

# Developing a Roadmap for Achieving Scientific Supremacy in Pharmaceutical Sciences Groups in Iran

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## Abstract

**Background:** To attain and consolidate scientific supremacy, academic communities must actively foster cultural transformation and build scientific capacity within society through fundamental change. This study aims to develop a roadmap for Iran's scientific supremacy across all branches of pharmaceutical sciences. This roadmap will be a practical step toward Iran attaining global leadership in pharmaceutical knowledge and provide a model for similar roadmaps in other medical science disciplines.

**Objectives:** This study aims to develop a roadmap for scientific supremacy in Iranian pharmaceutical sciences by assessing current scientific momentum, evaluating researchers' academic standing, and identifying discipline-specific indicators through expert consultation.

**Methods:** This study employed a multi-phase, descriptive design conducted sequentially between January and December 2024. All pharmaceutical science groups active in Iranian medical universities were included (13 Disciplines). Phase One: Calculating Scientific Capability and Competitive Advantage of Pharmaceutical Sciences Groups. Phase Two: Determining Academic Reputation and Excellence of Pharmaceutical Sciences Groups and Phase Three: Identifying Discipline-Specific Indicators for Achieving Scientific Supremacy in Pharmaceutical Sciences.

**Results:** The findings of this study categorized Iran's pharmaceutical science groups into three categories, including flagship (Pharmacology, Pharmaceutics, Medicinal Chemistry, Medicinal Toxicology, Pharmacognosy, Pharmaceutical Biotechnology), pioneer (Pharmaceutical Nanotechnology, Traditional Pharmacy, Clinical Pharmacy, Drug Control), and emerging (Biopharmaceuticals, Nuclear Pharmacy, Drug Economics and Management) groups. A tiered roadmap was developed, directing flagship groups toward networking and internationalization, while leading and emerging groups must first achieve foundational goals in quality improvement and capacity building, respectively. In addition, before reaching the areas mentioned above, necessary measures must be taken for the pioneer groups to achieve the goals of quality improvement, capacity building, culture building, and stewardship. Ultimately, the emerging group must take steps toward focused planning, ensuring alignment, and developing before reaching the status of flagship and pioneer groups.

**Conclusion:** This study provides a strategic, evidence-based model for systematically advancing Iran's pharmaceutical sciences globally, which can be adapted for other scientific disciplines. It is recommended that the general principles of the strategic plan for scientific authority for each pharmaceutical science group be formulated and communicated through legal channels to pave the way for implementation and achieving scientific authority gradually.

**Keywords:** Scientific Supremacy; Pharmaceutical Sciences Groups; Scientific Leadership; Roadmap

## Background

Scientific supremacy refers to exerting a pivotal influence on the current standing and shaping the future trajectory of a scientific discipline. The starting point for an academic institution to move toward scientific supremacy can be its competitive academic advantage over peer institutions. This advantage grants the institution the confidence and courage to compete with rival academic entities, holding a winning edge to achieve a superior position through dedicated effort. A competitive academic advantage encompasses the unique characteristics that elevate an institution above similar entities. These characteristics may relate to infrastructure, capital and resources, accessibility and connections, reputation, personnel, processes, and outstanding academic functions (1). Essentially, competitive advantage is the degree to which an organization is more attractive than its competitors from the perspective of customers; it is the distinctiveness in features or dimensions that enables an organization to provide superior services compared to its rivals (2).

To achieve a competitive advantage, organizations must consider both their external positioning and internal capabilities (3). Accordingly, organizations should seek sustainable competitive advantages. Creating and sustaining such advantages requires competencies that leverage organizational capabilities to generate customer value. Organizational resources—including financial assets, capabilities, processes, information, knowledge, etc.—must be controlled in ways that develop and implement value-creating strategies (3). Generally, higher education institutions pursue educational quality, identification of research and development domains, innovation, and societal engagement. These institutions have evolved beyond traditional roles into hubs for knowledge dissemination, production, and commercialization of research outputs, significantly contributing to national economic development (4).

A deeper examination of scientific supremacy reveals that current global examples stem from foundational, long-term transformations at philosophical and theoretical levels of scientific development. Achieving scientific supremacy requires universities and academic centers to excel globally in education, research, technology, theory development, being reference points, responsiveness, currency, leadership, and innovation. Meanwhile, Iran's pharmaceutical industry demonstrates that innovation

among Iranian drug manufacturers differs from that of global pharmaceutical companies. This difference indicates that a significant portion of global experiences regarding innovation and its enhancement may not apply to Iran's pharmaceutical industry, necessitating specialized solutions tailored to the context of Iranian pharmaceutical companies (5). In Iran, research aimed at identifying dimensions of distinction among medical universities through specialized protocols determined competitive advantages and academic capabilities in clinical specialties and subspecialties (6).

Scientific leadership is a cornerstone of progress and innovation in the pharmaceutical sciences, driving the discovery, development, and delivery of life-saving medications and therapies. In an era of rapid technological advancement, complex health challenges, and the growing demand for novel treatments, effective leadership is essential for fostering a culture of innovation, interdisciplinary collaboration, and strategic foresight within research groups and industry (7, 8). Visionary leadership propels scientific breakthroughs and ensures that research efforts align with societal needs, regulatory requirements, and global health priorities (9).

Despite constraints and limited resources over the past two decades, Iran has achieved remarkable growth in research article quantity and joined the top 20 countries in global scientific rankings (10). However, this alone is insufficient for achieving supremacy. To attain and consolidate scientific supremacy, academic communities must actively foster cultural transformation and build scientific capacity within society through fundamental change (11). Given the emphasis on achieving scientific supremacy in higher-level health policy documents, Iran must reach a position in pharmaceutical sciences where global stakeholders reference the achievements of Iranian researchers and scientists to meet their needs for pharmaceutical knowledge, innovation, and access to scientific advancements. This study aims to develop a roadmap for Iran's scientific supremacy across all branches of pharmaceutical sciences. This roadmap will be a practical step toward Iran attaining global leadership in pharmaceutical knowledge and provide a model for similar roadmaps in other medical science disciplines.

## Objectives

The study objectives are:

1. Determining the current scientific momentum of pharmaceutical science disciplines toward scientific supremacy by calculating scientific capability and research competitive advantage indices to identify competitive advantages of medical universities in pharmaceutical sciences.

2. Determining the academic standing of researchers and faculty members in pharmaceutical science disciplines.

3. Identifying discipline-specific indicators for achieving scientific supremacy in pharmaceutical sciences based on expert opinions and higher-level policy documents.

## Methods

This study employed a multi-phase, descriptive design conducted sequentially between January and December 2024. All pharmaceutical science groups active in Iranian medical universities were included (n=13 disciplines) (Figure 1).

**Participants:** All pharmaceutical science groups active in Iranian medical universities were included, covering: Pharmaceutics, Pharmaceutical Chemistry, Pharmacology, Pharmaceutical Toxicology, Pharmaceutical Biotechnology, Pharmacognosy, Clinical Pharmacy, Nanopharmaceutical Technology, Nuclear Pharmacy, Drug Control, Traditional Pharmacy, Pharmaceutical Economics and Management, and Pharmaceutical Biomaterials.

**Phase One:** Calculating Scientific Capability and Competitive Advantage of Pharmaceutical Sciences Groups

Phase one analyzed the momentum of scientific output, capability, and research competitive advantage in the pharmaceutical sciences. Data were collected using the Faculty Members Scientometrics System (isid.research.ac.ir), based on Scopus data. Formulas and indices for calculating competitive advantages utilized the *h*-index and the *h2*-index. These indices were used to compute the Scientific Strength Index (SSI) and ultimately the Competitive Strength Index (CSI) for each pharmaceutical sciences group (Table 1).

The formulas for calculating the Scientific Strength Index (SSI) and Competitive Strength Index (CSI) (Figures 2 and 3) (Appendix 1). The final composite score for scientific supremacy was calculated for each discipline as the average of three normalized indicator scores (research advantage, number of top scientists, and student training capacity), where each indicator was scaled from 0 to 100 relative to the highest-performing

group. In Phase Three, the initial indicators were derived from a literature review and prior research (6, 12). Questionnaires were sent to the examination boards of all 13 disciplines, achieving a response rate of 90%. The responses were analyzed descriptively and thematically to finalize the discipline-specific indicators (Table 1).

**Phase Two:** Determining Academic Reputation and Excellence of Pharmaceutical Sciences Groups

Global excellence was assessed using the 2023 list of the world's top scientists published by \*PLOS Biology\*. The number of Iranian pharmaceutical scientists in this list was recorded for each group (13). Educational excellence was evaluated based on PhD student enrollment capacity using data from Iran's Medical Education Assessment System (www.sanjeshp.ir) for 2024 (Table 2).

**Phase Three:** Identifying Discipline-Specific Indicators for Achieving Scientific Supremacy in Pharmaceutical Sciences

Following calculations from previous phases, groups' positions on the roadmap were determined using a scientific supremacy index developed in prior research (1). Questionnaires based on identified indicators were emailed to examination and evaluation boards of 13 pharmaceutical disciplines. Follow-ups ensured questionnaire completion over three intervals. Completed questionnaires were collected and analyzed by group, and discipline-specific indicators were finalized (Table 3).

## Analysis

To determine key nodes (indicators) for scientific supremacy in each discipline, modeling is incorporated:

- Scientific capability and competitive advantages
- Number of group scientists among the world's top scientists
- Number of universities training specialized students (Table 3).

The highest values among these indicators were used as benchmarks for full scores.

## Results

The final index was normalized to a maximum score of 100 for each indicator. For instance, in research advantage, the pharmaceutics group demonstrated the highest value and was thus assigned the benchmark score of 100. Other groups received proportionally lower scores based on their performance relative to this benchmark.

Among the groups, the pharmacology and pharmaceuticals groups had the most significant number of universities training specialized students, which were assigned a score of 100.

Additionally, the medicinal chemistry group had the highest number of scientists among the world's top scientists, and was also assigned a score of 100. Finally, the final score was considered based on the average of the three indicators. According to the indicators (Table 1) of the group comparison results, a score above 60 was considered for the flagship groups. Pharmacology, pharmaceuticals, medicinal chemistry, medicinal toxicology, pharmacognosy, and pharmaceutical biotechnology groups were included in this category. In the pioneer group, which received a score between 30 and 60, the categories of pharmaceutical nanotechnology, traditional pharmacy, clinical pharmacy, and drug control were included. The third group, which received a score of 10 to 30, was considered an emerging group, comprising the biopharmaceuticals, nuclear pharmacy, and drug economics and management groups (Tables 4 and 5).

Based on the calculations and modeling carried out in this study, a roadmap for achieving Scientific Supremacy for pharmaceutical science groups was developed, so that the flagship groups were considered in the areas of networking, internationalization, value creation and expansion of action and access, and the planning of these groups in these areas should be in line with achieving Scientific Supremacy. In addition, before reaching the areas mentioned above, necessary measures must be taken for the pioneer groups to achieve the goals of quality improvement, capacity building, culture building, and stewardship. Then, steps should be taken towards achieving Scientific Supremacy in line with the areas of the flagship group. To develop a roadmap for attaining Scientific Supremacy, the areas of focused planning were considered, ensuring alignment.

After achieving the goals of these areas, they targeted quantitative development for the emerging group, which was considered for the areas intended for the pioneer and flagship groups in line with attaining scientific supremacy (attachment of the Scientific Supremacy map of pharmaceutical science groups) (Appendix 2).

### Discussion

Scientific supremacy refers to exerting a pivotal influence on the current standing and shaping the future trajectory of a scientific discipline. The starting point for

an academic institution to move toward scientific supremacy can be its competitive academic advantage over peer institutions (1). In examining Chinese universities' performance, Lu & Qin (2012) found that enhancing effective university functions significantly impacts entrepreneurship and high-tech industry development (8). Salazar & Wang (2009) prioritized improving educational quality and revising curricula/programs for competitive advantage at the University of Houston-Victoria (14). Harper (2004) identified key internal/external factors affecting the University of Texas, highlighting strengths like enrollment growth, quality programs, research expansion, community engagement, faculty-student interaction, student activity, security, and external funding (15).

While competitive advantage positions an institution favorably initially, it does not guarantee ultimate success. Competitors starting from lower positions can overturn outcomes through targeted planning and effort—termed the "Red Ocean Strategy" (competing in existing crowded markets) (16). Disciplines can be prioritized for scientific supremacy based either on competitive advantage (Red Ocean Strategy) or national priorities (1). Conversely, a discipline may be nationally vital yet lack domestic competitors. The first institution entering this space can leverage the "first-mover advantage" (over "best-in-class") to rapidly become the national hub for that discipline. Organizations struggle to grow parallel to rivals in competitive environments, necessitating strategies that create new value or markets—the "Blue Ocean Strategy" (17). Competing organizations vie for service share; crowded competition ("Red Oceans") stifles growth and becomes destructive (16). While competitive (Red Ocean) strategy is necessary for superior performance, it is insufficient. Institutions must address factors beyond competition to ensure growth and survival—this is the essence of the "Blue Ocean Strategy" (18). Achieving scientific supremacy in pharmaceutical sciences offers transformative benefits for Iran, including Enhanced Public Health: Leadership in pharmaceutical research enables the development of advanced therapies and improved access to essential medicines, directly impacting population health outcomes (19, 20). Economic Growth and Export Potential: Scientific excellence fosters a competitive pharmaceutical industry capable of exporting high-value products, generating revenue, and creating quality jobs for scientists and researchers (21, 22).

**Global Influence and Collaboration:** Supremacy in pharmaceutical sciences positions Iran as a regional and global leader, opening avenues for international partnerships and collaborative innovation despite external constraints (21, 22).

**Sustainable Innovation Ecosystem:** A robust scientific environment supports continuous innovation, resilience against external shocks, and the capacity to address emerging health challenges (7). By addressing these core components, the roadmap seeks to empower Iranian pharmaceutical sciences groups to overcome current challenges, harness their full potential, and attain a position of scientific leadership both regionally and globally.

For policymakers, a key recommendation is to formally incorporate this evidence-based roadmap into national science and health policy to guarantee a long-term and structured commitment. Support should be strategically tailored: flagship groups require funding for international networking and high-impact projects; pioneer groups need investment in quality improvement and infrastructure; and emerging groups benefit from seed funding and capacity-building initiatives. Furthermore, policies should promote collaboration between industry and academia, revise academic incentives to prioritize impact over sheer quantity, and bolster scientific diplomacy to enhance Iran's global pharmaceutical standing.

Future research should concentrate on refining methodologies by developing broader metrics for excellence, encompassing innovation and societal impact, in addition to traditional bibliometrics. Researchers should also undertake in-depth studies to identify the specific challenges faced by each group tier, including barriers to internationalization for flagship groups. Longitudinal studies are essential to evaluate the roadmap's effectiveness over time, and subsequent work should integrate diverse data sources beyond Scopus to provide a more comprehensive and inclusive assessment of Iran's scientific output.

While this article has several strengths, it also has limitations. One key limitation is its reliance on Scopus data, which, although extensive, may miss high-quality research published in reputable regional or national journals that are not indexed in this database. Additionally, there is a potential for non-response bias in the expert questionnaires, as well as inherent subjectivity involved in weighting and finalizing the indicators for the supremacy index. Future research could benefit from incorporating a wider range of

databases and utilizing Delphi techniques to achieve greater consensus on the indicators.

## Conclusion

The successful execution of this roadmap is contingent upon addressing underlying infrastructural and policy challenges. Therefore, it is recommended that the strategic principles of this roadmap be formally adopted into national science and health policy to enable a structured and resourced journey toward global scientific leadership in pharmaceutical sciences.

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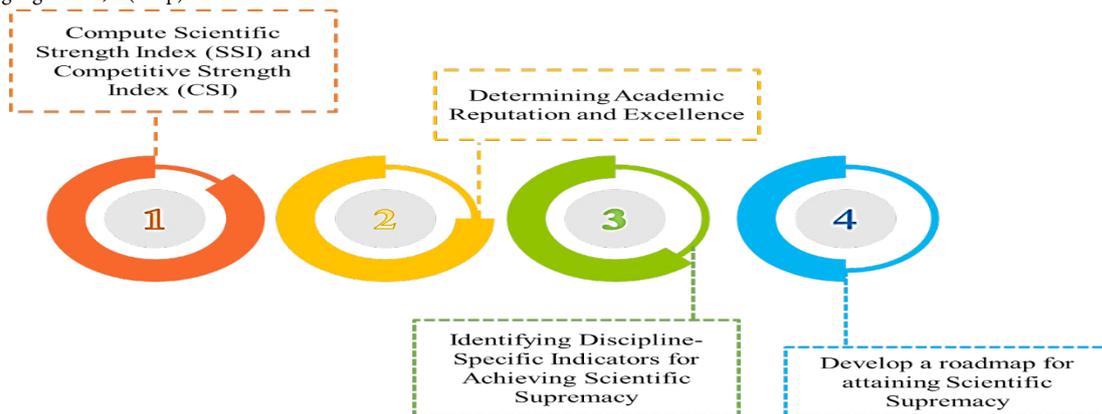


Figure 1. Semantic model of the study of determining the path to achieving scientific authority in pharmaceutical science groups

$H_2$	$T_{10}$	$T_{10N}$	$T_{10U} / T_{10N}$
<ul style="list-style-type: none"> <li>• <b>Group: <math>H_2</math></b> This index is the largest number (N) of members in a group who all have an H-index greater than or equal to N.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Total Citations of the University Team:</b> To calculate this index, the university's researchers in the specific field are ranked in descending order based on their individual h-index, and the total number of citations for the papers of the top 10 researchers on this list is calculated.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Total Citations of the National Team:</b> To calculate this index, the country's researchers in the specific field are ranked in descending order based on their individual h-index, and the total number of citations for the papers of the top 10 researchers on this list is calculated.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Ratio of University Team Citations to National Team Citations:</b> To calculate this index, the total citations of the university team in the relevant field is divided by the total citations of the national team in the same field.</li> </ul>

Figure 2. Formula for determining competitive advantage in pharmaceutical sciences

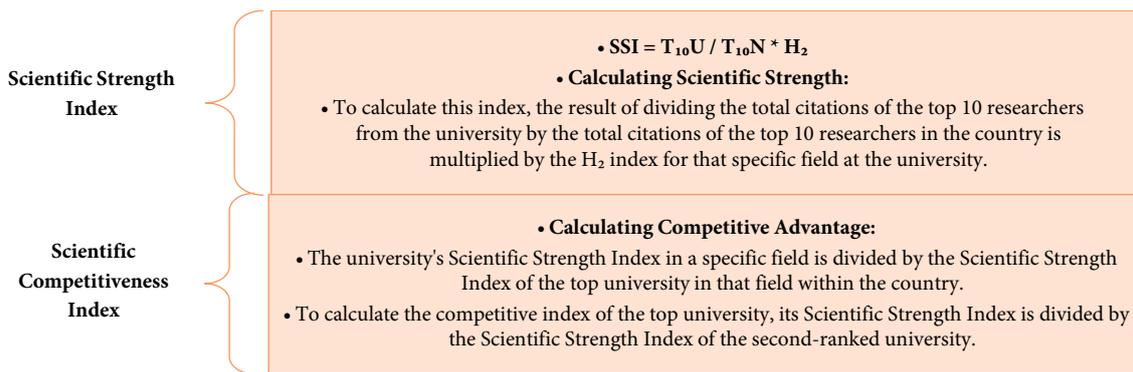


Figure 3. A formula for calculating the scientific power of the competitive advantage of pharmaceutical science groups

Table 1. Assumptions Used in Calculating Scientific and Competitive Strength of Pharmaceutical Sciences Groups

Core Component	Specific Criteria and Procedures
Necessities and Prerequisites for Determining Competitive Advantages of Medical Universities in Pharmaceutical Sciences	Utilization of scientometric indicators for faculty members. Extraction of research data from the scientometrics system. Performance of calculations for all pharmaceutical sciences disciplines. Execution of calculations for individual medical schools/universities.
Optimization of the Methodology for Determining Competitive Advantages of Medical Universities in Pharmaceutical Sciences	Conducting calculations based on the *h*-index from the Scopus database. Calculation performance for all pharmaceutical sciences disciplines. Ranking faculty members according to their *h*-index. Conducting calculations for disciplines with faculty members present in more than one university.
Valuation Criteria for Competitive Advantages of Medical Universities in Pharmaceutical Sciences	A Competitive Strength value above 5.0 is classified as an "Exclusive Advantage." A Competitive Strength value between 0.3 and 5.0 is classified as a "Highly Competitive Advantage." A Competitive Strength value between 0.1 and 0.3 is classified as a "Moderate Competitive Advantage." A Competitive Strength value below 0.1 is classified as "No Competitive Advantage."
Index for Determining Scientific Supremacy Groups in Pharmaceutical Sciences	A Scientific Supremacy Modeling Score of 60-100 designates a "Flagship Group." A Scientific Supremacy Modeling Score of 30-59 designates a "Pioneer Group." A Scientific Supremacy Modeling Score of 10-29 designates an "Emerging Group."

Table 2. Educational and Research Information Related to Pharmaceutical Science Disciplines

Row	Group Name	Number of Scientists*	Postgraduate Student Admissions**
1.	Pharmaceutics	10	11 Universities (37 Students)
2.	Pharmaceutical Chemistry	12	6 Universities (22 Students)
3.	Pharmacology	11	11 Universities (43 Students)
4.	Pharmaceutical Toxicology	6	9 Universities (33 Students)
5.	Pharmaceutical Biotechnology	6	7 Universities (28 Students)
6.	Pharmacognosy	5	9 Universities (30 Students)
7.	Clinical Pharmacy	0	7 Universities (44 Students)
8.	Pharmaceutical Nanotechnology	4	10 Universities (28 Students)
9.	Nuclear Pharmacy	0	2 Universities (6 Students)
10.	Drug Control	2	6 Universities (18 Students)
11.	Traditional Pharmacy	2	10 Universities (27 Students)
12.	Drug Economics and Management	0	2 Universities (5 Students)
13.	Pharmaceutical Biomaterials	1	4 Universities (13 Students)

\*Number of discipline scientists in the list of top world scientists. \*\*University admission capacity relates to the year 2023-2024 (Iranian calendar year 1402).

**Table 3.** Modeling Calculations for Determining the Roadmap to Achieve Scientific Authority in Pharmaceutical Sciences

Discipline Name	Research Advantage	Research Advantage Score	Number of Student-Training Universities*	Educational Advantage Score	Number of Top Scientists*	Top Scientists Score
Pharmacology	26	96.3	11	100	11	91.7
Pharmaceutics	27	100	11	100	10	83.3
Pharmaceutical Chemistry	26	96.3	6	54.5	12	100
Pharmaceutical Toxicology	23	85.2	9	81.8	6	50.0
Pharmacognosy	21	77.8	9	81.8	5	41.7
Pharmaceutical Biotechnology	22	81.5	7	63.6	6	50.0
Pharmaceutical Nanotechnology	13	48.1	10	90.9	4	33.3
Traditional Pharmacy	9	33.3	10	90.9	2	16.7
Clinical Pharmacy	15	55.6	7	63.6	0	0
Drug Control	9	33.3	6	54.5	2	16.7
Pharmaceutical Biomaterials	6	22.2	4	36.4	1	8.3
Nuclear Pharmacy	11	40.7	2	18.2	0	0
Drug Economics and Management	7	25.9	2	18.2	0	0

Data pertains to the Iranian academic year 1402 (2023-2024).

**Table 4.** Identification of Scientific Authority Attainment Groups in Pharmaceutical Sciences

Discipline Name	Group Research Advantage	Number of Specialist Student-Training Universities	Number of Top Iranian Scientists Worldwide	Final Score	Group Categorization
Pharmacology	26	11	11	96.0	Flagship Groups
Pharmaceutics	27	11	10	94.4	
Pharmaceutical Chemistry	26	6	12	83.6	
Pharmaceutical Toxicology	23	9	6	72.3	
Pharmacognosy	21	9	5	67.1	
Pharmacognosy	21	9	5	67.1	Pioneer Groups
Pharmaceutical Biotechnology	22	7	6	65.0	
Pharmaceutical Nanotechnology	13	10	4	57.5	
Traditional Pharmacy	9	10	2	47.0	
Clinical Pharmacy	15	7	0	39.7	
Drug Control	9	6	2	34.9	
Pharmaceutical Biomaterials	6	4	1	22.3	Emerging Groups
Nuclear Pharmacy	11	2	0	19.6	
Drug Economics and Management	7	2	0	15	

**Table 5.** Classification of Pharmaceutical Science Groups Based on Scientific Supremacy Index

Category	Score Range	Disciplines
Flagship Groups	60-100	Pharmacology, Pharmaceutics, Medicinal Chemistry, Medicinal Toxicology, Pharmacognosy, Pharmaceutical Biotechnology
Pioneer Groups	30-59	Pharmaceutical Nanotechnology, Traditional Pharmacy, Clinical Pharmacy, Drug Control
Emerging Groups	10-29	Biopharmaceuticals, Nuclear Pharmacy, Drug Economics and Management

**Appendix 1.** Research Competitive Strength and Scientific Strength of Pharmaceutical Sciences Groups in Iranian Universities of Medical Sciences

Discipline	University	Scientific Strength	Competitive Research Strength	Type of Research Advantage
Pharmaceutical Toxicology	Tehran	15.84	4.30	Highly Competitive Advantage
	Mashhad	3.69	0.23	Highly Competitive Advantage
	Shahid Beheshti	2.86	0.18	Highly Competitive Advantage
	Shiraz	2.68	0.17	Highly Competitive Advantage
	Tabriz	1.88	0.12	Highly Competitive Advantage
Nanopharmaceutical Technology	Tabriz	7.46	2.67	Highly Competitive Advantage
	Zanjan	2.08	0.38	Highly Competitive Advantage
	Mashhad	1.98	0.27	Highly Competitive Advantage
	Kermanshah	1.13	0.15	Highly Competitive Advantage
	Tehran	0.91	0.12	Highly Competitive Advantage
Drug Control	Tabriz	4.18	1.84	Highly Competitive Advantage
	Tehran	2.28	0.54	Highly Competitive Advantage
	Mashhad	2.18	1.52	Highly Competitive Advantage
Pharmacognosy	Mashhad	08.11	1.32	Highly Competitive Advantage
	Tehran	8.38	0.76	Highly Competitive Advantage
	Isfahan	6.98	0.63	Highly Competitive Advantage
	Shahid Beheshti	4.89	0.44	Highly Competitive Advantage
	Tabriz	4.27	0.38	Highly Competitive Advantage
	Shiraz	3.20	0.29	Moderate Competitive Advantage
	Jahad Daneshgahi	2.91	0.26	Moderate Competitive Advantage
	Kerman	2.43	0.22	Moderate Competitive Advantage
	Iran	1.99	0.18	Moderate Competitive Advantage
	Mazandaran	1.37	0.12	Moderate Competitive Advantage
Pharmaceutics	Tehran	15.23	1.16	Highly Competitive Advantage
	Tabriz	11.13	0.86	Highly Competitive Advantage
	Mashhad	7.60	0.50	Highly Competitive Advantage
	Shiraz	63.4	0.30	Highly Competitive Advantage
	Isfahan	4.58	0.30	Highly Competitive Advantage
	Shahid Beheshti	3.80	0.25	Moderate Competitive Advantage
	Zanjan	2.46	0.16	Moderate Competitive Advantage
	Mazandaran	2.07	0.14	Moderate Competitive Advantage
	Kerman	1.96	0.13	Moderate Competitive Advantage
Medicinal Chemistry	Tabriz	15.55	1.22	Highly Competitive Advantage
	Tehran	12.79	0.82	Highly Competitive Advantage
	Mashhad	6.97	0.45	Highly Competitive Advantage
	Mazandaran	5.94	0.38	Highly Competitive Advantage
	Shiraz	3.85	0.25	Moderate Competitive Advantage
	Shahid Beheshti	3.78	0.24	Moderate Competitive Advantage
	Isfahan	2.41	0.16	Moderate Competitive Advantage
Pharmaceutical Biomaterials	Kermanshah	4.55	4.52	Highly Competitive Advantage
	Tehran	1.01	0.22	Highly Competitive Advantage
Clinical Pharmacy	Tehran	2.31	2.42	Highly Competitive Advantage
	Shahid Beheshti	0.95	0.41	Highly Competitive Advantage
	Isfahan	0.65	0.28	Highly Competitive Advantage
	Tabriz	0.55	0.24	Highly Competitive Advantage
	Mazandaran	0.46	0.20	Highly Competitive Advantage
	Mashhad	0.45	0.19	Highly Competitive Advantage
	Hamadan	0.44	0.19	Highly Competitive Advantage
	Shiraz	0.43	0.19	Highly Competitive Advantage
	Iran	0.25	0.11	Highly Competitive Advantage

Pharmaceutical Economics and Management	Tehran	5.95	13.37	Exclusive Advantage
Pharmacology	Mashhad	15.84	1.43	Highly Competitive Advantage
	Tehran	06.11	0.70	Highly Competitive Advantage
	Shahid Beheshti	8.77	0.55	Highly Competitive Advantage
	Iran	5.21	0.33	Highly Competitive Advantage
	Isfahan	4.21	0.27	Moderate Competitive Advantage
	Tabriz	3.99	0.25	Moderate Competitive Advantage
	Shiraz	3.98	0.25	Moderate Competitive Advantage
	Jahad Daneshgahi	2.50	0.16	Moderate Competitive Advantage
	Babol	2.06	0.13	Moderate Competitive Advantage
	Kerman	1.93	0.12	Moderate Competitive Advantage
Pharmaceutical Biotechnology	Tehran	15.23	1.16	Highly Competitive Advantage
	Tabriz	13.11	0.86	Highly Competitive Advantage
	Mashhad	7.60	0.50	Highly Competitive Advantage
	Shiraz	4.63	0.30	Highly Competitive Advantage
	Isfahan	4.58	0.30	Highly Competitive Advantage
	Shahid Beheshti	3.80	0.25	Moderate Competitive Advantage
	Zanjan	2.46	0.16	Moderate Competitive Advantage
	Mazandaran	2.07	0.14	Moderate Competitive Advantage
Kerman	1.96	0.13	Moderate Competitive Advantage	

**Appendix 2.** Roadmap for Achieving Scientific Supremacy in Pharmaceutical Sciences

Domains for Achieving Scientific Supremacy	Strategies
Focused Planning	Forming a consensus on a differentiated mission
	Developing a differentiated strategic roadmap
	Developing a differentiated strategic plan
Ensuring Alignment	Designing and establishing an academic monitoring and governance system
	Providing and allocating mission-based financing with an emphasis on focal areas
Targeted Quantitative Development	Developing faculty members in the discipline with special attention to focal areas
	Developing infrastructure and equipment related to focal areas
	Developing disciplines and degrees related to focal areas
	Providing student scholarships related to focal areas
	Developing scientific institutions, research centers, service delivery centers, think tanks, incubators, science and technology parks
	Recruiting students relevant to the discipline
Quality Improvement	Process management
	Revising curricula related to the discipline
	Standardizing relevant processes
	Evaluation and auditing
	Obtaining accreditation
	Benchmarking
	Receiving quality certifications
	Organizational quality improvement (CQI, TQM)
Improving standing in ranking systems	
Capacity Building	Team building
	Targeted recruitment
	Empowerment
	Staff training
	Decentralization and delegation
	Postgraduate education for faculty members
Culture Building	Organizing festivals
	Awarding prizes
Stewardship	Developing national curriculum standards for the discipline

	Developing national service standards related to the discipline
	Developing national strategies for the discipline
	Developing professional ethical codes for the discipline
	Facilitating relevant accreditations for the discipline
	Conducting national foresight studies for the discipline
	Planning the expansion of the discipline at the national level
	Planning the workforce for the discipline at the national level
	Playing a key role in professional associations
Internationalization	Educating international students
	Offering international degrees and certifications
	Implementing faculty exchange programs
	Implementing student exchange programs
	Training international personnel
	Implementing cross-border educational programs
	Implementing joint research projects
	Implementing language learning programs
	Obtaining international program accreditation
	Producing international curriculum content
	Offering and receiving international grants
	International networking with top researchers
	Creating opportunities for travel and mobility
	Degree equivalency and transfer
Networking	Establishing national and international virtual networks
	Launching national forums
Value Creation	Developing innovation
	Entrepreneurship
	Establishing knowledge-based companies
	Service/Product development
	Branding
	Market creation
	Revenue generation
Expansion of Action and Access	Pioneering: Conducting cutting-edge research
	Pioneering: Developing advanced technology
	Leadership: Publishing the most articles
	Leadership: Publishing the most books
	Leadership: Training and employing the most researchers
	Leadership: Collaborating with the most institutions
	Leadership: Highest number of registered innovations and inventions
	Impact: Hosting global conferences
	Impact: Networking with global researchers
	Impact: Launching global forums
	Quality: Establishing and upgrading global journals with the highest Impact Factor (IF)
	Quality: Authoring global reference books
	Quality: Training the best scientists
	Quality: Achieving top institutional positions in global rankings
	Quality: Providing the best services/products
	Application: Conducting applied studies
	Application: Conducting studies supporting innovations and inventions
	Application: Highest economic value-added from knowledge
	Authority: Hosting headquarters of global scientific institutions
	Authority: Conducting global accreditation
	Authority: Conducting global scientometrics
	Authority: Determining international research priorities