

# 5P's of Academic Research

*Everything you really never wanted to ask about academic research ,but here it is anyway!*

*Professor Arun S. Mujumdar, NUS*

# 5P's of Academic research: A personal perspective

Professor Arun S. Mujumdar  
National University of Singapore  
Singapore

2004

# What are the 5 P's?

- Propose
- Plan
- Prepare
- Present
- Publish

*This is a simplistic list of what academic research entails!*

# Propose

- First step is to propose a suitable project that is relevant, of current and potential interest and ,in many instances, fundable
- Proposer must be up-to-date with current state-of-the-art
- No short-cut to uncovering, accessing and studying critically relevant research literature- must cover broader range of subjects
- Too narrow a literature search can cause problems since all significant literature may not be uncovered with few keywords!

# More on Defining project

- Define objectives and scope- remember these are dynamic especially over 3-5 year span of PhD work
- Work elsewhere can impact research scope/objectives/methodology etc
- Develop continuous network involving research groups around the world- share research results when feasible to avoid duplication and get feedback from experts
- Think globally but act locally- what is relevant or important in one part of the world may not be so in another part
- Think about producing an excellent researcher and research ( often a by-product!)

# More about proposal...

- Be realistic – match resources (quality and quantity) with objectives and scope !
- Evaluate human resources (grad students etc) carefully
- Be ambitious but goal posts should be reachable!
- Avoid buzz word research! Buzz may fizzle out before work is finished!
- Also, steer clear of ROM (run-of-the-mill) or Me-TOO research !
- Collaborate if necessary expertise is brought in by collaborator- or else work may simply be slowed down with additional resistance to communication in group. Have **real** cooperation.
- **No point in having collaborator with same or less skill level in same area- will dilute publications and delay work!**
- **Too many cooks spoil the broth- also true for research!**

# Planning

- Important first step- develop schedule, assign resources correctly. Wrong assignments can cause problems later
- Be flexible- timeline cannot be cast in concrete in true research marked by significant uncertainty.
- Update timeline frequently.
- Report/present results within group/ network regularly- not sporadically!
- Get all team members involved- they should assume ownership of their research
- Make researchers entrepreneurs and CEO's of their projects !

# Planning-Human resources

- Assuming you have financial resources, quality of human resources can be even more critical
- Evaluate quality of research personnel available-analytical vs experimental traits
- Potential graduate students must be resourceful, keen, highly motivated, intrigued and fascinated by project, driven to succeed and make a difference!
- Develop initiative, willingness to work hard under extreme pressure, enjoy learning/reading, have patience, ethical bend; have leadership and team-building skills, willingness to share success, appreciate others' strengths and achievements etc.



# Traits of potential researchers

- Must have strong fundamentals
- Willingness to self-study and self-learn
- Capable of critical thinking
- Creative, able to innovate
- Able to identify opportunities to make a contribution to knowledge and strong desire to do so
- Able to take up ownership of the "Research Enterprise"

# More about what makes a good researcher...

- Has desire to stay up-to-date
- Has desire to be a team member and lead teams when required
- Logical, ethical, amicable, resourceful, helpful to others, willing to share knowledge, good in oral and written communication skills
- Preferably analytical and good in experimental techniques needed
- Interested in life long learning

# Prepare ...

- Allow mistakes but not the same repeatedly!
- Learn from experience of team members- critical for multi-disciplinary projects
- Hold formal/informal group meetings
- At NUS, we hold mini-technical sessions with 6-8 formal presentations every few weeks!
- Researchers more enthusiastic when there is interested audience that learns from them and have genuine interest in their output!
- Encourage critical discussion- not at personal level

# More about preparation –execution of project

- Researchers and advisors must keep abreast of literature continuously- not just in initial phases
- Evaluate literature critically- do not read it like a novel or newspaper!
- Prepare summaries of relevant papers –to be cited in your work
- Benchmark against high quality work in same area. Try to achieve similar or higher level of accomplishment
- Do not repeat earlier work except to compare/validate your work –inject element of innovation and creativity in your research

# Prepare....

- No substitute to hard work!
- Researchers must be able to multi-task i.e. carry out several tasks in parallel and in series
- Often delays can occur over which one has no control- use this time productively
- Analyze data critically (and statistically!). Take ownership of results..
- Research students must take their project as their business enterprise- must strive to make it a "profitable" undertaking – profits are research output of value.

# Preparation contd..

- Be productive thinker- coupling creativity with productivity
- Research value is time-dependent- typically decays with time.
- Half-life of research results depends on area- some may be short ( 1 yr) while others may be 10 years!
- Basic work lasts longer than applied work, in general
- Rapid publication is essential for short half-life areas.

# Presentations..

- Presentation of work to proper audiences at right time is key to success. Dated presentation to wrong audiences is wasteful.
- High quality presentation is key to attract and maintain audience interest
- Do not make false claims- worse , do not claim someone else's work as yours!
- Always cite and credit earlier work- not just in passing but with a high quality citation.
- Follow ethical and professional guidelines rigorously.
- Choose conferences and journals carefully



# Presentations (contd)

- Choose journal based on its acceptance in audience you wish to address.
- Engineering papers in physics journals will be largely ignored- although ISI may give it high impact factor!
- Let your paper enhance impact of journal –rather than expecting the reverse!
- Some work maybe more appropriate to large-circulation professional journals (e.g. CEP, Chemical Engineering rather than AIChEJ or Chem.Eng. Sci. if the work is of direct engineering interest!)



# Presentations...

- Impact factor (IF) may not quantify actual usefulness or real engineering impact- more a measure of academic impact
- Objective of engineering paper should not be to lead to another paper by someone else- either the work is incomplete or only of academic interest in such cases
- No objective or quantitative way to measure real engineering impact e.g. in design or operation of processes and equipment.

# Publish...

- Critical in academic life-must be done carefully
- Only results of archival value (not transient value) should be published
- Research in progress may be presented at conferences
- Study "good" papers carefully- identify why you think they are really "good" so that you can use them as models
- Be original but benefit from past experience of others
- Papers must be clear, concise and correct (3C's!)

# More on publishing

- Reviewers comments can help improve quality of presentation but also research itself.
- Third party, unbiased comments are useful- negative comments must be accepted professionally and should not be taken as personal attack!
- "To cite or not to cite.." is a difficult question to answer in a blanket form
- Ensure that appropriate credit is given to earlier work- do not just list reference but actually refer to it in text (review as well as results & discussion)- quality of citedness is important.

# Publishing...

- Do not focus on number of papers- it may measure extent of research but not its quality and impact
- Measurement of impact is difficult and subjective
- Invitations to write book /handbook chapters, give plenary and keynote addresses etc membership of editorial boards, scientific committees of major conferences etc are some measures used commonly
- Thesis is a public document of limited visibility- hence important to publish in journals
- Remember the adage: **Publish or perish!**

# Closing Remarks

- For academics the 5Ps are very important – what is given here is only a personal viewpoint based on experience in many parts of the world
- Coverage is only superficial- much more can be said and done!
- Research by academics, in academia and for academics is just that- academic research (of little wider interest).
- Note every researcher is not effective as an academic- some better off working in industrial R&D instead.
- ***SO DO YOU REALLY WANT TO DO JUST ACADEMIC RESEARCH ?***