SESSION 3
DRDO Proposal Writing: Case Study

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Session Overview

- Research In India
- DRDO research schemes
- Procedures and process
- Prerequisites
- Thrust areas and selection of thrust areas
- Proposal Preparation Guidelines
- Case Study
- Summary
India: Global Status

- India as the global hub for Engineering and Design (NASSCOM)
  - 750+ Engineering, Research and Design (ER&D) companies in India
  - 350+ Global ER&D centres in India
  - USD 11.2 billion ER&D export revenue from India in FY2012
  - USD 37-45 billion ER&D revenues from India – NASSCOM 2020 vision
- Engineering and Design hub vertical domains
  - Automobiles, Aerospace, Semiconductor, Telecom, Computing and Hi-tech
- India’s global research output is just 3.5% (Thomson Reuters)
  - Engineering: 4.2%(16.4%)
  - Computer sciences: 2.4%(15%)
- World Intellectual Property Indicators – 2013
  - China: 217,105 (503,582)
  - Europe: 65,665
  - India: 4,328 (42,291)
  - USA: 253,155
- The Full Time Equivalent R&D professionals in India was estimated at 1,54,000 in 2008
  - $171000 – India
  - $173000 – China
  - $181000 - Brazil
  - $342000 - US
- Cost to Country of a professor as ratio of per capita GDP is one of the highest in the world

STI in new economy

[Diagram showing the relationship between innovation, leadership, market, and national prosperity]

April 2014
Thoughts on India STI
Getting a Research Topic

CAREER Plan and Research

- Career: Who are you?
  - Your expertise/interests
  - Your career/life goals
  - Your position/resources
- Your proposal should fit into your life plan (Strategic plan)
  - A strategic plan has three parts:
    - Where are you today?
    - Where do you want to be in the future (5, 10, 20 years from now)?
    - How do you get from here to there?
- Your Proposal
  - Should advance you toward your life goals
  - Should be a stepping stone to the next thing
  - Should be compatible with your institution’s goals
  - Should represent a contribution to society at large

A strategic plan is a roadmap for your life

P. S. RAMAIYAH (NRB-Specialist panel)
- B.E. in Electronics and Communications Engineering, Andhra University, India, July 1974.
- Ph.D. in Computer Science and Systems Engineering, Andhra University, India, July 1990

Research Awarded - Sponsored Research

2. Principal Investigator: "Design and Development of Real-Time Coordination of Department of Science & Technology, New Delhi, India, Nov. 2001 – Feb. 2004

Research Areas-Univ. of California Berkeley

- Artificial Intelligence (AI)
- Biosystems & Computational Biology (BIO)
- Communications & Networking (COMNET)
- Computer Architecture & Engineering (ARC)
- Control, Intelligent Systems, and Robotics (CIR)
- Human-Computer Interaction (HCI)
- Integrated Circuits (INC)
- Micro/Nano Electro Mechanical Systems (MEMS)
- Physical Electronics (PHY)
- Security (SEC)
- Signal Processing (SP)

IBM Research

- Power7(TM) design
  - Smart electrical grids to real-time analytics for financial markets
- Power reduction in high-performance microprocessors
  - Micro-architectural, logic and circuit levels
- 3D VLSI Integration

- Technology Modeling, Characterization and Monitoring
  - Technology modeling and simulation to on-chip characterization and in-field monitoring on a wafer below 22nm
Research-Univ. of Washington

- Electronic Drive & Control Systems for the EcoCar
- The Center for the Design of Analog-Digital Integrated Circuits
  - 200-250GHz
- SHF: Small: CGRAs - Control and Architecture for Next-Generation FPGAs
- PECASE: New Directions for Silicon Integrated Optics
  - Nano-power Electronics Module
- Power Optimized Techniques for Ultra-Wideband CMOS mmwave Receivers with Applications in High-Speed I/O
  - Low-power 70-90 GHz receiver
- High-Sensitivity Plastic Fiber Optical Transceivers
- Test Generation for Mixed-Signal Design Verification and Post-Silicon Debugging

Research at Intel

- Efficient computing
  - Calculating, transporting, or storing data
- Immersive Experience
  - How people communicate, collaborate, socialize, and bring those experiences to life
- Transportation
  - Vehicle communication system design, Machine-to-Machine (M2M) communication, new driver-safe human machine interface technologies, and connected vehicle applications and services
- Intelligent Connectivity
  - Communications will be between people and “things” more real
- Sustainability
  - Smart grids
- Worry-Free Computing
  - Confident and secure while shopping and banking online
- Visual Computing
  - Photorealism, interactivity, HD video and audio to enable real-time, life-like immersive computing
Institute of Infocomm Research, Singapore

- Brain Computer Interface based Treatment for Attention Deficit and Hyperactivity Disorders (ADHD)
- Advanced rehabilitation therapy for stroke based on Brain-Computer Interface
- Brain-Computer Interface based Robotic Rehabilitation for Stroke
- Brain Controlled Wheelchair
- Probes for in-vivo deep brain stimulation and recording

Selection of research topics

- Referring to journals such as IEEE –
  - IEEE takes minimum 1 year to publish, submission will be before one year, work completed will be two years and hence not appropriate to choose from journals
- IEEE Standards Association - [https://standards.ieee.org/](https://standards.ieee.org/)
  - Leading consensus building organization that nurtures, develops & advances global technologies
  - 5G should be rolled out by 2020 to meet business and consumer demands
- Tender documents – DRDO
  - [http://www.drdo.gov.in/drdo/tenders/liveTenders.jsp](http://www.drdo.gov.in/drdo/tenders/liveTenders.jsp)
- Planning commission of India
  - NITI Aayog reports (2020,2030,2050)
    - Energy, water, swatch bharat, toilets
- Societal relevance
  - [http://mospi.nic.in/MospineoNew/site/home.aspx](http://mospi.nic.in/MospineoNew/site/home.aspx) (Ministry of statistics & program implementation)
  - Autism, cancer, old age people
Research @ MSEC

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<th>Title</th>
<th>Duration</th>
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<td>Two years</td>
<td>NRB</td>
<td>In Process</td>
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<tr>
<td>Ovarian/Prostate cancer detection using Nano-bio sensors</td>
<td>Three Years</td>
<td>DST</td>
<td>In Process</td>
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<td>UWB Front End for WSN</td>
<td>Two Years</td>
<td>ISRO-RESPOND</td>
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<td>Bioinspired systems</td>
<td>Two Years</td>
<td>AICTE/DRDO</td>
<td>In Process</td>
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<tr>
<td>Under water sensors &amp; imaging</td>
<td>Three Years</td>
<td>VGST</td>
<td>In Process</td>
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<td>CNT based chemical and mechanical sensors</td>
<td>Two Years</td>
<td>DST</td>
<td>In Process</td>
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<tr>
<td>Brain computer interface</td>
<td>Three years</td>
<td>DST/DRDO</td>
<td>In process</td>
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<td>Precision Agriculture</td>
<td>Two years</td>
<td>DRDO/ISRO/ITRA</td>
<td>In process</td>
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DRDO-Funding Opportunities

- Extramural Research & IPR
  - Scheme focuses on research on phenomena or observations that are not understood, and that lack of understanding is recognized as an obstacle to scientific or technological progress in the broad topic area of relevance to military R&D
  - Provides pathways to significant advances in the mission-effectiveness of traditional military roles
  - Supports the instrumentality of Memoranda of Collaboration (MoC) between DRDO Laboratories & Establishments and academia
  - Provides financial assistance for organizing conferences/seminars/workshops on the topics related to DRDO activities
DRDO-Funding Opportunities

- **Research Boards:**
  - **AERONAUTICS R&DB (AR&DB)**
    - Aerodynamics
    - Aerospace Resources
    - Materials & Manufacturing
    - Propulsion
    - Structures Systems & Systems Engineering
    - Special Interest Group for Micro Aircraft (SIGMA)
  - **Armament Research Board (ARMREB)**
    - High Energy Materials (HEM)
    - Armament Sensor & Electronics (ASE)
    - Materials for Armament Applications (MAA)
    - Combustion Detonics & Shockwaves (CDSW)
    - Armament Design Mechanism and Ballistics (ADMB)

- **Research Boards:**
  - **NRB**
    - Materials
    - Hydrodynamics
    - Solar & signal power
    - Ocean environment
    - Scientific computing
    - Marine systems
  - **LSRB**
    - Life support system and biomedical technologies for air, land and sea operations,
    - Military psychology, cognitive engineering, personnel selection,
    - Human adaptation to extreme environments, ergonomics and human factors/engineering for equipment development and man machine interface,
    - Nutrition, radioprotection, stress management, combat fatigue, bio-defence against human, animal and plant pathogens, specialized food technologies, vector and malaria control, biotechnology and high altitude agro animal technologies, nuclear, biological and chemical detection, protection and decontamination.

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The Proposal Cycle

- Conceptualize
- Write & Revise
- Funded!
- Declined
- Try again
- What next?
- Conceptualize
Life Cycle of a Grant Proposal

Idea
- Contact Office of Sponsored Projects (focal point, website, announcements, mentors)

Proposal
- Draft, get feedback, revise
- Draft budget (get permissions if needed)

Proposal finalized
- Budget finalized (contact vendors, suppliers, research organizations)

5 days before a deadline, should start the routing process:
- Routing Forms for University Approval: PIs, co-PIs, Chair, Deans, Directors, VPs, Finalizing agency forms

Submit proposal to Agency

Days before agency submission deadline
- 90+ 60 30 14

Business Days
- 7 5 3 0

5 days before a deadline, should start the routing process:
- Routing Forms for University Approval: PIs, co-PIs, Chair, Deans, Directors, VPs, Finalizing agency forms

Submit proposal to Agency

Life Cycle of a Grant Proposal

Submit proposal to Agency
- Review, feedback, resubmission

Presentation
- to expert committee, feedback and resubmission (Results indicated)

Approval letter sent to PI and Head of institution

Money transfer, start date of project

Days after submission
- 0+ 60+ 90+ 100+

Business Days
DRDO proposal process

Projects of interest to national needs & DRDO

Proposal preparation

Referred to specialist panel for approval

Check for funds

Proposal approval

Review of proposal by DRDO

Commencement date – approval letter date

Panel recommendations to DRDO

Progress review

Proposal Contents – Generic

- Technical Field of proposal
- Title of proposal
- Abstract
- Objective - Project Significance / Relevance with ongoing academic activities
- Project Impact - Expected outcome
- Literature survey on National & International scenario
- Techno-Commercial status / Outcome / IPR / Social benefit / other
- Technical Consultancy / Revenue generation
- Time & activity chart
- Facilities / equipment available in the area of research proposed
- Budget Estimates – Non Recurring
- Budget Estimates – Recurring
My experience with DRDO grants

- Toxic gas detection – 42 lakhs – SIGMA/ER (ongoing)
- Optic flow algorithm – 30 lakhs – SIGMA (completed)

First proposal submitted:
- High speed low power VLSI architectures – Proposal rejected – not relevant to DRDO

Second proposal submitted:
- Optic flow based motion detection algorithm for MAVs – rejected – PI expertise

Third proposal submitted (joint proposal):
- Optic flow based obstacle detection for autonomous navigation on reconfigurable platform: proposal accepted for review, awarded, successfully completed

Prerequisites:
- Selection of thrust area
- PI expertise – publications, patents, initial work experience
- Co-PI expertise
- Minimum resources existing, knowledge on DRDO roadmaps

Writing research proposal
What is Research?

- Research is the process of finding out something that we (everyone) don’t already know
- Scientific research builds upon the extant knowledge base and it is methodical, repeatable and verifiable
  - Methodical means that you can specify, in advance, a procedure to accomplish your stated objective

Question: Exactly what will your research contribute to the knowledge base?
Essential ingredients of Research Proposal

- What Makes a Good Proposal
  - Influence decision-makers
  - Convince them to commit dollars in support of a specific project
  - A winning proposal addresses an important question with
    - an innovative idea,
    - well expressed,
    - with a clear indication of methods for pursuing the idea,
    - evaluating the findings, and
    - making them known to all who need to know

- Essential ingredients are:

- Example:
  - Sensors for MAVs
  - Autism diagnosis
  - Underwater communication
  - Underwater charging
  - Human body detection

Case study on Research Proposal Preparation
WHAT ARE MAVS(μAV’S)?

- Multi functional, militarily capable, small flight vehicles

<table>
<thead>
<tr>
<th>Air Vehicle Specification</th>
<th>Air Vehicle Performance</th>
<th>Requirements</th>
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<tbody>
<tr>
<td>Length = 0.52 m</td>
<td>Endurance = 10 min</td>
<td>12 V, 7A Battery</td>
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<tr>
<td>Height = 0.2 m</td>
<td>Flight Time = 15 min</td>
<td>2100mAh/11.1V</td>
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<tr>
<td>Weight = 0.53 g</td>
<td>Speed = 20-45 kmph</td>
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</table>

**Applications:**
- Surveillance
- Wildlife study & photography
- Crowd control
- Traffic monitoring
- Tracking criminals & illegal activities
- Biochemical sensing
- Inspection of pipes

**Challenges:**

- Low Reynolds number
  
  \[
  \text{Reynolds number} = \frac{\text{fluid density} \times \text{speed} \times \text{size}}{\text{viscosity}}
  \]

  Aerodynamics at low Reynolds numbers are not clearly understood. Insects whose size is even smaller than NAV, have ultralow Reynolds number.
Challenges?

- Problem of system integration

- Super capacitor rather than a battery was used as a power source

Small birds and insects adopt task of energy harvesting: the search for food

Most Successful Insects

- **Coleoptera or Ladybug**
  - The beetles, Nature's most successful order, comprising over 250,000 identified species

- **Hymenoptera**
  - More than 110,000 species of ants, wasps, and bees

- **Diptera**
  - This order counts over 85,000 identified species of flies, mosquitoes, and gnats

- **Lepidoptera**
  - About 150,000 species of butterflies and moths found
Basic Insect Morphology

- The insect body is divided into three parts:
  - the **head** carries
    - Antennae
    - Compound eyes
    - Mouth parts
  - the **thorax** bears
    - Legs and wings
  - the **abdomen** holds
    - Breathing
    - Digestive
    - Reproductive
    - Heart

Compound eyes

- Compound eye is composed of a large number (generally a few hundred to thousands) of **facets**, each of which faces a slightly different direction than its neighbors.
- Each facet records a general impression of the color and intensity of the light which comes from the direction in which it faces, but does not produce a complete image.
Compound eyes

- Every facet is bound by its own optic nerve to the insect's brain and contributes one spot of light to the image

- Quality of the picture which an insect sees is determined by the resolution (number of facets) of its eyes
- Compound eye offers a much greater flicker fusion rate

Modeling of compound eyes

- In the 1950s, Reichardt, along with Hassenstein, proposed a model of how a neuron receiving input from photoreceptors, which only respond to changes in luminance, could be used to compute motion.
- Experimental evidence consistent with the hypothetical behaviour of a Reichardt detector, the corresponding circuitry has not yet been found
- Correlation-type motion detection scheme -
  - Reichardt, 1961; Borst and Egelhaaf, 1988; Egelhaaf and Borst, 1993; Borst, 2000; Borst et al., 2003; Borst, 2004; Lindemann et al., 2005; Straw et al., 2008; Brinkworth and O’Carroll, 2010; Meyer et al., 2011
- Computational principles are being decomposed on the circuit level
  - Freifeld et al., 2013; Joesch et al., 2013; Maisak et al., 2013; Reiser and Dickinson, 2013; Silies et al., 2013; Tuthill et al., 2013; Behnia et al., 2013; Hopp et al., 2014; Mauss et al., 2014; Meier et al., 2014; Strother et al., 2014
Motion Detection Model

This is the basic Reichardt model also called as bio-inspired EMD model.

Motion Detection Model

Bioinspired models for motion detection:
- Reichardt Model
- Elaborated Reichardt model
- Energy Model
- Kirschfeld model
- Harris & O’Carroll Model
- Marr and Ullman Model

When delay is been added in both the branches and subtracted by a subtractor both side motion is been detected.

Proposal types

- Type 1 – Theoretical study on existing work, highlight limitations of existing work and propose new research work, demonstrate that this work is superior than existing work
- Type 2 – Propose new methods or algorithms, demonstrate that significant amount of work is carried out by simulation, mathematical modeling, publications, seek fund for further improvement and real time implementation
- Type 3 – Illustrate the merits & demerits of previous research work funded by DRDO, or illustrate the adoption of previous work for new application area and seek fund for new work
- NOTE:
  - PI/Co-PI profile and resources at institutional are very important for award of research grant
Illustration of Type 1 Proposal

- Gangadhar et al 2009, horn & schunck method for object detection has been implemented on CPU platform, with CUDA-APIs.
- K. R. Prashanth et al 2013, have implemented horn & schunck method on OMAP processor with 4 seconds delay for object detection
- Cyril et al have implemented horn & schunck on FPGA with delay or 550 micro seconds
- Computation delay is due to complexity in number of processing elements and data size
- To minimize computation delay, optic flow method would not be viable solution, bioinspired model based on Reichardt Model provides better resolution and reduced computation delay

Illustration of Type 2 Proposal

- Cyril et al 2012 have proposed modified Reichardt model for motion detection
- Cyril et al 2013 have developed novel architecture for modified Reichardt model on FPGA platform
- Cyril et al 2014 have developed high speed architectures for bioinspired motion detection model for autonomous navigation
- Velocity estimation models integrated with motion estimation models provide additional information for autonomous navigation of MAVs
- Real time interface with camera and reconfigurable platforms of online processing required for MAVs
Components/elements of research proposal

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<tr>
<th>Part</th>
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<th>Acceptable share (%)</th>
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<tr>
<td>Findings and Discussion</td>
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<td>70</td>
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<tr>
<td>Summary and Conclusion</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
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- **Title of research:**
  - **Good**
    - Concise title that gives reviewer a general sense of what you are investigating.
    - For example: Understanding the role anti-cell death protein BNIP3 plays in brain cancers
  - **Reject**
    - Too long and technical of a title will not gain the reviewer’s attention or interest.
    - Too short and broad a title will make the reviewer too critical of grant.
    - Example: Determining the mechanism of action of Bcl-2 family members in regulating apoptotic signaling complexes within the mitochondria leading to a cure in cancers.

Research Proposal Preparation

- **Objectives**
- **National and International Scenario**
- **Scientific Importance of the project**
- **Field of major scientific interest**
- **Methodology (Methods and Procedure)**
- **Budget**
Components of Research Proposal

Executive Summary:
- Intellectual Merit
- Broader Impact

Objectives

Objective 1
Objective 2
Objective 3
Objective 4
Objective 5

Methodology:
- Sampling techniques
- Algorithms and architectures
- Measurement instruments
- Validation procedures
- Data collection procedures
- Data analysis process

Goals/Aims

Project Impact - Expected outcome

Techno-Commercial status / Outcome / IPR / Social benefit / other

National & International Scenario (Summary of Research)

- National Scenario
  - Select 6 research papers with Authors from IITs, IISc., DRDO, Reputed Universities in India related to the area of research and summarize their research findings

- International Scenario
  - Select 6 research papers specific to the area of research from reputed Journals (impact factor of more than 2)
  - Summarize their work
LITERATURE SURVEY – Example 1

Authors

Literature Survey: History of NN

- Adopted Hebb's NN for IC
  - 1989 Sengers et al.

- ANN with online training
  - 2002 Costa et al.

- LMS for NN
  - 1991 Haykin

- Nonlinear NN
  - 1992 Li et al.

- Recurrent NN
  - 1995 Haykin

- IC using PCA
  - 1998 Rosaka

- CNN NN IC
  - 1997 Abel et al.

- IC using Nonlinear NN
  - 1998 Costa et al.

- Coined MDNN with training
  - 2004 Current Research work proposes TDANN RDC approved in 2005

- ANN with online training
  - 2005 Rama Murthy
Methodology

Time Line – Gantt Chart

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<th>Activity</th>
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Factors We Can’t Control/Factors We Can Control

- Can’t control
  - Internal politics within the funding agency
  - Stiff competition from other applicants
  - Limited availability of funds for certain program areas within funding agency

- Factors We Can Control
  - Requires careful research and planning
  - Requires meticulous execution

Writing proposals: DOs

- Have a strategic plan
- Build on your strengths
- Differentiate this proposal from your Ph.D. thesis work and other sponsored work or use your existing work as base line
- Perform thorough literature search and exploratory research before writing the proposal
  - Journal articles (update with personal contact)
  - Read the thrust areas
- Establish and keep your contacts
COMMON REJECTION REASONS

The reasons why over 700 research proposal applications were denied. Their findings are worth reviewing before preparing a proposal for submission to NIH or any other granting agency.

I. Nature of the Problem (18%)
- A. It is doubtful that new or useful information will result from the project (14%).
- B. The basic hypothesis is unsound (5.5%).
- C. The proposed research is scientifically premature due to the present inadequacy of supporting knowledge (0.6%).

II. Approach to the Problem (38.9%)
- A. The research plan is nebulous, diffuse and not presented in concrete detail (8.6%).
- B. The planned research is not adequately controlled (3.7%).
- C. Greater care in planning is needed (25.2%).
  - 1. The research plan has not been carefully designed (11.8%).
  - 2. The proposed methods will not yield accurate results (8.8%).
  - 3. The procedures to be used should be spelled out in more detail (4.6%).
- D. A more thorough statistical treatment is needed (0.7%).
- E. The proposed tests require more individual subjects than the number given (0.7%).

III. Competence of the Investigators (38.2%)
- A. The applicants need to acquire greater familiarity with the pertinent literature (7.2%).
- B. The problems to be investigated are more complex than the applicants realize (10.5%).
- C. The applicants propose to enter an area of research for which they are not adequately trained (12.8%).
- D. The principal investigator intends to give actual responsibility for the direction of a complex project to an inexperienced co-investigator (0.9%).
- E. The reviewers do not have sufficient confidence in the applicants to approve the present application, largely based on the past efforts of the applicants (6.8%).

IV. Conditions of the Research Environment (4.8%)
- A. The investigators will be required to devote too much time to teaching or other non-research duties (0.9%).
- B. Better liaison is needed with colleagues in collateral disciplines (0.4%).
- C. Requested expansion on continuation of a currently supported research project would result in failure to achieve the main goal of the work (5.5%).

A comparable study was conducted in the Bureau of Occupational and Vocational Education. Based on a sample of 353 research grant applications,
- 18% forgot to number the pages.
- 73% forgot to include a table of contents.
- 81% had no abstract.
- 92% failed to provide resumes of proposed consultants.
- 25% had no resume for the principal investigator.
- 66% included no plan for project evaluation.
- 17% forgot to identify the project director by name.
- 20% failed to list the objectives of the project.
Problem statements

**ASD**
- The cost of monitoring ASD disorder children is approximated to be $17,000 per year, child with severe disorder the cost could be over $21,000 as per the projection reported by Lavelle et al. medical expenditure for children and adolescents is estimated to be 4–6 times higher than normal child every year. The major challenges are to determine whether people have ASD, and monitoring their progress due to treatment. UN reports indicate that there are one billion people or approximately 15% of the world’s population affected with ASD and hence excludes them in fully participating in the society. Every 2-6 children of every 1000 have autism, in India 1 in every 250 have been recognized to have autism, currently there are one million people in India suffering from Autism. Study on physical and behavioral characteristics of children with ASD have been explored, health conditions of ASD children is also monitored, factors affecting child with risk for developing ASD is also researched. One of the major challenges for researchers is detecting ASD and sub grouping ASD children which in turn can improve the ability of doctors and parents to effectively classify children ASD for guiding the treatment.

**Underwater imaging**
- A total 3, 90,884 accidental deaths were reported in the country during the year 2011. A total of 6, 94,390 cases of Un-Natural Accidents have caused 3, 67,194 deaths and rendered 5, 06,348 people injured during 2011. The major un-natural causes of accidental deaths were Road Accidents (37.3%), Railway Accidents and Rail-Road Accidents (7.6%), Poisoning (8.0%), Drowning (8.1%), Sudden Deaths (7.3%) and Fire Accidents (6.7%). 29708 deaths have occurred during the year 2011 due to drowning (boat capsize). Recovering the bodies from the deep water is a herculean task, as trained divers are required to dive deep into the water, identify the body, and carefully remove the body from the bottom. Currently there are very limited solutions to detect the body without diving into the waterfront. Divers need to swim underneath the water and with trial and error locates the bodies and recover them.

**Physically challenged children & old age**
- The population of disabled in India is estimated to be 90 million and 30 million are children below the age of 14 years. One in every 10 children is born with or acquires a physical, mental or sensory disability. India has approximately 450 million child populations and the prevalence rate mental retardation is 0.5 to 1% (Planning commission of India). In every one lakh persons in our total population, 94 are persons with mental retardation. On the other hand neurological disorders such as dementia mainly affect older people; only 2% of cases start before the age of 65 years. After this the prevalence doubles with every five year increment in age. Dementia is one of the major causes of disability in later life. The prevalence of dementia in India is 1.9% over the age of 60 years. In India there are large number of organisation taking care of neurological disorder patients, mentally retarded patients and old age people. With the number of patients increase at 2% rate every year, there is a need for use of technology to manage, monitor and interact with such differently able patients.

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Research avenues in India

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Funding Agency</th>
<th>Dead lines</th>
<th>Funding limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>AICTE (RPS)</td>
<td>Any time</td>
<td>15 Lakhs</td>
</tr>
<tr>
<td>02</td>
<td>DST – NSTEDB - IEDC</td>
<td>December 31</td>
<td>45 Lakhs</td>
</tr>
<tr>
<td>03</td>
<td>ISRO-RESPOND</td>
<td>Throughout the year</td>
<td>25 Lakhs</td>
</tr>
<tr>
<td>04</td>
<td>International Funds - NSF</td>
<td>Throughout the year</td>
<td>Not limited</td>
</tr>
<tr>
<td>05</td>
<td>DRDO</td>
<td>NRB – (May, Nov)</td>
<td>&gt;10 Lakhs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEBEL-LSRB (Feb)</td>
<td>&gt;10 Lakhs</td>
</tr>
<tr>
<td>06</td>
<td>National - VGST</td>
<td>Half year</td>
<td>&gt;5 Lakhs</td>
</tr>
</tbody>
</table>
Problem statements

Locked-in Patients

While estimates vary, at the turn of the new millennium about 21 million people in India were found to have disability as per the official statistics. These included persons with visual, hearing speech, locomotor or mental disabilities, who constituted about 2 percent of the population. However, some sources claim that the magnitude in actuality is more with at least 5 per cent of population suffering from one disability or other and the official statistics accounting for only the most severe ones.

Research Funding Agencies available at National Level which can be approached for Research Work

- Atomic Energy Regulatory Board (AERB)
- Aeronautics Research and Development Board (ARDB)
- Board of Research in Nuclear Sciences (BRNS)
- Council of Scientific & Industrial Research (CSIR)
- Defence Research & Development Organisation (DRDO)
- Department of Atomic Energy
- Department of Biotechnology (DBT)
- Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers
- Department of Electronics and Information Technology
- Indian Council of Agricultural Research (ICAR)
- Indian Council of Medical Research (ICMR)
- Indian Council of Social Science Research (ICSSR)
- Indian National Science Academy (INSA)
- Indian Space Research Organisation (ISRO)
- Ministry of Defence
- Ministry of Earth Science
- Ministry of Environment & Forests (MoEF)
- Ministry of Health & Family Welfare
- Ministry of Petroleum & Natural Gas
- Ministry of Power
- Ministry of Rural Development
- Ministry of Railways
- Ministry of Small Scale Industries
- Ministry of Textiles
- Ministry of Urban Development
- Ministry of Water Resources
- National Board for Higher Mathematics (NBHM)
- Naval Research Board (NRB)
- Petroleum Conservation Research Association (PCRA)
- Science and Engineering Research Board (SERB)
- Tata Institute of Fundamental Research
Information Technology Research Academy (ITRA)

- ITRA has initiated projects in two areas
  - IT based innovations in Water Resources Sustainability &
  - Mobile Computing, Networking & Applications
- Research (Focus) Areas are identified based on national priorities, need assessment and opportunities. For each focus area, specific projects are defined through Strategy Formulation Meetings of national and international experts and stakeholders.
- ITRA is considering areas such as
  - Diagnostic Dome,
  - Human Simulator,
  - Computational Fluid Dynamics,
  - Cyber Physical Systems,
  - Dependable Electronics/ VLSI,
  - Computational Genomics,
  - Biometrics – Technology for human identification,
  - Cyber Security
- Submission Deadline: Throughout the year program

DEITY

- Major divisions of the group include the following.
  - Electronics Systems Development & Application Division
  - R&D in Medical Electronics & Health Informatics Division
  - Electronic Materials & Components Development Division
  - Microelectronics Development Division
  - Semiconductor ICs Layout Design Registry
  - Nanotechnology Initiative Division
- Schemes
  - ICT&E R&D and Innovation Framework 2013
  - Technology Incubation and Development of Entrepreneurs Scheme (TIDE)
  - Multiplier Grants Scheme (MGS)
  - SIP-EIT Scheme
- Submission Deadline: Throughout the year program
Summary

- Research is a strategic plan
- Research enhances career opportunities
- Selection of research areas
- Selection of funding agencies
- Networking with experts
- Research is passion