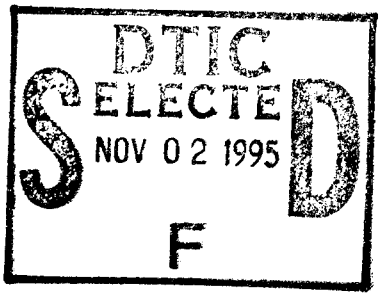
Computer Science Research in India *



Krithi Ramamritham
Dept. of Computer Science
University of Massachusetts
Amherst, Mass. 01003
(krithi@cs.umass.edu)

October 7, 1995

Contents

*This work was supported in part by the U.S. Office of Naval Research under Grant No. N00014-95-1-0126. The information in this document does not necessarily reflect the position or policy of the U.S. Government, and no official endorsement should be inferred.

Glossary of Terms

Educational Institutions:
IISc – Indian Institute of Science
IIT – Indian Institute of Technology
REC – Regional Engineering College
UoH – University of Hyderabad
UoP – Pune University
VRCE – Visweswarayya College of Engineering, Nagpur

Government Sponsored Organizations:
BARC – Bhabha Atomic Research Center
CAIR – Center for AI and Robotics
CDAC – Center for the Development of Advanced Computation
CDOT – Center for the Development of Telematics
CMC – Computer Maintenance Corporation
ECIL – Electronics Corporation of India, Limited
ISI – Indian Statistical Institute
ISRO – Indian Space Research Organization
MatScience – Inst. for Mathematical Sciences, Madras
NAL – National Aerospace Laboratories
NCST – National Center for Software Technology
NIC – National Informatics Center
NRSA – National Remote Sensing Agency
TIFR – Tata Institute for Fundamental Research

Private Organizations:
SSF – SPIC Science Foundation, Madras
TCS – Tata Consultancy Services
TRDDC – Tata Research, Development, and Design Center
PSPL – Persistent Systems Private Limited, Pune

Professional Organizations:
CSI – Computer Society of India
NASSCOMM – National Association of Software and Service Companies
IMA – Indian Manufacturers Association

Infrastructure:
ERNET – Educational and Research Network
NICNET – National Informatics Center Network
STP – Software Technology Parks
VSAT – Very Small Aperture Terminal

Government (Funding) Agencies
AICTE – All India Council for Technical Education
DAE – Department of Atomic Energy
DoE – Department of Electronics
DoS – Department of Space
DST – Department of Science and Technology
MoD – Ministry of Defence

Conferences:
COMAD – Conference on the Management of Data
FSTTCS – Foundations of Software Technology and Theoretical Computer Science
IWPP – Intl. Workshop on Parallel Processing
CONSEG – Intl. Conference on Software Engineering Practices
Networks – Conference on Computer Communication Networks
CISMOD – Conference on Information Systems and Management of Data

1 Introduction

India prides itself in having one of the largest technical manpower in the world. Her software industry has seen tremendous growth – over 50% each year during the last 10 years – which is the envy of many software exporting countries throughout the world. The students from India's top science and technology educational institutions are highly sought after by research universities in the US and Europe. India is one of just half a dozen countries to have successfully built and deployed their own satellites and launch vehicles.

Given these much-publicized accomplishments, an obvious question is: Has the potential for high-caliber research, indicated by the above facts, been realized? This report addresses this question, in the context of Computer Science. The observations and findings are based on visits to research and educational institutions and discussions with researchers – undertaken during a one-year sabbatical stay in India.

This paper begins with a discussion of the nature of Computer Science Research in India. The type of institutions in which Computer Science research is conducted is considered next followed by a discussion of the students and faculty at the educational institutions. Support for conducting research in the form of equipment, infrastructure, and publications, is the next topic discussed. We then examine how Indian researchers publish their work. Finally we study the influence on Indian Computer Science research of the phenomenal growth in exports by the Indian software industry and the arrival of multinationals since the recent liberalization and globalization of the Indian economy.

Readers interested in knowing more about the research conducted at the Indian Computer Science R&D establishments mentioned in this report should refer to the detailed trip report [5] which complements this summary paper. Additional reading material on Indian Science in general can be found in some of the references listed at the end of this paper.

2 Nature of Computer Science Research in India

Computer Science (CS) research in India started in earnest only in the mid-80's triggered by the establishment of post-graduate programs in many institutions throughout the country at that time. Today, almost all areas of computer science research are covered by researchers in India, including topics that are "hot" elsewhere such as multi-media, workflow automation, virtual reality, and hardware-software co-design [5]. The territory covered by Indian researchers is impressive and most of the research problems tackled are of current interest globally. Some of the research has even attracted international attention including work on neuro-fuzzy systems, machine learning, genetic and neural algorithms, the modeling and control of flexible manufacturing systems, speech synthesis, databases, and complexity theory.

One area where solutions unique to Indian conditions have been developed is machine-assisted language processing. With a vast population conversing in a multitude of languages (there are over twenty officially-recognized regional languages!), many with their own scripts, the problem of translation and transliteration from English to these languages and from one Indian language to another is daunting, but one which has the potential for a huge pay-off, – socially, politically, and economically. It is not surprising that many computer

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	7Oct95	FINAL 1Nov94 - 31Oct95

4. TITLE AND SUBTITLE
Computer Science Research in India

5. FUNDING NUMBERS
N00014-95-1-0126

6. AUTHOR(S)
Krithi Ramamritham

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of Massachusetts
Dept. of Computer Science
Amherst MA 01003-4610

8. PERFORMING ORGANIZATION REPORT NUMBER
CMPSCI TR95-84

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of Naval Research
Scientific Officer Code: 311
Ballston Tower One
800 North Quincy St.
Arlington, VA 22217-5660

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This paper begins with a discussion of the nature of Computer Science Research in India. The type of institutions in which Computer Science research is conducted is considered next followed by a discussion of the students and faculty at the educational institutions. Support for conducting research in the form of equipment, infrastructure, and publications, is the next topic discussed. We then examine how Indian researchers publish their work. Finally we study the influcence on Indian Computer Science research of the phenomenal growth in exports by the Indian software industry and the arrival of multinationals since the recent liberalization and globalization of the Indian economy.

14. SUBJECT TERMS
computer science, developing country, research and development, international science

15. NUMBER OF PAGES
38

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR