Research on the Establishment and Development of Computer Discipline in Indian Institutes of Technology

Xue Jiang*
Hebei University, China
Corresponding author: jiangxue20032000@163.com

Abstract

As a benchmark of reform and innovation in Indian higher education, the development of the Computer Science discipline in the Indian Institute of Technology (IIT) from its inception to its ranking among the world-renowned disciplines is of significant research value. Based on the historical research method, case study method, and literature research method, this paper systematically examines the development trajectory of the discipline from 1963 to 2025. It divides the period into three phases: founding and early development (1963-1982), rapid rise (1983-1991), and steady enhancement (1992 to present). The analysis examines the academic platform, faculty, scientific research, and human resources in each phase. It analyzes the initiatives and effectiveness of each phase in terms of core elements, including academic platform, faculty, scientific research, and talent cultivation. It is found that the discipline has realized leapfrog development by following national strategies, integrating international resources, and promoting the integration of industry, academia, and research, etc. Its successful experience and problems hold great reference significance for the development of the computer science discipline in China's construction of the “double first-class”.

Keywords

Indian Institutes of Technology, Computer Discipline, Discipline Construction, Milestones of Development, World-class Discipline

The Indian Institute of Technology, as a typical representative of national key colleges created by the Indian government, is a product of important innovation and reform of the Indian higher education system. Its computer education is second to none in India and has a great influence in the world, cultivating many world-renowned senior computer talents, and becoming the object of recruitment by many multinational corporations with global influence. China and India are relatively similar in terms of national conditions and historical development background.

The growth path of computer science in the Indian Institute of Technology (IIT) has important reference significance for China's higher education to create first-class disciplines, successful computer education, and effectively play the social service function of computer science. This paper adopts the historical research method, case study method and literature research method, starting from the characteristics of different historical stages of discipline development, taking time as a clue, exploring the characteristics of the necessary elements of discipline construction such as its academic platform, faculty, scientific research, talent training, academic exchanges, management system and social services and the relationship between them, summarizing its construction experience, pointing out the shortcomings, and clarifying

the construction of first-class disciplines in China. Historical value of the construction of first-class disciplines in China.

Inception and Foundation: The Establishment and Early Development of Computer Science at the Indian Institutes of Technology (1963–1982)

Founding of the discipline

In 1963, through the collaborative efforts of the Indian government and the "Kanpur Indo-American Program," the Computer Center at IIT Kanpur was officially established, marking the founding of the computer science discipline at the Indian Institutes of Technology (IIT).

Following India's independence, the nation faced economic reconstruction and an urgent demand for engineering talent[1]. Jawaharlal Nehru, India's first Prime Minister, established governance objectives centered on science and technology, with a strong emphasis on developing the information technology industry, while also securing international aid. Concurrently, the third wave of the global scientific and technological revolution, coupled with the Indian government's strategic focus on science and technology, created a pivotal opportunity for the establishment of the computer science discipline.

Early development initiatives

(1) Academic Platform Expansion: Computer center facilities were gradually expanded, with notable additions like the IBM S370-155 mainframe introduced at the Madras campus in 1973. The Departments of Electrical Engineering and Mathematics also initiated computer education programs, offering diverse degree courses and projects.

(2) Faculty Development: The university recruited eminent domestic scholars like Rajaraman and Mahabala, while promoting international collaboration through appointments of foreign experts. For instance, computer scientist Kesavan served as the Computer Center's director.

(3) Scientific Research: Research priorities were established in foundational computer theory, spanning automata theory, formal languages, and programming theory.

(4) Talent Cultivation: Multiple degree programs were offered, emphasizing mastery of core computer science principles and practical skills. Graduation projects focused on theoretical computer science.

(5) International Support: Key initiatives—including the Kanpur Indo-US Program, Mumbai-USSR Bilateral Aid Agreement, and Madras Indo-German Agreement—provided critical hardware and funding for disciplinary growth.

(6) Governance Framework: Academic, faculty, and student governance bodies were established to ensure organizational efficacy.

(7) Community Engagement: Quality enhancement initiatives and industry consultancy projects were implemented to fulfill institutional social responsibilities.

Achievements and Challenges

The key accomplishments include establishing a foundational platform for disciplinary development, assembling a high-caliber faculty team, developing a comprehensive talent cultivation system, securing international support, implementing robust academic governance structures, and actively fulfilling institutional social responsibilities.

However, challenges persist, including inadequate research infrastructure, homogeneous academic activities, lack of collaborative synergies among researchers, limited scope and quality of research projects, and underdeveloped diversity in community engagement initiatives.

National Leadership: The Rapid Ascendancy of Computer Science at India's IITs (1983–1991)

The Ascendancy Context

The Third Scientific and Technological Revolution was gaining full momentum, propelling the global economy into an era of accelerated globalization. During this transformative period, the Indian government implemented robust support measures to foster the growth of its computer industry. Under the leadership of Prime Minister Rajiv Gandhi - widely recognized as the "Computer PM" - India embarked on its transition to the information age[2-4]. This strategic development was further institutionalized through landmark policies: the Technology Policy Statement enacted by the Indian Parliament in 1983, followed by the 1986 Computer Software Export, Development and Training Policy, which collectively established a comprehensive policy framework for advancing computer science.

Ascendancy Initiatives

(1) Specialization of Academic Platforms: The Computer Center was upgraded and renovated, and the Department of Computer Science and Engineering was officially established in 1983, providing a more specialized platform for the development of the discipline.

(2) Academic Team Building: A cohesive academic team was formed based on academic recognition, with team members adhering to the same academic philosophy and engaging in specialized teaching, research, and scientific research activities.

(3) Scientific Research: Establishing a research direction focused on computer applications, establishing a Computer-Aided Design Center, conducting industry-academia-research collaboration projects, and implementing projects such as graphic and Indian script terminal technology development.

(4) Talent Cultivation: Centering on the cultivation of practice-oriented computer talent, establishing a Master's degree program in Computer Applications and a five-year integrated Bachelor's and Master's degree program for Engineering Master's degrees.

(5) Academic Exchange: Continuously strengthen domestic and international academic exchanges through initiatives such as “inviting in” and “going out,” inviting international experts to visit, encouraging faculty to study abroad, and enhancing domestic academic exchanges.

(6) Management System: Improve the five-tier management system to ensure administrative autonomy and academic freedom.

(7) Literacy Enhancement Program: Implement the university's computer literacy and learning enhancement program to promote basic computer knowledge and skills.

Achievements and Issues

Achievements include establishing a comprehensive and specialized academic infrastructure, maintaining a well-structured faculty team, cultivating high-quality application-oriented talent, conducting diverse academic exchanges, implementing a distinctive governance system, and advancing public computer literacy[5]. Challenges primarily involve compromised talent cultivation quality due to shortened academic programs, as well as disproportionate emphasis on software development, resulting in insufficient training in hardware engineering and lagging technological R&D in related fields.

International Recognition: The Steady Advancement of Computer Science at the

Indian Institutes of Technology (1992–Present)

Improving the background

The global information revolution has propelled countries into the information economy era, and India feels both pressure and motivation.[6-8] Indian leaders have established the strategic goal of becoming a superpower in the information industry, promulgating a series of policies to support the development of the information technology industry and providing guidance for the steady advancement of computer science.

Improvement measures

(1) Academic platform and facility upgrades: Establish an innovation and technology transfer foundation to promote industry-academia-research integration; modernize computer center facilities to achieve campus networking and high-speed campus network construction; establish computer science laboratories and new "research centers."

(2) Academic team building: Build academic teams to explore core areas of the discipline, such as the Computational Complexity Theory academic team at the Kampus branch, which has achieved significant research results[9].

(3) Scientific Research: Establish a research direction focused on cutting-edge computer science, explore frontier fields such as parallel and distributed computing, artificial intelligence, and computer and network security, independently develop and build supercomputers, and rapidly expand computer research and development projects.

(4) Talent Development: Focus on cultivating innovative, multidisciplinary computer science talent, establish a dual-degree academic program in computer science and engineering, and build a broad, flexible, diverse, and in-depth curriculum system. Reasons for and Issues in the Development of Computer Science at the Indian Institute of Technology[10-13].

Reasons for rapid development

Align with the national science and technology development strategy, clarify the positioning of the discipline; focus on building a high-quality faculty team to ensure human resource support; promote interdisciplinary integration and advance sustainable development; effectively utilize international aid and deepen international cooperation and exchange; actively seek funding support from multiple sources to ensure financial security.

Issues in Development

The Indian government's excessive intervention has weakened academic autonomy; there is an imbalance between the growth in the number of outstanding faculty members and the steady improvement of disciplines; and the total volume of high-level scientific research achievements is insufficient, hindering the expansion of international academic influence. In summary, the development process of the computer science discipline at the Indian Institute of Technology provides valuable experience and insights for the construction of first-class disciplines in our country. We should draw on its successful aspects, avoid the issues encountered in its development, and promote the construction of higher education disciplines in our country to a new level.

Funding: This research received no external funding.

Acknowledgments: The authors would like to express sincere gratitude to the technicians who contributed to this research.

References

[1] Denning, P. J., Comer, D. E., Gries, D.,

Mulder, M. C., Tucker, A., Turner, A. J., Young, P. R. (1989). Computing as a discipline. Computer, 22(2), 63-70.

[2] Banshal, S. K., Solanki, T., Singh, V. K. (2018). Research performance of the national institutes of technology in India. Current Science, 115(11), 2025-2036.

[3] Sutradhar, B. (2006). Design and development of an institutional repository at the Indian Institute of technology Kharagpur. Program, 40(3), 244-255.

[4] Madhusudhan, M., Prakash, S. (2013). Websites of Indian Institutes of technology: A webometric study. International Journal of Library and Information Studies, 3(4), 93-107.

[5] Paul, P. K. (2021). Digital education: from the discipline to academic opportunities and possible academic innovations—International context and Indian strategies. In Digital education for the 21st century, 255-281.

[6] Goel, S., (2006). Competency focused engineering education with reference to IT related disciplines: is the Indian system ready for transformation? Journal of Information Technology Education: Research, 5(1), 27-52.

[7] Paul, P., Aithal, P. S., Bhimali., Kumar, K. (2017). Emerging degrees and collaboration: the context of engineering sciences in computing IT-an analysis for enhanced policy formulation in India. International Journal on recent research in science, Engineering & Technology, 5(12), 13-27.

[8] Anthony Ralston. (1981). Computer science, mathematics, and the undergraduate curricula in both. The American Mathematical Monthly, 88(7), 264-268.

[9] Deepak Khemani. (2012). A Perspective on AI research in India. AI Magazine, 33(1), 562-569.

[10] Jandhyala B. G. Tilak. (2004). Fees, autonomy, and equity. Economic and Political Weekly, 39(9), 358-366.

[11] Pulapre Balakrishnan. (2006). Higher education needs a longer view. Economic and Political Weekly, 41(32), 665-669.

[12] Ravinder Pal Singh. (2000). An Assessment of Indian science and technology and Implications for Military Research and Development. Economic and Political Weekly, 35(31), 1003-1010.

[13] P.V. Indiresan. (2007). A Different degree. Indian International Centre Quarterly, 34(3), 255-260.