPAIR AND REGENERATION	2.952	Q1	78.750	2	0.71

Table 168 Top journals on Clinical Medicine of ShanghaiTech University

Journal	Impact factor	Quartile	Percentile	Number of publications	JNCI
CANCER RESEARCH	9.13	Q1	92.568	3	0.79
JOURNAL OF CLINICAL ENDOCRINOLOGY & METABOLISM	5.789	Q1	86.364	2	1.06
HEPATOLOGY	14.079	Q1	94.375	2	0.59
EBIOMEDICINE	6.183	Q1	90.602	2	1.85
SCIENTIFIC REPORTS	4.122	Q1	82.031	2	0.28
CIRCULATION RESEARCH	15.211	Q1	99.296	2	1.04
BIOCHIMICA ET BIOPHYSICA ACTA-MOLECULAR BASIS OF DISEASE	5.108	Q1	88.194	2	1.51

5.13 Number of publications on top comprehensive journals

Table 169 shows the numbers of publications of Southern University of Science and Technology and six benchmarking universities on top four journals of *Nature, Science*, *Cell* and *PNAS*. In terms of the total number of publications, University of Chinese Academy of Sciences and Nanyang Technological

University devote the most publications on the four journals and seven universities have fewer publications on *Cell* compared to other journals.

Table 169 Number of publications of seven universities on four top journals

Institution	Number of publications on Nature	Number of publications on Science	Number of publications on Cell	Number of publications on PNAS
Southern University of Science and Technology	3	2	1	14
University of Chinese Academy of Sciences	27	22	15	118
Nanyang Technological University	26	27	6	57
Hong Kong University of Science and Technology	6	3	2	24
Pohang University of Science and Technology	5	14	1	44
King Abdullah University of Science and Technology	11	12	1	22
ShanghaiTech University	12	10	8	15

Chapter VI Analysis of Highly Cited Publications and Research Fronts of Southern University of Science and Technology

If the citations of a publication (which is published in recent 10 years, indexed in *SCIE* or *SSCI* whose the document type is Article or Review) rank top 1% of all the publications at the same publication year and the same category, this publication could be selected as a highly cited publication. ESI Highly Cited Publications refer to the publications attracting high attention in the same category and exerting high impact in the academic community.

If a set of publications are co-cited frequently, the research topics of the set of publications usually have a higher correlation. The publication clusters generated by applying the co-citation relationship of publications reveal the self-organized structure of science. And these clusters are valuable for researchers in discovering the important research problems and following the significant academic issues. The ESI Research Fronts are a set of Highly Cited Publications with strong co-citation relationship, and ESI Research Fronts reveal the significant research theme and research hotspot.

The Highly Cited Publications which contribute the ESI Research Fronts are called core publications. The names of ESI Research Front are the most frequent keywords from the titles of core publications. For example, Table 170 is the example of an ESI Research Front, and its average publication year indicates the average publication year of core publications. According to the ESI database updated in September 2018, there are 9,256 Research Fronts in 22 categories.

Table 170 Example of ESI Research Fronts

Research fronts	Number of core publications	Average year of publication
DYNAMIC COVALENT CHEMISTRY APPROACHES; DYNAMIC COVALENT CHEMISTRY; DYNAMIC COMBINATORIAL CHEMISTRY; DYNAMIC IMINE CHEMISTRY; DYNAMIC COMBINATORIAL/COVALENT CHEMISTRY	20	2013.2

This chapter will analyze ESI Highly Cited Publications and Research Fronts participated by Southern University of Science and Technology. Those scholars who contribute the highly cited papers will also be analyzed.

6.1 ESI Highly Cited Publications of Southern University of Science and Technology

Southern University of Science and Technology has published 65 Highly Cited Publications. Please see ESI category distribution from Table 171. The 65 Highly Cited Publications are in three main categories that are Chemistry, Materials Science and Physics. Among all highly cited papers, the paper from Professor Dai Junfeng on *Nature Nanotechnology* has been mostly cited, the ciatation number of which is up to 1,360.

Table 171 ESI Highly Cited Publications from Southern University of Science and Technology

ESI Category	Number of Highly Cited Publications
Chemistry	27
Materials Science	14
Physics	9
Engineering	4
Geosciences	4
Environment/Ecology	2
Agricultural Sciences	1
Biology & Biochemistry	1
Computer Science	1

ESI Category	Number of Highly Cited Publications
Microbiology	1
Plant & Animal Science	1

6.2 ESI Research fronts with the participation of Southern University of Science and Technology

According to the ESI Research fronts data in September 2018, Southern University of Science and Technology has participated in 23 Research Fronts in total, and the name of each front, number of Highly Cited Publications, average year of publication, citations per publication can be seen in Table 172, In which the front with the greatest citations is No 1.

Table 172 ESI Research Fronts with the participation of Southern University of Science and Technology

No.	Name	Number of core papers	Average publication year	Citations	Citations per publication
1	CANDIDATE TYPE-II WEYL SEMIMETAL MOTE2;CANDIDATE TYPE-II WEYL SEMIMETAL WTE2;TYPE-II WEYL SEMIMETAL CANDIDATE WTE2;TOPOLOGICAL WEYL SEMIMETAL CANDIDATE NBP;TYPE-II WEYL SEMIMETAL CANDIDATE MOXW1-XTE2	40	2015	11647	291.18
2	SINGLE CESIUM LEAD HALIDE PEROVSKITE NANOCRYSTALS;ALL-INORGANIC CESIUM LEAD HALIDE PEROVSKITE NANOCRYSTALS;HIGHLY LUMINESCENT ALKYLAMMONIUM LEAD HALIDE PEROVSKITE NANOCRYSTALS;HIGHLY LUMINESCENT LEAD HALIDE PEROVSKITE NANOCRYSTALS;SHAPE-CONTROLLED CESIUM LEAD HALIDE PEROVSKITE NANOCRYSTALS	46	2015.6	8341	181.33
3	BROADBAND ABSORBING SEMICONDUCTING POLYMER NANOPARTICLES;SELF-QUENCHED SEMICONDUCTING	39	2015.9	3350	85.90

No.	Name	Number of core papers	Average publication year	Citations	Citations per publication
	POLYMER NANOPARTICLES;DIKETOPYRROLOPYRROLE-BASED SEMICONDUCTING POLYMER NANOPARTICLES;SEMICONDUCTING POLYMER NANOPARTICLES;VIVO PHOTOACOUSTIC IMAGING				
4	PHOSPHORIC ACID CATALYZED ASYMMETRIC 1;BIFUNCTIONAL TERTIARY AMINE-SQUARAMIDE CATALYZED ASYMMETRIC CATALYTIC 1;ASYMMETRIC BRONSTED ACID CATALYZED CYCLOADDITIONS;ORGANOCATALYTIC ASYMMETRIC SYNTHESIS;ASYMMETRIC ORGANOCATALYTIC SYNTHESIS	29	2015.6	3013	103.90
5	THERMOELECTRIC P-TYPE POLYCRYSTALLINE SNSE;HEAVILY DOPED P-TYPE SNSE SINGLE CRYSTALS;P-TYPE POLYCRYSTALLINE SNSE DOPED;NA-DOPED P-TYPE POLYCRYSTALLINE SNSE;POLYCRYSTALLINE P-TYPE SNSE	12	2015.3	2391	199.25
6	UNACTIVATED ALIPHATIC ALKENES;UNACTIVATED ALKENES;ALKENES;COPPER-CATALYZED TRIFLUOROMETHYLATION-INITIATED RADICAL 1;COPPER-CATALYZED INTERMOLECULAR TRIFLUOROMETHYLAZIDATION	14	2013.3	2362	168.71
7	ENVIRONMENTAL ANTIBIOTIC RESISTANCE GENES;ABUNDANT ANTIBIOTIC RESISTANCE GENES;DISCOVER ANTIBIOTIC RESISTANCE GENES;ANTIBIOTIC RESISTANCE GENES;COMPREHENSIVE ANTIBIOTIC RESISTANCE DATABASE	16	2014.6	2247	140.44
8	MULTIPLE GLOBAL CLIMATE;GLOBAL WATER RESOURCES AFFECTED;GLOBAL HYDROLOGICAL MODELS;CLIMATE CHANGE IMPACTS SIMULATED;GLOBAL FLOOD RISK	20	2014.9	2130	106.50
9	LOW ENERGY OXIDE-BASED ELECTRONIC SYNAPTIC DEVICE;NEUROMORPHIC VISUAL SYSTEMS;NEUROMORPHIC NETWORK	7	2013.7	1804	257.71

No.	Name	Number of core papers	Average publication year	Citations	Citations per publication
	BASED;NEUROMORPHIC SYSTEMS;BIOREALISTICALLY IMPLEMENT SYNAPTIC PLASTICITY				
10	SATELLITE SOLAR-INDUCED CHLOROPHYLL FLUORESCENCE;SATELLITE CHLOROPHYLL FLUORESCENCE MEASUREMENTS;SATELLITE CHLOROPHYLL FLUORESCENCE OBSERVATIONS;FAR-RED SUN-INDUCED CHLOROPHYLL FLUORESCENCE;CHLOROPHYLL FLUORESCENCE REMOTE SENSING	22	2015	1484	67.45
11	LARGE SINGLE-CRYSTAL BILAYER GRAPHENE;LARGE SINGLE-CRYSTAL GRAPHENE;SINGLE-CRYSTAL MONOLAYER GRAPHENE;SINGLE-CRYSTAL GRAPHENE ASSISTED;MILLIMETER-SIZE SINGLE-CRYSTAL GRAPHENE	8	2014.8	1451	181.38
12	SOFTWARE-DEFINED NETWORKING;SOFTWARE-DEFINED NETWORKS;SOFTWARE-DEFINED NETWORK;PROGRAMMABLE NETWORKS;COMPREHENSIVE SURVEY	12	2014.3	1385	115.42
13	BIOLOGICALLY ACTIVE SPIROOXINDOLES;SPIROOXINDOLES;ORGANOCATALYTIC ASYMMETRIC ASSEMBLY REACTIONS;ASYMMETRIC ORGANOCATALYTIC CONSTRUCTION;SYNTHESIS	6	2014.7	1248	208.00
14	SNTE FACILITATES VALENCE BAND CONVERGENCE;HIGH THERMOELECTRIC PERFORMANCE;THERMOELECTRIC PERFORMANCE;OPTIMIZES THERMOELECTRIC PROPERTIES;P-TYPE SNTE	8	2014.9	806	100.75
15	BICUSEO OXYSELENIDES;NEW PROMISING THERMOELECTRIC MATERIALS;HIGH THERMOELECTRIC PERFORMANCE;CA-DOPED BICUSEO;OXYSELENIDES	2	2013.5	273	136.50
16	ENANTIOSELECTIVE COPPER-CATALYZED INTERMOLECULAR CYANOTRIFLUOROMETHYLATION;ENANTIOSELECTIVE COPPER-CATALYZED INTERMOLECULAR AMINO-;CATALYTIC ASYMMETRIC	6	2016.5	261	43.50

No.	Name	Number of core papers	Average publication year	Citations	Citations per publication
	RADICAL AMINOPERFLUOROALKYLATION; DIRECT ASYMMETRIC RADICAL AMINOTRIFLUOROMETHYLATION; COPPER-CATALYZED RADICAL RELAY				
17	NEW PROVINCIAL CO2 EMISSION INVENTORIES;REDUCED CARBON EMISSION ESTIMATES;UPDATED EMISSION FACTORS;CHINA BASED;CHINA	3	2015.7	255	85.00
18	TOPOLOGICAL SEMIMETALS CARRYING ARBITRARY HOPF NUMBERS;PERIODICALLY DRIVEN NODAL LINE SEMIMETALS;WEYL SEMIMETALS;TOPOLOGICAL SEMIMETALS;CREATING STABLE FLOQUET-WEYL SEMIMETALS	7	2016.7	233	33.29
19	AXIALLY CHIRAL NAPHTHYL-INDOLE SKELETONS;CATALYTIC ASYMMETRIC PAAL-KNORR REACTION;AXIALLY STEREOENRICHED BIARYLS;HIGHLY ATROPOSELECTIVE SYNTHESIS;ORGANOCATALYTIC ASYMMETRIC ARYLATION	4	2016.8	172	43.00
20	URBAN WATER INFRASTRUCTURE;WATER SCARCITY ASSESSMENTS;WATER;URBAN PLANET;PAST	2	2015.5	84	42.00
21	TOUGH HYDROGEL BASED;SELF-HEALABLE TOUGH HYDROGEL;MUSSEL-INSPIRED ADHESIVE;MUSSEL-INSPIRED CONDUCTIVE;NANOCLAY CONFINED DOPAMINE POLYMERIZATION	2	2017	53	26.50
22	UV STABLE HIGHLY EFFICIENT PEROVSKITE SOLAR CELLS;THERMALLY STABLE MAPBI(3) PEROVSKITE SOLAR CELLS;GA-DOPED SNO2 MESOPOROUS CONTACT;1 CM(2) ACHIEVED;ADDITIVE ENGINEERING	2	2017.5	47	23.50
23	ENDOSIDIN2 TARGETS CONSERVED EXOCYST COMPLEX SUBUNIT EXO70;DIFFERENT ENDOMEMBRANE TRAFFICKING PATHWAYS ESTABLISH APICAL;BASAL POLARITIES;EXOCYTOSIS	2	2016.5	33	16.50

Table 173 to Table 195 show the list of the top institutions based on the number of core papers in each Research Front and the number of core papers contributed by Southern University of Science and Technology.

Table 173 Top Institutions in Research Front 1 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Princeton University	15	37.50%
United States Department of Energy	14	35.00%
Chinese Academy of Sciences	12	30.00%
National University of Singapore	9	22.50%
Academia Sinica	7	17.50%
National Tsing Hua University	7	17.50%
Northeastern University	6	15.00%
Paul Scherrer Institute	6	15.00%
Peking University	6	15.00%
University of Oxford	6	15.00%
Southern University of Science and Technology	**2**	**5.00%**

Table 174 Top institutions in Research Front 2 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Swiss Federal Institute of Technology Zurich	9	19.57%
Swiss Federal Institute of Materials Science and Technology	9	19.57%
United States Department of Energy	6	13.04%
Italian Institute of Technology	4	8.70%
Lawrence Berkeley National Laboratory	4	8.70%
University of California, Berkeley	4	8.70%
Beijing Institute of Technology	3	6.52%

Institution name	Record	Proportion of Highly Cited Publications
Chinese Academy of Sciences	3	6.52%
City University of Hong Kong	3	6.52%
Jilin University	3	6.52%
Kavli Nanoscience Institute at the California Institute of Technology	3	6.52%
Nanjing University	3	6.52%
Nanjing University of Science and Technology	3	6.52%
Southern University of Science and Technology	**1**	**2.17%**

Table 175 Top institutions in Research Front 3 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Nanyang Technological University	17	43.59%
Stanford University	9	23.08%
Autonomous University of Madrid	4	10.26%
Nankai University	4	10.26%
Federal University of Alagoas	4	10.26%
University of Quebec	3	7.70%
Southern University of Science and Technology	**1**	**2.56%**

Table 176 Top institutions in Research Front 4 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
RWTH Aachen University	5	17.24%
Chinese Academy of Sciences	4	13.79%

Institution name	Record	Proportion of Highly Cited Publications
China Pharmaceutical University	2	6.90%
Hong Kong University of Science and Technology	2	6.90%
Nankai University	2	6.90%
Northwest University	2	6.90%
University of Chinese Academy of Sciences	2	6.90%
Universität Leipzig	2	6.90%
Southern University of Science and Technology	**1**	**3.45%**

Table 177 Top institutions in Research Front 5 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Northwest University	4	33.33%
University of Michigan	3	25。00%
Beijing Aerospace University	2	16.67%
California Institute of Technology	2	16.67%
Chinese Academy of Sciences	2	16.67%
University of Houston	2	16.67%
Southern University of Science and Technology	**1**	**8.33%**

Table 178 Top institutions in Research Front 6 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Chinese Academy of Sciences	4	28.57%

Institution name	Record	Proportion of Highly Cited Publications
University of Zurich	2	14.29%
Donghua University	1	7.14%
Federal Institute of Technology, Lausanne	1	7.14%
Hanyang University	1	7.14%
Lanzhou University	1	7.14%
Nanjing University	1	7.14%
Institute of Physical and Chemical Research	1	7.14%
Saitama University	1	7.14%
Tokyo Institute of Technology	1	7.14%
Université Claude Bernard Lyon 1	1	7.14%
University of North Carolina	1	7.14%
University of North Carolina at Chapel Hill	1	7.14%
Oxford university	1	7.14%
Xi'an Jiaotong University	1	7.14%
Southern University of Science and Technology	**1**	**7.14%**

Table 179 Top institutions in Research Front 7 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
University of Chinese Academy of Sciences	4	25.00%
Michigan State University	3	18.75%
Julius Kuhn Institute	2	12.50%
Macquarie University	2	12.50%
Hong Kong university	2	12.50%
Washington University in St. Louis	2	12.50%
Southern University of Science and Technology	**1**	**6.25%**

Table 180 Top institutions in Research Front 8 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Potsdam Institute for Climate Studies	11	55.00%
Utrecht University	8	40.00%
Met Office	7	35.00%
University of Nottingham	7	35.00%
Max Planck Society	6	30.00%
National Institute for Environmental Studies	6	30.00%
Kassel University	6	30.00%
University of Bonn	6	30.00%
Norwegian Water Resources and Energy Directorate	5	25.00%
University of Tokyo	5	25.00%
Southern University of Science and Technology	**1**	**5.00%**

Table 181 Top institutions in Research Front 9 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Stanford University	2	28.57%
University of California, Santa Barbara	2	28.57%
Agency for Science,Technology and Research	1	14.29%
Arizona State University	1	14.29%
Chinese Academy of Sciences	1	14.29%
Harvard University	1	14.29%
Nanjing University	1	14.29%

Institution name	Record	Proportion of Highly Cited Publications
National Research Council	1	14.29%
Peking University	1	14.29%
Southern University of Science and Technology	**1**	**14.29%**
State University of New York at Brookport	1	14.29%
University of Michigan	1	14.29%
University of Pennsylvania	1	14.29%

Table 182 Top Institutions in Research Front 10 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
National Aeronautics and Space Administration	15	68.18%
Carnegie Institution for Science	9	40.91%
California Institute of Technology	7	31.82%
Freie Universität Berlin	6	27.27%
Harvard University	5	22.73%
University of Technology Sydney	5	22.73%
Twente University	5	22.73%
Helmholtz Association	4	18.18%
University of Arizona	4	18.18%
University of Valencia	4	18.18%
Southern University of Science and Technology	**1**	**4.55%**

Table 183 Top Institutions in Research Front 11 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Sungkyunkwan University	3	37.50%

Institution name	Record	Proportion of Highly Cited Publications
Austin University	3	37.50%
Columbia University	2	25.00%
Hong Kong Polytechnic University	2	25.00%
Institute for Basic Science	2	25.00%
Beijing University	2	25.00%
Rice University	2	25.00%
Sandia National Laboratories	2	25.00%
Southern University of Science and Technology	**2**	**25.00%**
Ulsan National Institute of Science and Technology	2	25.00%
United States Department of Energy	2	25.00%
Wuhan University	2	25.00%

Table 184 Top Institutions in Research Front 12 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Georgia Institute of Technology	3	25.00%
Queen's University Belfast	2	16.67%
Southern University of Science and Technology	**1**	**8.33%**

Table 185 Top Institutions in Research Front 13 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Hong Kong Polytechnic University	1	16.67%
Lanzhou University	1	16.67%
National Academy of Science of Ukraine	1	16.67%

Institution name	Record	Proportion of Highly Cited Publications
University of Lisbon	1	16.67%
Ukrainian Academy of Medical Sciences	1	16.67%
National University of Pharmacy	1	16.67%
Scripps Research Institute	1	16.67%
University of Texas Medical School	1	16.67%
Zhengzhou University	1	16.67%
Southern University of Science and Technology	**1**	**16.67%**

Table 186 Top Institutions in Research Front 14 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Northwest University	5	62.50%
University of Michigan	5	62.50%
Argonne National Laboratory	4	50.00%
United States Department of Energy	4	50.00%
University of Chicago	4	50.00%
Beihang University	2	25.00%
Department of Science & Technology (India)	2	25.00%
Jawaharlal Nehru Centre for Advanced Scientific Research	2	25.00%
Boston College	1	12.50%
Massachusetts Institute of Technology	1	12.50%
University of Houston	1	12.50%
Southern University of Science and Technology	**1**	**12.50%**

Table 187 Top Institutions in Research Front 15 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Centre national de la recherche scientifique	2	100.00%
Université Paris-Saclay	2	100.00%
Southern University of Science and Technology	**1**	**50.00%**

Table 188 Top Institutions in Research Front 16 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Chinese Academy of Sciences	5	83.33%
University of Chinese Academy of Sciences	3	50.00%
Southern University of Science and Technology	**2**	**33.33%**
Hong Kong University of Science and Technology	1	16.67%
University of Wisconsin-Madison	1	16.67%

Table 189 Top Institutions in Research Front 17 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
California Institute of Technology	3	100%
Chinese Academy of Sciences	3	100%
Tsinghua University	3	100%
East Anglia University	3	100%
Harvard University	2	66.67%
University of California, Irvine	2	66.67%
Cambridge University	2	66.67%
University of Maryland, College Park	2	66.67%
Southern University of Science and Technology	**1**	**33.33%**

Table 190 Top Institutions in Research Front 18 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Chinese Academy of Sciences	2	28.57%
Massachusetts Institute of Technology	2	28.57%
Tsinghua University	2	28.57%
Boston College	1	14.29%
Germany Hamburg Free Electron Laser Science Center	1	14.29%
Swiss Federal Institute of Technology Zurich	1	14.29%
Max Planck Society	1	14.29%
Nanjing University of Aeronautics and Astronautics	1	14.29%
North Carolina State University	1	14.29%
Southeast University	1	14.29%
Stanford University	1	14.29%
Sungkyunkwan University	1	14.29%
Basque University	1	14.29%
University of North Carolina	1	14.29%
University of Palermo	1	14.29%
University of Tokyo	1	14.29%
Wuhan University	1	14.29%
Southern University of Science and Technology	**1**	**14.29%**

Table 191 Top Institutions in Research Front 19 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Southern University of Science and Technology	**2**	**50.00%**
Chinese Academy of Sciences	1	25.00%
Centre national de la recherche scientifique	1	25.00%
Jiangsu Normal University	1	25.00%
University of Strasbourg	1	25.00%
Wuhan University	1	25.00%

Table 192 Top Institutions in Research Front 20 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
University of Kassel	2	100.00%
Aalto University	1	50.00%
Baruch College	1	50.00%
Beijing Forestry University	1	50.00%
Columbia University	1	50.00%
Swiss Federal Institute of Technology Zurich	1	50.00%
Cancer Research UK	1	50.00%
McGill University	1	50.00%
National Aeronautics and Space Administration	1	50.00%
National Institute for Environmental Studies	1	50.00%
The Nature Conservancy	1	50.00%
Stanford University	1	50.00%
State University of New York at Brookport	1	50.00%
Swiss Federal Institute of Aquatic Sciences	1	50.00%
University of Basel	1	50.00%
University of Nottingham	1	50.00%

Institution name	Record	Proportion of Highly Cited Publications
University of Tokyo	1	50.00%
Utrecht University	1	50.00%
Southern University of Science and Technology	**1**	**50.00%**

Table 193 Top Institutions in Research Front 21 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Flinders University	2	100.00%
Hong Kong University of Science and Technology	2	100.00%
Sichuan University	2	100.00%
Southwest Jiaotong University	2	100.00%
Chinese University of Hong Kong	1	50.00%
South China University of Technology	1	50.00%
Southern University of Science and Technology	**1**	**50.00%**

Table 194 Top Institutions in Research Front 22 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
Adolphe Merkle Institute	1	50.00%
Helmholtz Association	1	50.00%
National Institute for Material Science	1	50.00%
Shanghai Jiaotong University	1	50.00%
University of Fribourg	1	50.00%
Southern University of Science and Technology	**1**	**50.00%**

Table 195 Top Institutions in Research Front 23 and the number of core papers from Southern University of Science and Technology

Institution name	Record	Proportion of Highly Cited Publications
University of California, Riverside	2	100.00%
Charles University, Prague	1	50.00%
Czech Academy of Sciences	1	50.00%
University of Pulkine, Czech Republic	1	50.00%
University of Pennsylvania	1	50.00%
Southern University of Science and Technology	**1**	**50.00%**

Chapter VII Summary

7.1 Main Findings of the Report

Through the systematic bibliometric analysis of the scientific output of Southern University of Science and Technology, we can see that:

Although the establishment history of Southern University of Science and Technology is relatively short, the scale of scientific research output has developed rapidly, from 124 papers in 2013 to 1,151 papers in 2018 and the growth rate of publications in each year is far higher than the average growth level of papers in Chinese Mainland. Compared with the benchmarking universities, from the aspects of the indicators emphasizing on scales such as the number of publications and total citations, Southern University of Science and Technology still keeps significant gaps with the five benchmarking universities that are University of Chinese Academy of Sciences, Nanyang Technological University, Hong Kong University of Science and Technology, Pohang University of Science and Technology and King Abdullah University of Science and Technology, but shows certain superiority compared with the young ShanghaiTech University (Table 1). The number of publications and total citations of University of Chinese Academy of Sciences and Nanyang Technological University are apparently higher than other five benchmarking universities. In terms of the normalized indicator - citations per publication, Nanyang Technological University ranks first among the seven universities. The indicators of Southern University of Science and Technology and University of Chinese Academy of Sciences are very close, ranking sixth and seventh, which can be seen that the average number of citations still need to be further improved. According to the output of the CNCI (Category Normalized Citation Impact), CNCI of all seven universities is much higher than the global average level, among which the CNCI of Southern University of Science and Technology is 1.75 times the strong of the global average level, approaching to Hong Kong

University of Science and Technology and Nanyang Technological University. From the perspective of Percentage of Documents in Top 10%, Hong Kong University of Science and Technology is up to 20.93%, which is twice as many as the global average level (10%), only second to King Abdullah University of Science and Technology. The findings suggest that, although the output scale of scientific research publications of Southern University of Science and Technology is not so high, the citation impact of publications is rather high, which reflects that the scientific achievements of Southern University of Science and Technology have gained the high attention of the academic community.

It is not easy to give an accurate definition for world-class universities. However, carrying out the comparative analysis with scientometrics methods from the perspective of scientific research performance is an important method for us to master the core characteristics of world-class universities. Through analyzing the number of publications and CNCI of world-class universities, we can see that, despite low publication output of Southern University of Science and Technology, its CNCI has exceeded the threshold value of world-class universities as well as the CNCI of the top universities in Chinese Mainland, which indicates that Southern University of Science and Technology has strong scientific research strength.

We can see from the analysis of category distribution and performance of Southern University of Science and Technology that, in terms of the number of publications, Southern University of Science and Technology devotes the most publications on Chemistry, Physics and Materials Science; in terms of citations, the CNCI of top 5 categories based on publication volume is obviously higher than the global average level, while the CNCI of Chemistry which is the top category is twice of the global average level, which is the reason why it has ranked the line of world-class universities. Currently, Chemistry is the most advantaged category of Southern University of Science and Technology (Table 4).

According to comparison analysis on category distribution, Southern University of Science and Technology and the six benchmarking universities all have a higher output of publications on Chemistry, Physics, Materials Science, Engineering and Computer Science as a whole. In terms of concentration degree of category, Southern University of Science and Technology has the highest concentration degree of category among the seven universities, in which, the publications on Chemistry and Physics account for a large proportion of that of the entire university, and the overall publication proportion of the two categories is 45.41% of that of the whole university.

If two universities have similar proportions of publications in each category, they have similar category structures; otherwise, the category structures of two universities differ obviously. As a whole, the seven universities have a higher similarity of category structure. As for Southern University of Science and Technology, its category structure is the closest to that of Pohang University of Science and Technology, but among the seven universities, Nanyang Technological University and Hong Kong University of Science and Technology have the highest degree of similarity.

As for collaborative countries/regions, Southern University of Science and Technology mainly carries out scientific research collaboration in the USA, Hong Kong, and Singapore. Meanwhile, Chinese Mainland is also the country/region where the four benchmarking universities outside Chinese Mainland keep the closest collaboration. In terms of top 10 collaborative institutions based on publication volume, the collaborative institutions of Southern University of Science and Technology are mainly in Chinese Mainland (5 institutions) and Hong Kong (3 institutions), that of University of Chinese Academy of Sciences mainly come from Chinese Mainland (9 institutions), that of Hong Kong University of Science and Technology mainly come from Chinese Mainland (8 institutions), while that of Nanyang Technological University are mainly in Singapore (4 institutions) and Chinese Mainland (2 institutions).

Through the benchmarking analysis of 12 ESI categories and Life Science area - Chemistry, Physics, Materials Science, Engineering, Mathematics, Biology & Biochemistry, Computer Science, Economics & Business, Environment & Ecology, Geosciences, Molecular Biology & Genetics and Clinical Medicine, we find that in Chemistry, CNCI and Percentage of Documents in Top 10% of Southern University of Science and Technology rank the top of seven benchmarking universities, and the citation performance has ranked among the world's first-class disciplines. Chemistry is the most advantageous category for Southern University of Science and Technology and is the most potential category to become the world-class category at present. It is worth noting that, in terms of the number of ESI categories, after two ESI categories ie. Agricultural Science and Geosciences have publications during 2013-2016 compared with that in 2013-2015, the university achieved a breakthrough in Microbiology during 2013-2017. We can say that, 2017 is a year that ESI Microbiology has made great progress; Pohang University of Science and Technology has large publication proportion on Materials Science, but has the lowest CNCI and the Percentage of Documents in Top 10% in the seven universities, which indicates that, despite that Pohang University of Science and Technology occupies a large scale of research on Materials Science, the citation impact is relatively low among the seven universities; Southern University of Science and Technology occupies the highest proportion on Mathematics among the 7 universities, while ShanghaiTech University ranks the bottom on Mathematics. Meanwhile, the CNCI and Percentage of Documents in Top 10% on Mathematics of ShanghaiTech University are obviously lower than the global average level, which manifests that Mathematics is still at the inferior status; the proportion of publications on Computer Science of Southern University of Science and Technology and University of Chinese Academy of Sciences are still lower than other five universities, and the CNCI and Percentage of Documents in Top 10% on Computer Science of University of Chinese Academy of Sciences are apparently lower than the global average level; in Economics & Business,

publications proportion of Hong Kong University of Science and Technology is far higher than that of other six universities, and King Abdullah University of Science and Technology still has not published any papers on the category; for Life Science, University of Chinese Academy of Sciences is the strongest in terms of research output and citations; although ShanghaiTech University has small publication scale, it has the highest citation impact; Southern University of Science and Technology is at a moderate level in terms of the impact of publications, but there is still a certain gap in the number of publications, which is definitely closely related to the overall scale of the category of the university; Environment & Ecology of University of Chinese Academy of Sciences takes the lead of other universities in terms of research output, but CNCI is lower than other 6 universities. King Abdullah University of Science and Technology performs best in both publication number and citation impact. Although Southern University of Science and Technology has only 71 papers in this category, the Percentage of Documents in Top 10% reaches 21.13%, far higher than the global average level; in terms of Geosciences, Southern University of Science and Technology shows the phenomenon of “polarization”, which means the smallest publication scale but highest citation impact. It indicates that Southern University of Science and Technology has published publications with great impact in this category, but the number of publications needs to be increased; ShanghaiTech University has the highest proportion of publications in Molecular Biology & Genetics, accounting for 14.99% while other six universities are generally distributed between 2% and 3%. Southern University of Science and Technology has published only 57 papers in this category, which is lower than other six universities, but the Percentage of Documents in Top 10% (19.3%) is second only to King Abdullah University of Science and Technology (26.75%) and ShanghaiTech University (21.89%); In terms of Clinical Medicine, Southern University of Science and Technology has the smallest volume (33 papers), and the CNCI is 1.47, which is at the middle level among the seven benchmarking

universities. In general, University of Chinese Academy of Sciences is the strongest university in ESI Clinical Medicine.

From the perspective of collaboration, most publications of Southern University of Science and Technology on 12 ESI categories are collaborative publications. The proportion of collaborative publications on Chemistry is the lowest among the 12 categories with a value more than 80%. The proportion of collaborative publications on Computer Science exceeds 95%, and the publications on Mathematics, Environment & Ecology, Geosciences, and Economics & Business are all finished collaboratively with other institutions. On the whole, Southern University of Science and Technology keeps the closest collaboration with Chinese Academy of Sciences, Nanyang Technological University, University of Hong Kong and Peking University on 12 ESI categories. It is worth mentioning that the ranking for the collaboration between Peking University and Southern University of Science and Technology has been improved from the 4th in past report to the 2nd currently, and the citation impact is far higher than the global average level. Based on the further investigation, we can see that these two universities collaborate frequently on category Environment & Ecology and Geosciences. In addition, in this report, Wuhan University enters the list of top10 institutions collaborated with Southern University of Science and Technology based on publication volume for the first time, ranking the 5th. These two universities have carried out many high-level collaborations on Chemistry.

According to ESI data updated in November 2018, two categories including Chemistry and Materials Science of Southern University of Science and Technology have ranked as the global top 1% disciplines. Among the remaining 19 ESI categories, the category with the greatest potentialities is Engineering (52.24%), but there is still a gap to the threshold becoming the global top 1% discipline.

Through the analysis of departments and scholars of 12 ESI categories of Southern University of Science and Technology, we can see that, in ESI Chemistry, Departments of Chemistry and Materials Science and Engineering offer the main support. Professors Tan Bin and Liu Xinyuan of Department of Chemistry have the highest contribution for this category in both number of publications and citations; in ESI Physics, Department of Physics contributes most, with 185 papers. Department of Materials Science and Engineering has published only 43 papers, but it has obtained 792 citations. Professor Sun Xiaowei from Department of Electrical and Electronic Engineering makes the highest contribution on the number of publications, and CNCI of Professor Lu Haizhou from Department of Physics is up to 6.41; in ESI Materials Science, Department of Materials Science and Engineering contributes the most to the publication number. The output efficiency of Departments of Physics, Electrical and Electronic Engineering and Chemistry are all greater than 1. The CNCI of Associate Professor Liang Yongye from Department of Materials Science and Engineering is up to 5.12, who is also on the list of the Highly Cited Researcher from 2016 to 2018 released by Clarivate; in ESI Engineering, over 50% of publications are contributed by only one department that is Department of Electrical and Electronic Engineering, and citations are much higher than other departments. Among the Top11 scholars based on the publication volume, 8 of them have higher CNCI than the global average level, and their overall citation impact is relatively high. Similar to ESI Engineering, the interdisciplinary research of other departments in Mathematics is not very active either. The major supporting department is Department of Mathematics. Associate Professor Li Jingzhi in Department of Mathematics has made the greatest contribution to the category both in the number of publications and citation; in ESI Biology & Biochemistry, Department of Biology contributes the most papers and citations. Due to the limited category scale, the output of scholars is generally small. Associate professor Wei Zhiyi from the Department of Biology has published the most papers (7 papers); in ESI Computer Science, Department of Electrical and

Electronic Engineering is the major contributor, with 25 papers and 304 citations. Professor Gong Yi of Department of Electrical and Electronic Engineering has the highest contribution to citations; in Economics & Business, Department of Finance publishes 14 papers with 12 citations. Associate Professor Yang Zhaojun and Assistant Professors Chen Kun of Department of Finance are the major contributors; in Life Science, Department of Biology contributes a lot to both the number of publications and citations. Other performing departments include the Shenzhen Key Lab Cell Microenvironment. Professor Xiao Guozhi and Associate Professor Wei Zhiyi of Department of Biology have the highest number of publications, and the highest contribution to citations and the CNCI are both higher than the global average level; in ESI Molecular Biology & Genetics, the major participating department is still Department of Biology, with 44 papers and 288 citations. The author with the highest number of papers is professor Wu Chuanyue from Department of Biology; in ESI Clinical Medicine, the major participating departments are Department of Biology, Shenzhen Key Lab Cell Microenvironment and Department of Electrical and Electronic Engineering. The papers published by Associate Professor Liang Yongye from Department of Materials Science and Engineering and Chair Professor Chen Wei from Department of Biology have attracted much attention. From the total number of publications of various categories, from 2013 to 2017, Professor Sun Xiaowei, Professor Lu Zhouguang, Professor He Jiaqing, Assistant Professor Chen Shuming, Professor Liu Xinyuan contribute the highest number of publications, and CNCI of most researchers exceed the global average level. In general, based on these indicators, Southern University of Science and Technology onwns a group of outstanding scientific researchers.

Seen from the top journals of the publications, most of the top journals of the seven universities on 12 ESI categories are concentrated in Q1, indicating that the seven universities published their research on the high impact journals of related research categories. However, we can see that the citations of Pohang University of Science and Technology on top journals are usually lower than

average citations on the same journal, which manifests that the publication impact of Pohang University of Science and Technology is relatively low.

At present, Southern University of Science and Technology altogether participates in 65 Highly Cited Publications and 23 global Research Fronts. In 2017, the number of publications of Southern University of Science and Technology in the top four journals continues to increase. In particular, seven high-level papers are published in PNAS totally during 2013 to 2016. These 7 papers are mainly contributed by Department of Biology (5 papers) and Department of Materials Science and Engineering (2 papers).

7.2 Comparative analysis with the previous reports

The publication and citation impact of scientific research achievements have the cumulative effect of time, and the research output of a university presents a dynamic change at varying periods, therefore, we can reveal and observe the development of scientific research through the comparative analysis of output at varying periods, so as to help people at research office to master the university's overall research performance level from a macroscopic perspective. This section is to provide data support for further development of research in Southern University of Science and Technology by comparing research performance in the universiry during 2013 - 2015, 2013 - 2016 and 2013 - 2017.

7.2.1 Trend change of overall publications of Southern University of Science and Technology

Firstly, from the number of publications, Southern University of Science and Technology has 3,152 publications in 2013-2018. During 2013 to 2017, it was 2001 with an increase of 927 compared with that in 2013-2016 (1,074 papers), far exceeding the growth of 559 papers in 2013-2016 compared with that in 2013-2015, which signifies that Southern University of Science and Technology has been developed a lot in research output. Based on deep analysis of 926 papers published by Southern University of Science and Technology in 2017, we

found that about 61% of the papers are from the three dominant categories, ehich include Chemistry, Material Science and Physics. This is similar to the data in 2016 which is 66%. This indicates that the advantaged categories of Southern University of Science and Technology effectively drive the output level of overall publications of the university.

Secondly, regarding citation impact, we can see that the citations per publication grow from 9.24 between 2013 and 2015 to 10.42 between 2013 and 2016, and then to 10.46 between 2013 and 2017; besides, the CNCI keeps in the steady from 1.73 to 1.75, maintaining growth at a high level. These number indicates that when the output scale of Southern University of Science and Technology expands as time goes by, its citation impact is also enhanced steadily.

7.2.2 Change of closeness degree to ESI top 1% discipline

If one category's citations of one institution within a period of 10 years rank top 1% of all institutions around the world, this institution enters the ESI global top 1% institution in this discipline. In the last 2018's report, we predicted that Southern University of Science and Technology would soon have ESI global top 1% category. In the ESI data updated in July 2018, we are pleased to see that Chemistry and Materials Science, two most potential categories, have entered the ESI global top 1% for the first time. According to the ESI data released in November 2018, Southern University of Science and Technology ranks 1085 out of 1209 top 1% institutions in Chemistry and 702 out of 835 top 1% institutions in Materials Science. It is believed that the ranking performance of these two categories will get better and better over time. At the same time, the possibility of Engineering entering the global top 1% list has increased from 10.5% to 25.63% and then to 52.24 % currently. Although the potential value base is small, the growth rate cannot to be underestimated. It would be the next ESI global top 1% discipline in the next few years.

7.2.3 Comparison of impact with the Chinese top and world-leading universities

In order to construct a world-class university, it is needed to guarantee both the quality and impact of scientific output firstly. Through comparing the impact of scientific research output in three periods (2013 to 2015, 2013 to 2016, 2013 to 2017), we can see that, on the one hand, the CNCI of Southern University of Science and Technology remain in a high level, being 1.73 at two periods respectively, rose slightly to 1.75 in 2013-2017, all of which are far higher than the global average level; on the other hand, compared with Chinese and world-leading universities, the CNCI of Southern University of Science and Technology takes the lead in Chinese leading universities and has reached the threshold value of world-class universities. It is suggested that Southern University of Science and Technology shall expand the publications scale while maintaining the output quality, encourage and guide the researchers to focus on the global high impact journals and Research Fronts, as well as promote and stimulate the output of more high impact achievements.

7.2.4 Change of Highly Cited Papers and Research Front

ESI Highly Cited Papers quantitatively can reveal the output level of high-impact research to a certain extent, and the Research Fronts involved in Highly Cited Papers also provide a reference for institutions to identify world hotspots and to track the development direction of different research areas. From the perspective of the number of Highly Cited Papers, Southern University of Science and Technology has expanded rapidly. The number of Highly Cited Papers has increased from 38 last year to 65 this year, and more and more papers have gained wide attention from global peers, indicating that Southern University of Science and Technology is improving its global impact. At the same time, the number of Research Fronts involved has also increased from 12 last year to 23 this year, which once again shows that Southern University of Science

and Technology actively participates in or even dominates the research on some key and hot topics.

7.3 General advice

According to the development status and characteristics of various categories of Southern University of Science and Technology in all three reports of this project and relevant policies implemented by other institutions in the process of discipline development, this section focuses on summarizing several general suggestions for promoting discipline development.

7.3.1 Expanding the scale of disciplines and improving the structure of disciplines

Based on the above summary analysis of all disciplines, we can see that for many disciplines in Southern University of Science and Technology, the expansion of discipline scale is an important step for further developments. Generally speaking, the expansion of the discipline scale can be achieved gradually by strengthening scientific research awards and funding support, as well as recruiting high-level talents. Meanwhile, the adjustment and improvement of discipline structure should also be taken into account to achieve the improvement of the overall discipline scale.

During the implementation process, it needs to be determined according to the specific developmental stage. For example, for those disciplines with a certain scale and its own characteristic, it is suggested to improve the discipline structure based on its own advantages such as focusing on the research direction of its advantages. For those small disciplines, it is suggested to start from the basic level and to refer to the best practices from other universities. Besides, it's also necessary to comprehensively consider the organization and construction of the discipline structure.

7.3.2 Promoting international collaboration and internationalization

Based on the analysis in section 2.5.1, the citation impact of international collaborative publications of Southern University of Science and Technology is generally higher than the global average level and the overall level of the university. A lot of bibliometric analyses and studies show that the impact of international collaborated papers is usually higher than that of the institution itself, which means, international collaboration plays a positive role in promoting the impact of institution's scientific research. For those disciplines with a certain scale, enhancing international collaboration is an important way to improve the global impact. In that way, the speed to enter the ESI global top 1% could be accelerated.

From another point of view, the significance of international collaboration is not only to enhance the citation impact of papers, but also to enhance the international reputation of the university and research reputation of disciplines in general. Mr. PHIL BATY, head of Times Higher Education World University Ranking, pointed out, "In recent years, several universities which have significantly improved their rankings have made great progress in globalization, including enhancing international collaborations, recruiting high-level international researchers and providing international student exchange programs. We can see that progress in internationalization not only contributes directly to ranking improvement but also improves other important ranking indicators such as reputation and global research impact."

7.3.3 Targeting and Following Research fronts and high-impact journals

In the process of promoting potential categories to the ESI global top 1%, many research institutions try to provide relevant guidance and reference information for researchers from the management level, which aim to assist researchers to focus their research on global Research Fronts and hot spots, select high-impact journals, and improve the visibility of research results.

To be specific, on the one hand, the university can guide researchers to focus on global Research Fronts and hot spots, concentrate limited research resources on more influential research issues, strive for progress and breakthroughs in these key research topics and fields, and ultimately enhance the overall research influence. On the other hand, it can help researchers to target those high impact journals so that their research results have more possibility to get high citations. The high-impact journal can be defined from many aspects, such as the journal with more Highly Cited Papers, the journal with higher Impact Factor and the journal with higher ranking by Quartile.

7.3.4 Constructing talented persons and recruiting high-level talents

At present, for research institutions, there is keen competition in talents. Attracting high-level talents from foreign and domestic institutions has become a very important strategy for domestic institutions to enhance their scientific and teaching level. Clarivate Analytics release the list of Highly Cited Researchers annually since 2014. The list is based on publication data from Web of Science^{TM} Core Collection Database. It selects the researchers with the largest number of Highly Cited Papers in the ESI Categories in the past 10 years, in order to identify the world-class researchers in the major disciplines. Two scholars from Southern University of Science and Technology, Associate Professor Liang yongye from Department of Materials Science and Engineering and Chair Professor Wang Haijiang from Department of Mechanical and Energy Engineering, are included in the list of "2018 Highly Cited Researchers" released last year. It is suggested that Southern University of Science and Technology shall conduct an in-depth analysis of the performance of its researchers, so as to identify and to cultivate those potential researchers to become Highly Cited Researchers and therefore to promote the development of the discipline.

In addition to the institution's existed talents, recruiting high-level talents is also an important way to enhance the strength of the discipline. The recruiting qualifications need to match the development of the discipline. Combining the

development trend of each discipline, different talent development and introduction strategies can be formulated:

1) For those disciplines whose scale is expanding year by year, but citation impacts are still very low, on the one hand, a better performance appraisal system can be established through reward and support policies, so as to promote the development of this discipline from quantity oriented to quality oriented. On the other hand, more efforts can be made to attract talents evolved in the current global discipline hotspots, Research Fronts areas or selected in Highly Cited Researchers around the world.

2) For those disciplines that have a steady number but have stable increasing in citation impact, the university can go deep into those advantages sub-areas, expand the talented team of these advantage areas, and continue to maintain high impact.

3) For those disciplines with low scale and influence, it is necessary to start with expanding the talent team and intensify the introduction of basic talents, with the main goal of increasing publication number.

7.3.5 Promoting the sustainable development of the discipline

For disciplines that have become the ESI global top 1%, it is still necessary to continuously improve their global influence in ESI so as to maintain and further improve their ranking in ESI. Similarly, policy incentives can be carried out in the aspects of talent cultivation, talent introduction, journal selections and so on by referring to the above suggestions. For those disciplines with a lower ranking in the ESI, it's quite normal that it will drop out of ESI global top 1% because ESI is a rolling and dynamic ranking. For universities, it is more reasonable to put into a longer period of time to study.

It is meaningless that ESI itself only provides indicators of the global top 1% institutions, but institutions can set higher goals on this basis, so as to ensure the progress and improvement of superior disciplines. For example, for the discipline

ranked in the top 1%, the university can consider setting a goal of top 1‰. For those disciplines in the middle of the rankings, consider setting a goal of five thousandths, and so on. Based on different goals, the university can adjust its incentive policy, development strategy, and resource investment.

7.4 Outlook

According to the development history of the universities such as Nanyang Technological University and Hong Kong University of Science and Technology, it is quite possible for young universities to be global research universities with high level. Although the establishment history of Southern University of Science and Technology is short and its output number is small, we can see the number of publications of Southern University of Science and Technology is elevated rapidly in one aspect, and from the citation impact, the CNCI of Southern University of Science and Technology exceeds the performance of Chinese leading universities in another aspect. Compared with University of Chinese Academy of Sciences, Nanyang Technological University, Hong Kong University of Science and Technology, Pohang University of Science and Technology, King Abdullah University of Science and Technology and ShanghaiTech University, it also ranks the top and even reaches the threshold value of average citation level of world-class universities.

World-class universities mean they have world-class standards in many aspects. In addition to first-class scientific research, world-class universities shall have the first-class talent team, first-class educational quality, first-class student pool, first-class resource investment, first-class management level, etc. Only carrying out all-around construction in line with the connotation of world-class universities can build a world-class university.

From the view of global (especially American) world-class universities, notwithstanding the generality of world-class universities, we can see clearly that the world-class universities possess their own features and characteristics, and

construction paths of various universities to world-class universities also have obvious differences. Clear definition, rational planning, and long-term persistence are important parts in the construction of world-class universities. Qualified higher education requires huge investment, and it might be an efficient path in the construction of modern world-class universities by combining the development direction of universities, the regional, national and global technology and the requirements of economic and social development.

It is predictable that Southern University of Science and Technology will be a powerful competitor for China's first completion of world-class universities.

Appendix

Appendix 1: Definition of 22 ESI Categories[6]

ESI Category	Description
AGRICULTURAL SCIENCES	Agricultural Sciences covers journals in general agriculture, agricultural chemistry and engineering, agronomy, dairy science, and animal science as it relates to agricultural needs, as well as food science and nutrition. Topics covered include tillage research and soil science; agroforestry; horticulture; crop protection and science; pest control and weed science; agrochemistry; phytochemistry; agricultural biochemistry; food chemistry; cereal chemistry; carbohydrate and lipid research; food composition, additives, and contaminants; food microbiology and technology; agricultural engineering and processing; meat and dairy science; animal breeding; animal genetics, nutrition, and production; poultry science; nutrition and metabolism; and nutritional biochemistry. Clinical nutrition also maps here. Agricultural economics maps to *Economics & Business*.
BIOLOGY & BIOCHEMISTRY	Biology & Biochemistry covers a broad range of general topics. These include structure and chemistry of biological molecules; molecular, cellular, and clinical studies of the endocrine system (but does not include clinical endocrinology); regulation of cell, organ, and system functions by hormones; experimental research in general biology and biological systems; anatomy; physiology; cytology; pathology; morphology; proteomics; histochemistry; biophysics; regulation of biological functions at the whole organism level; exploitation of living organisms or their components; industrial microbiology; pollution remediation; industrial chemicals and enzymes; biosensors; bioelectronics; pesticide development; food, flavor, and fragrance industry applications; and waste treatment. Computational biology and life-science-related microscopy journals also map here.

[6] Definition for each ESI category：http://ipscience-help.thomsonreuters.com/incitesLiveESI/ESIGroup/overviewESI/scopeCoverageESI/esiScopeNotes.html 。Journal Mapping list can be downloaded from http://ipscience-help.thomsonreuters.com/incitesLiveESI/ESIGroup/overviewESI/esiJournalsList.html

ESI Category	Description
CHEMISTRY	The Chemistry category covers a broad spectrum of topics within the chemical sciences, including analytical chemistry, inorganic and nuclear chemistry, organic chemistry, physical chemistry, crystallography, electrochemistry, chemical methods and structures, natural and laboratory syntheses, and isolation and analysis of clinically significant molecules. This category also covers instrumentation and spectroscopy journals. Miscellaneous and applied chemistry journals also map here. Polymer science journals not largely related to Materials Science map here; otherwise, they map to *Materials Science.* Chemical engineering journals also map here, provided they deal exclusively with chemical engineering—if they deal with multiple forms of engineering, they map to *Engineering*.
CLINICAL MEDICINE	The Clinical Medicine category covers journals dealing with a wide range of medical and biomedical topics. These include anesthesia and critical care medicine, cardiovascular medicine and cardiology, dentistry, dermatology, general and internal medicine, endocrinology, environmental medicine, gastroenterology, gynecology, hepatology, hematology, legal medicine, nephrology, nuclear medicine, nursing, obstetrics and reproductive medicine, oncology, ophthalmology, otolaryngology, pediatrics, radiology, respiratory medicine and pulmonology, rheumatology, surgery (including neurosurgery), and urology. Clinical pharmacology as it relates to clinical trials maps here; otherwise pharmacology topics map to *Pharmacology & Toxicology*. All nutrition topics map to *Agricultural Sciences*. Ethics journals solely devoted to medical ethics map here. Journals dealing with the clinical aspects of substance abuse are classified here; those dealing with the social aspects map to *Social Sciences, General.*
COMPUTER SCIENCE	Computer Science encompasses computer hardware and architecture, computer software, software engineering and design, computer graphics, programming languages, theoretical computing, computing methodologies, interdisciplinary computer applications, artificial intelligence theory, information systems and information technology, telecommunications, communications via various

ESI Category	Description
	devices and systems, and acquisition, processing, storage, management, and dissemination of information. Bioinformatics journals also map here.
ECONOMICS & BUSINESS	The Economics & Business category includes journals which cover theoretical, political, agricultural, and developmental economics, as well as business, finance, management, organizational science, strategic planning and decision-making methods, and industrial relations and labor matters.
ENGINEERING	Engineering includes publications covering a number of engineering disciplines, including aerospace engineering, mechanical engineering, electrical and electronics engineering, nuclear energy, civil engineering (which also encompasses water resources and supply and transportation and municipal engineering), the effects of humans on the environment and controls to minimize environmental degradation, applied artificial intelligence, robotics and automatic control, engineering mathematics (which encompasses mathematical modeling, optimization techniques, and statistical methods in engineering systems), energy and fuels, operations research, engineering management, construction and building technology, and the development, manufacture, and application of instruments. Chemical engineering journals also related to other areas of engineering map here; otherwise, they map to *Chemistry*.
ENVIRONMENT/ECOLOGY	Environment/Ecology covers interrelated disciplines on pure and applied ecology, ecological modeling and engineering, ecotoxicology, evolutionary ecology, environmental contamination and toxicology, environmental health, environmental monitoring and management, environmental technology, environmental geology, water resources research, climate change, limnology, and biodiversity conservation. Natural history journals are also covered here. Environmental *Studies* subjects map to *Social Sciences*.
GEOSCIENCES	The Geosciences category covers a broad range of journals related to physical studies of the Earth. These include geology, geochemistry, geophysics, geotechnics, economic geology, petrochemistry, mineralogy, meteorology and atmospheric sciences, hydrology, oceanography, petroleum geology, volcanology, seismology, climatology, paleontology,

ESI Category	Description
	remote sensing, geodesy, and geological, petroleum, and mining engineering.
IMMUNOLOGY	The category of Immunology incorporates journals containing cellular and molecular studies in immunology; clinical research in immunopathology; infectious diseases; autoimmunity and allergy; host-pathogen interactions in infectious diseases; and experimental therapeutic applications of immunomodulating agents.
MATERIALS SCIENCE	The Materials Science category deals with journals covering the admixtures of matter or the basic materials from which products are constructed. These include ceramics, paper and wood products, textiles, composites, coatings and films, biomaterials, metals and alloys, metallurgy, superconductors and semiconductors, ferroelectrics, dielectrics, and the application of chemistry to materials design and testing. Polymer journals largely related to Materials Science map here; otherwise they map to *Chemistry*.
MATHEMATICS	The Mathematics category comprises journals dealing with pure and applied mathematics as well as statistics and probability.
MICROBIOLOGY	The Microbiology category contains journals dealing with biology and biochemistry of protozoa and microorganisms (bacterial, viral, and parasitic), medical implications of the subsets of these organisms known to cause diseases, and the biotechnology applications of microorganisms for basic science or clinical use. Fungi journals are not mapped to this category, but rather to *Plant & Animal Science*.
MOLECULAR BIOLOGY & GENETICS	Molecular Biology & Genetics covers all aspects of basic and applied genetics, as well as research that has specific emphasis on cellular functions in eukaryotic systems. These topics include biochemistry in eukaryotic systems; receptor biology; signal transduction; regulation of gene expression; morphogenesis; cell-environment interactions; molecular genetics; developmental genetics; developmental biology; biomedical engineering; mechanisms of mutagenesis; structure, function, and regulation of genetic material; clinical genetics; patterns of inheritance; genetics causes of diseases; and screening for and treatment of genetic diseases. General cell biology journals also map here.
MULTIDISCIPLINARY	This category includes journals of a broad or general character in the sciences and covers the spectrum of

ESI Category	Description
	major scientific disciplines. It also includes journals devoted to a multidisciplinary approach to the study of particular regions, ecosystems, or biological systems, as well as interdisciplinary journals designed to illuminate significant connections between fields.
NEUROSCIENCE & BEHAVIOR	Neuroscience & Behavior includes journals that cover cellular and molecular neuroscience, neuronal development, basic and clinical neurology, psychopharmacology, biobehavioral psychology, molecular psychology, and neuronal function underlying higher cognitive processes. Neurosurgery is not covered in this category, but rather in *Clinical Medicine* with other surgical journals.
PHARMACOLOGY & TOXICOLOGY	*Pharmacology* covers journals dealing with pharmacology; pharmaceutics, cellular and molecular pharmacology; drug design and metabolism; mechanisms of drug action; drug delivery; natural products and traditional medicines; xenobiotics; medicinal chemistry; and mechanisms of action for clinical therapeutics. *Toxicology* covers journals dealing with molecular and cellular effects of harmful substances, environmental toxicology, occupational exposure, and clinical toxicology.
PHYSICS	Physics includes journals covering articles from all areas of physics and the following subfields: mathematical physics, particle and nuclear physics, physics of fluids and plasmas, quantum physics, theoretical physics, chemical physics, applied physics, condensed matter physics, physics of materials, and optics and acoustics.
PLANT & ANIMAL SCIENCE	Plant Science covers general botany journals as well as non-agricultural plant research, including regional botany, mycology, bryology, plant physiology, forestry, plant pathology, economic botany, aquatic botany and toxicology, marine ecology, plant nutrition, photosynthesis research, experimental botany, and cellular and molecular biology or physiology of plant cells and plant systems. Animal Science covers non-agricultural animal science journals. Topics include animal behavior, health, and genetics; veterinary medicine; lab animal science; marine and freshwater biology; fisheries science; aquaculture; entomology; evolutionary

ESI Category	Description
	biology; wildlife research; and zoology, encompassing primatology, mammalogy, ornithology, herpetology, nematology, and malacology.
PSYCHIATRY/PSYCHOLOGY	All areas of psychiatry and psychology are covered in this category, including applied, biological, clinical, developmental, educational, mathematical, organizational, personal, and social, as well as the diagnosis and treatment of psychiatric disorders.
SOCIAL SCIENCES, GENERAL	The Social Sciences category includes journals which cover communication, environmental studies, library and information sciences, political science, public health and administration, rehabilitation, social work and social policy, sociology, anthropology, law, education, linguistics, tourism and hospitality, and demography. Journals covering the history and philosophy of science also map to this category. Ethics journals are classified here, unless they deal strictly with medical ethics, then they map to *Clinical Medicine*. Journals dealing with the social aspects of substance abuse map here; any with clinical aspects map to *Clinical Medicine*.
SPACE SCIENCE	The Space Science category covers journals dealing with all areas of astronomy and astrophysics, celestial bodies, and observation and interpretation of radiation from the component parts of the universe.

Appendix 2: Variants of Southern University of Science and Technology

No	Variant Name	Unified organization	City and Country
1	S UNIV SCI TECHNOL	Southern University of Science & Technology	PEOPLES R CHINA
2	S UNIV SCI TECHNOL CHINA	Southern University of Science & Technology	PEOPLES R CHINA
3	SOUTH UNIV SCI TECHNOL	Southern University of Science & Technology	PEOPLES R CHINA
4	SOUTH UNIV SCI TECHNOL	Southern University of Science & Technology	SHENZHEN, PEOPLES R CHINA
5	SOUTH UNIV SCI TECHNOL CHINA	Southern University of Science & Technology	PEOPLES R CHINA
6	SOUTH UNIV SCI TECHNOL CHINA	Southern University of Science & Technology	SHENZHEN, PEOPLES R CHINA
7	SOUTH UNIV SCI TECHNOL	Southern University of	SHENZHEN,

No	Variant Name	Unified organization	City and Country
	CHINA SUSTC	Science & Technology	PEOPLES R CHINA
8	SOUTH UNIV SCI TECHNOL CHINA SUSTECH	Southern University of Science & Technology	PEOPLES R CHINA
9	SOUTH UNIV SCI TECHNOL CHINN	Southern University of Science & Technology	PEOPLES R CHINA
10	SOUTH UNIV SCI TECHNOL SHENZHEN	Southern University of Science & Technology	PEOPLES R CHINA
11	SOUTH UNIV SCI TECHNOL SUSTECH	Southern University of Science & Technology	PEOPLES R CHINA
12	SOUTHEN UNIV SCI TECHNOL	Southern University of Science & Technology	PEOPLES R CHINA
13	SOUTHERN UNIV SCI TECHNOL	Southern University of Science & Technology	PEOPLES R CHINA
14	SOUTHERN UNIV SCI TECHNOL CHINA	Southern University of Science & Technology	PEOPLES R CHINA
15	SOUTHERN UNIV SCI TECHNOL CHINA SUSTECH	Southern University of Science & Technology	PEOPLES R CHINA
16	SOUTHERN UNIV SCI TECHNOL SUSTECH	Southern University of Science & Technology	PEOPLES R CHINA
17	SOUTHERN UNIV SCI TECHNOL UNIV	Southern University of Science & Technology	PEOPLES R CHINA
18	SUSTC	Southern University of Science & Technology	SHENZHEN, PEOPLES R CHINA

Appendix 3: Top 10 institutions based on total citations from 2008-2018 on four ESI categories around the Globe, Asia and China mainland

Top 10 global institutions based on total citations on Chemistry

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	77655	1614776	22.82%	1.47	16.49%
2	Centre National de la Recherche Scientifique (CNRS)	54785	1038836	16.07%	1.10	11.08%
3	University of California System	26145	888170	6.60%	1.92	21.30%

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
4	United States Department of Energy (DOE)	28399	822685	20.37%	1.82	19.95%
5	CNRS - Institute of Chemistry (INC)	27267	536494	58.01%	1.14	11.17%
6	Max Planck Society	14445	391754	13.21%	1.59	15.96%
7	University of Chinese Academy of Sciences, CAS	21672	374974	24.25%	1.38	15.07%
8	Consejo Superior de Investigaciones Cientificas (CSIC)	16561	344123	15.48%	1.18	12.38%
9	University of California Berkeley	7467	312231	10.49%	2.33	25.98%
10	Council of Scientific & Industrial Research (CSIR) - India	19690	289957	34.77%	0.95	9.72%
*	Southern University of Science and Technology	519	8266	25.94%	2.01	21.39%

Top 10 Asian institutions based on total citations on Chemistry

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	77655	1614776	22.82%	1.47	16.49%
2	University of Chinese Academy of Sciences, CAS	21672	374974	24.25%	1.38	15.07%
3	Council of Scientific & Industrial Research (CSIR) - India	19690	289957	34.77%	0.95	9.72%
4	Nanyang Technological University	7845	266499	18.61%	2.20	23.58%
5	Indian Institute of Technology System (IIT System)	19411	257477	22.50%	0.99	10.37%
6	Zhejiang University	13546	249705	17.26%	1.22	13.28%
7	Tsinghua University	11565	247487	16.34%	1.56	16.38%
8	National University of Singapore	7106	227625	11.74%	1.91	23.30%
9	Japan Science & Technology Agency (JST)	8187	219310	28.37%	1.53	15.26%
10	Institute of Chemistry, CAS	8426	216171	68.98%	1.69	17.56%
*	Southern University of Science and Technology	519	8266	25.94%	2.01	21.39%

Top 10 China mainland's institutions based on total citations on Chemistry

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	77655	1614776	22.82%	1.47	16.49%
2	University of Chinese Academy of Sciences, CAS	21672	374974	24.25%	1.38	15.07%
3	Zhejiang University	13546	249705	17.26%	1.22	13.28%
4	Tsinghua University	11565	247487	16.34%	1.56	16.38%
5	Institute of Chemistry, CAS	8426	216171	68.98%	1.69	17.56%
6	University of Science & Technology of China	9812	211945	23.50%	1.64	18.15%
7	Peking University	9383	209467	13.53%	1.48	15.26%
8	Nanjing University	10247	208694	22.72%	1.42	18.05%
9	Changchun Institute of Applied Chemistry, CAS	7293	192507	64.47%	1.63	19.29%
10	Jilin University	12750	185704	30.23%	1.06	11.69%
*	Southern University of Science and Technology	519	8266	25.94%	2.01	21.39%

Top 10 global institutions based on total citations on Physics

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	United States Department of Energy (DOE)	46655	1187642	33.46%	1.95	21.45%
2	Centre National de la Recherche Scientifique (CNRS)	57948	1070709	16.99%	1.43	15.04%
3	University of California System	31906	943686	8.05%	2.25	24.09%
4	Chinese Academy of Sciences	53681	702447	15.78%	1.13	10.64%
5	Max Planck Society	24021	604450	21.97%	1.99	21.22%
6	Helmholtz Association	25602	534095	19.65%	1.66	18.66%
7	Universite Paris Saclay (ComUE)	23781	513864	22.87%	1.74	18.65%
8	Russian Academy of Sciences	51244	499293	27.08%	0.80	6.63%
9	Istituto Nazionale di Fisica Nucleare	20930	422789	73.93%	1.71	18.12%
10	Massachusetts Institute of Technology (MIT)	12184	412581	19.07%	2.77	28.89%
*	Southern University of Science and Technology	395	4098	19.74%	1.81	14.68%

Top 10 Asian institutions based on total citations on Physics

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	53681	702447	15.78%	1.13	10.64%
2	University of Tokyo	17221	349352	19.89%	1.63	16.26%
3	Tsinghua University	11727	188824	16.57%	1.58	14.91%
4	Peking University	10703	178548	15.43%	1.53	15.87%
5	University of Science & Technology of China	11849	176400	28.37%	1.37	14.14%
6	Kyoto University	9873	173510	15.61%	1.49	14.79%
7	Tohoku University	10401	171884	21.38%	1.16	9.84%
8	RIKEN	7812	162926	28.87%	1.63	18.50%
9	Japan Science & Technology Agency (JST)	6898	157406	23.90%	1.42	14.77%
10	Osaka University	9603	143313	19.58%	1.20	11.45%
*	Southern University of Science and Technology	395	4098	19.74%	1.81	14.68%

Top 10 China mainland's institutions based on total citations on Physics

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	53681	702447	15.78%	1.13	10.64%
2	Tsinghua University	11727	188824	16.57%	1.58	14.91%
3	Peking University	10703	178548	15.43%	1.53	15.87%
4	University of Science & Technology of China	11849	176400	28.37%	1.37	14.14%
5	Institute of Physics, CAS	7144	143154	67.90%	1.58	13.89%
6	Nanjing University	8168	118451	18.11%	1.39	12.79%
7	Institute of High Energy Physics, CAS	5262	104304	60.97%	1.87	18.81%
8	Zhejiang University	7720	101978	9.84%	1.13	11.39%
9	Shanghai Jiao Tong University	7127	90785	9.15%	1.35	13.15%
10	University of Chinese Academy of Sciences, CAS	11461	86849	12.82%	0.91	7.59%
*	Southern University of Science and Technology	395	4098	19.74%	1.81	14.68%

Top 10 global institutions based on total citations on Materials Science

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	38739	767327	11.39%	1.66	20.26%
2	United States Department of Energy (DOE)	14134	387754	10.14%	1.98	22.82%
3	Centre National de la Recherche Scientifique (CNRS)	20486	344337	6.01%	1.07	12.29%
4	University of California System	9866	325969	2.49%	2.15	25.04%
5	University of Chinese Academy of Sciences, CAS	9668	179885	10.82%	1.70	20.51%
6	Tsinghua University	9292	173190	13.13%	1.51	17.33%
7	Nanyang Technological University	5502	167911	13.05%	2.31	27.63%
8	Max Planck Society	4990	147162	4.56%	1.94	22.73%
9	Indian Institute of Technology System (IIT	12519	139927	14.51%	0.87	10.19%

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
	System)					
10	Massachusetts Institute of Technology (MIT)	3490	138919	5.46%	2.49	31.06%
*	Southern University of Science and Technology	380	4493	18.99%	1.93	26.58%

Top 10 Asian institutions based on total citations on Materials Science

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	38739	767327	11.39%	1.66	20.26%
2	University of Chinese Academy of Sciences, CAS	9668	179885	10.82%	1.70	20.51%
3	Tsinghua University	9292	173190	13.13%	1.51	17.33%
4	Nanyang Technological University	5502	167911	13.05%	2.31	27.63%
5	Indian Institute of Technology System (IIT System)	12519	139927	14.51%	0.87	10.19%
6	National University of Singapore	4411	135792	7.29%	2.08	25.91%
7	Shanghai Jiao Tong University	7331	119595	9.41%	1.33	16.42%
8	Zhejiang University	6284	109772	8.01%	1.45	18.00%
9	Fudan University	3654	108414	6.86%	2.26	28.46%
10	Harbin Institute of Technology	9728	108269	23.56%	1.00	12.56%
*	Southern University of Science and Technology	380	4493	18.99%	1.93	26.58%

Top 10 China mainland's institutions based on total citations on Materials Science

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	38739	767327	11.39%	1.66	20.26%
2	University of Chinese Academy of Sciences, CAS	9668	179885	10.82%	1.70	20.51%
3	Tsinghua University	9292	173190	13.13%	1.51	17.33%

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
4	Shanghai Jiao Tong University	7331	119595	9.41%	1.33	16.42%
5	Zhejiang University	6284	109772	8.01%	1.45	18.00%
6	Fudan University	3654	108414	6.86%	2.26	28.46%
7	Harbin Institute of Technology	9728	108269	23.56%	1.00	12.56%
8	Institute of Chemistry, CAS	2651	103899	21.70%	3.22	35.04%
9	Peking University	4240	93677	6.11%	1.94	22.95%
10	University of Science & Technology of China	4842	93204	11.59%	1.78	20.82%
*	Southern University of Science and Technology	380	4493	18.99%	1.93	26.58%

Top 10 global institutions based on total citations on Engineering

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	University of California System	17624	301311	4.45%	1.55	17.35%
2	Centre National de la Recherche Scientifique (CNRS)	25471	296720	7.47%	1.07	11.55%
3	Chinese Academy of Sciences	22915	260733	6.73%	1.37	13.66%
4	Indian Institute of Technology System (IIT System)	21399	211115	24.81%	1.02	10.07%
5	United States Department of Energy (DOE)	12575	187369	9.02%	1.55	18.60%
6	Tsinghua University	16548	180886	23.38%	1.32	14.13%
7	Harbin Institute of Technology	11558	127630	27.99%	1.42	13.93%
8	Nanyang Technological University	8637	124817	20.49%	1.54	17.47%
9	Shanghai Jiao Tong University	12718	122912	16.33%	1.10	11.25%
10	Massachusetts Institute of Technology (MIT)	6408	119219	10.03%	1.69	20.16%
*	Southern University of Science and Technology	174	1005	8.70%	1.40	16.67%

Top 10 Asian institutions based on total citations on Engineering

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	22915	260733	6.73%	1.37	13.66%
2	Indian Institute of Technology System (IIT System)	21399	211115	24.81%	1.02	10.07%
3	Tsinghua University	16548	180886	23.38%	1.32	14.13%
4	Harbin Institute of Technology	11558	127630	27.99%	1.42	13.93%
5	Nanyang Technological University	8637	124817	20.49%	1.54	17.47%
6	Shanghai Jiao Tong University	12718	122912	16.33%	1.10	11.25%
7	Zhejiang University	10910	113156	13.90%	1.18	11.53%
8	National University of Singapore	6996	112368	11.56%	1.59	19.18%
9	Hong Kong Polytechnic University	6762	101897	27.42%	1.57	18.13%
10	Xi'an Jiaotong University	10429	98652	25.32%	1.20	12.54%
*	Southern University of Science and Technology	174	1005	8.70%	1.40	16.67%

Top 10 China mainland's institutions based on total citations on Engineering

Ranking	Institution name	Number of Publications	Total Citations	Percentage of Publication of an ESI Category	Category Normalized Citation Impact	Percentage of Documents in Top 10%
1	Chinese Academy of Sciences	22915	260733	6.73%	1.37	13.66%
2	Tsinghua University	16548	180886	23.38%	1.32	14.13%
3	Harbin Institute of Technology	11558	127630	27.99%	1.42	13.93%
4	Shanghai Jiao Tong University	12718	122912	16.33%	1.10	11.25%
5	Zhejiang University	10910	113156	13.90%	1.18	11.53%
6	Xi'an Jiaotong University	10429	98652	25.32%	1.20	12.54%
7	Huazhong University of Science & Technology	8424	92489	17.90%	1.48	16.62%
8	Southeast University - China	8565	87940	27.87%	1.27	14.23%
9	Beihang University	8981	66371	34.70%	1.05	12.35%
10	Dalian University of Technology	7591	65680	25.59%	1.08	11.58%
	Southern University of Science and Technology	174	1005	8.70%	1.40	16.67%

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