

Research and Publishing in Software Engineering

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Research

- What is Research?



Research

- Answers some general question, whose answer is useful and unknown
 - The question may not be known or articulated before the research/answer
- Creates new knowledge which is interesting/useful



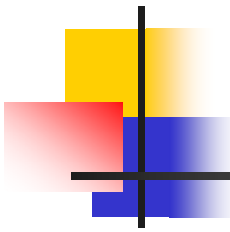
Science and Engineering Research

- Science research: Focuses on discovery of facts and laws of nature
 - Explains, predicts, defines limits,...
- Engineering is a synthetic discipline; engineering research facilitates creation
 - Creation of new artifacts
 - Or improving existing artifacts
- Software engineering is synthetic
 - Some aspects are in the science domain



Sw Engg Research

- Research (result) must have
 - A new idea (process, approach, framework, tool,...)
 - Which leads to some improvement
- Newness is necessary but not sufficient!
- A lot of SE research therefore is devoted to finding a *better* approach, methodology, architecture, tool, ...



Engineering vs. Engineering Research

- A new software is written, which a lot of people use – is it research?
 - Is research only if the software embodies some new ideas, and the use of the idea leads to some improvement
- A highly used new product could be good engineering or innovation but need not necessarily be research



SE Research Approaches

- Building tools, systems
 - Ideas best expressed by the system
 - Proof of some proposed concept
- Empirical research
 - Produces knowledge
 - Studies impact of something
 - Data collection and analysis



SE Research

- Conceptual, framework, approach
 - New processes, approaches
 - New algorithm for doing something
 - Approach for verification, specification, ..



Evaluating Research

- Two key components
 - The benefits or significance of the new idea
 - Magnitude and significance of the impact, i.e. how many and how deeply other researchers or users are impacted
- Impact is time dependent
 - Can be estimated by measures like no of downloads, uses, readers,...
- Significance is largely determined by the research community



Necessity of Publication

- Publication, even of research resulting in artifacts, is a way of establishing significance and newness
 - Is essential for research; hard to claim anything otherwise
 - Review and openness “guarantees” some quality
- An indirect measure of significance is the place where the paper appears
- Publication often necessary for impact (of course not sufficient)



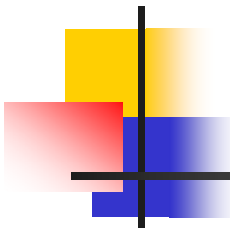
Publishing in SE

- Any research publication, particularly in engg., must clearly state
 - What is new in it
 - How is it better
- For both, comparison with existing works is essential
 - This is often lacking in papers from India or industry



Some Guidelines for Writing

- Writing style
 - Paper writing is not business writing
 - Paper should include background, related work, problem definition, results etc.
- Respect Copyright and IPR
 - Cannot copy even a single sentence verbatim from a paper or a website
 - All ideas (expressed in own words) must be attributed to original works



In Defense of “Incremental Research” in academics

- Lot of academic research is incremental
- Incremental research has its purpose
 - Keeps research skills sharp
 - Hard for most to go straight to the big problems and great solutions; path to greatness lies throu incremental research
 - Risk: Remain forever in this mode!



Summary

- Research is different from engineering – is about creating new knowledge
- Research must show what new ideas it has and must show how it improves the existing state
- Publishing is an integral part of research, papers must follow proper style and copyright/IPR rules