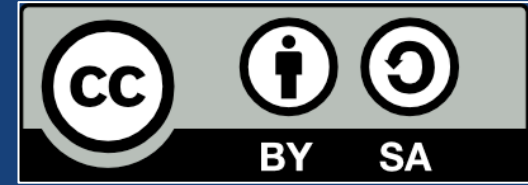# Methodology and Tools for Research:
Research landscape

Yannick Prié

Polytech Nantes, University of Nantes

Master DMKM, 2015-2016

Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)

- This course "*Methodology and Tools for Research: Research Landscape*" by Yannick Prié is licensed CC BY-SA 4.0

- This license covers the general organization of the material, the textual content, the figures, etc. <u>*except where indicated*</u>.

- This license means that you can share and adapt this course, provided you give appropriate credit to the author and distribute your contributions under the same license as the original

  ◦ for more information about this license, see http://creativecommons.org/licenses/by-sa/4.0/

- For any comment on this course, do not hesitate to contact me: yannick.prie@univ-nantes.fr or @yprie

Objectives of this course

- Understand the (mostly french) research landscape
- Discover various careers in research
- Know what a PhD thesis is

- Ressources for the course
  http://www.scoop.it/t/toolsandmethodologyforresearch

Outline

- Research bodies
- Funding and evaluation bodies
- Careers in research
- PhD Thesis

Outline

- **Research bodies**
- Funding and evaluation bodies
- Careers in research
- PhD Thesis

Public and private research

- Research is mostly public
  - General interest
  - No direct, easily measurable ROI
- Research can be private
  - Sufficiently large companies
  - R&D departments
    - new products (?)
    - new scientific and technological knowledge

- There are many public / private relations
  - State supported collaborative projects
  - Private funding
    - Labs (e.g. Medialab)
    - People (e.g. chairs)
    - Research contracts

Public research in France

- Mainly 3 types of institutions
- Research and teaching
  - Mostly civil servants
  - Universities, Engineering schools, Collège de France, ENS…
- Research
  - Mostly civil servants
  - CNRS (general), INSERM (medicine), INRA (agriculture), INRIA (computer science), IFFSTAR (transportation)…
- Industrial and commercial research
  - State-owned companies
  - CEA (nuclear), CNES (spatial), Ifremer (ocean)…
- 200.000 people

Research bodies
Universities and Engineering schools

- 80% of research staff
- Associate professors (Maîtres de Conférences) and Professors
  - Teaching + Research (+ administrative) activity
- Teaching Departments + laboratories
  - Universities
    - License (3 years) / Master (2 years) / PhD
  - Engineering schools
    - Engineer Degree: 3 years
  - Variants
    - e.g. Polytech' Nantes = University Engineering School

Research bodies
CNRS and INRIA

- Junior or senior researchers
  - Chargés de Recherche (CR)
  - Directeurs de Recherche (DR)

- CNRS (Centre National de la Recherche Scientifique)
  - All-disciplines
  - UMR (Unités Mixtes de Recherches) Laboratories
    - labels for mixed labs: CNRS / University / Schools

- INRIA (INstitut de Recherche en Informatique et Automatique)
  - Computer Science
  - No labs, just "team-projects"
    - can implicate university staff

Laboratories

- Base structure for organizing research
  - people + equipment
  - generally focused on one discipline
- People
  - Researchers and researchers-teachers
  - Director
  - Technicians
  - Administrative staff
- Internal bodies
  - research teams
  - lab council
  - direction team
  - …

Research teams

- Focused on one or several topics
  - long term: several years
  - regular evaluation of the team as such
  - usually organised around one or several professors
- Various sizes
  - 1 prof + 1 ass prof + 2 PhD
  - 5 prof + 10 ass prof + 13 PhD students + 3 ing + 3 tech
- Special case at INRIA
  - No lab, local research centers with team-projects
    - One topic
    - 4 years first, max 12 years

Lab life

- General seminar
- Various councils and workgroups
- Interactions
  - members of different teams
- Reporting
- Evaluation
- …

Team life

- Internal seminar
- Invited professors
- Interactions
  - Member of the same team
- Projects
- Reporting
- Evaluation
- Grants demand
- …

Private research

- Big corps
- (e.g. for computer science)
  - Dassault Systems
  - Thales
  - EADS
  - Orange / France Telecom
  - EDF
  - Michelin
  - SAP
  - IBM
  - Microsoft
  - Google
  - Rank Xerox
  - …

- Start-ups
  - Founded
    - by researchers
    - around research ideas
  - Contractual association with laboratories
    - incubation
    - see on labs' websites
      - LINA : Dictanova (NLP), EasyVirt (optimisation)

Researchers in Laboratory and Researchers Review Documents by Rhoda Baer are Public Domain

Outline

- Research bodies
- **Funding and evaluation bodies**
- Careers in research
- PhD Thesis

Funding research

- What do researchers need?

- Salaries
  - for them
  - for others researchers
    ◦ PhD, postdoc
  - for engineers & techs
  - for administrative help
- Equipment
  - computers
  - big and expensive machines
  - books
  - software licences
  - …

- Traveling expenses
  - conferences
  - project meetings
  - lobbying
  - inviting researchers

- Love

  THANK YOU !

  - being respected (in France)

Funding research units

- ## Recurring funding
  - Salaries for permanent staff
  - Offices, water, telephone
  - Around 20% of the budget of the lab (computer science)
- ## Contractual funding, two models
  - Additional cost related to projects
    - Non-permanent staff
    - Equipment
    - Travelling expenses
  - Percentage of the total cost of projects
    - e.g. 50% of total cost, including permanent staff salaries, infrstructure, etc.

Funding research units (cont.)

- Public money
  - Europe
    - The Seventh Framework Programme - 2007-2013 (FP7)
    - Erasmus
  - France
    - ANR, Ministries
    - FUI, Oseo (innovation)
  - Other countries
    - bilateral programs
  - Region, Urban community/city:
    - various programs
  - Organisation redistribution
    - eg. CNRS, internal call for projects at university level, Labex…

- Private money
  - Enterprises: sponsoring or direct contracts
  - Foundations

ANR:
Agence Nationale de la Recherche

- Contractual funding, all disciplines
- Collaborative projects
  - several teams / labs
  - enterprises (R&D: products or real research)
- Several calls each year
  - "blank" call: bottom-up approach
  - focused calls: top-down approach
- Selection rate: 8%
- Other countries
  - USA: NSF, DARPA, etc.
  - Germany: German Research Foundation (DFG)
  - …

Example: ANR Information and Communication Sciences and Technologies Department (2012)

- **Digital Models**
  - This programme is dedicated to research in modelling, simulation and optimisation leading to the creation of virtual digital worlds, in the context of huge masses of data from varied origins, localised or disseminated.

- **European programme on Long-term Challenges in Information and Communication Sciences and Technologies**
  - The ANR is the coordinator of CHIST-ERA, an ERA-NET initiative in the field of ICT which groups 13 national research funding agencies in Europe. In 2011, a first call for proposals was launched aiming at supporting innovative, multidisciplinary collaborative projects, with a strong scientific and technical impact.

- **Digital Engineering and Security**
  - This programme aims at promoting new paradigms, technologies, methods and tools to design digital hardware and software systems, where security and safety are major concerns.

- **Hardware and Software Infrastructures for the Digital Society**
  - The INFRA programme covers all the research work aiming to produce hardware and software infrastructures that make available ubiquitous communication, storage and computation resources

- **Content and Interactions**
  - The programme brings together two domains between which there are many similarities: the whole value chain of digital content capture, creation, production, editing, processing, interpretation, interaction, and economic uses, covers all types of media: audio-visual, film, animation, games, web, press, data on the web, personal content, etc. ; the part of robotics that relates to issues of perception and cognition by robots (terrestrial robots, humanoids, flying robots, etc.) situated within the general framework of interactions between artificial systems and the physical world.

Example: ANR Information and Communication Sciences and Technologies Department

2011 Key Figures

Budget: **€46.4 M**

Number of proposals submitted: **216**

Number of projects funded: **59**

Success rate: **29%**

Average funding per project: **€659 k**

Answering a call for proposal

- Choosing appropriate call
- Building the right consortium (teams / enterprises)
  - of the right size
    - depends on the funding of the program
  - with the adequate leader
    - credibility
- Defining the objectives of the project
  - Related works / projects
  - Difficulties

- Defining tasks/subtasks and a planning
  - Leader, descriptions of the work, risks, deliverables, etc.
- Defining a budget
  - Total cost / grant cost
- Writing it before the deadline!

Evaluation of research units

- Research units have a 4-year contract
  - with Ministry, CNRS, etc.
- Evaluation is related to renewal for another 4 years
- Important step

Evaluating research and teaching

- AERES
  - Evaluation of establishments, research units (labs, teams), degrees, doctoral schools, etc.
  - Report + visiting committee
- Notation
  - A+ → excellent, stay as you are
  - A → very good or good, why not reach A+?
  - B → average, you need to reach A next time
  - C → quite bad, you need to disappear and/or reorganize differently
- Difficulty as evaluation leads to sanctions

Evaluating researchers

- Done by a national council
  - discipline by discipline
- Each 4 years, record of activity
- New
  - The objective of that evaluation remains unclear
- Rants
  - researchers are evaluated all the time
    - papers
    - grants
  - why add another layer?

Outline

- Research bodies
- Funding and evaluation bodies
- **Careers in research**
- PhD Thesis

Researchers

- Universities and Engineering schools
  - Competitive examination
    - In general annual
    - Publication of teaching + research profile
  - Selection committee
    - One for each job
    - Examination of the record + hearing
- Associate professors / Professors
  - PhD / HDR
  - "qualification" (teaching / research certification)
  - 192 hours of teaching each year
- Average salaries
  - Small at the beginning

Researchers

- Research institutes (CNRS, INRIA)
  - National competitive examination
  - Disciplinary committees
    - Some interdisciplinary
    - Ranking of the candidates
  - Candidate express their wish
    - Lab/team
- "pure" researchers
  - PhD / HDR
  - Full-time research
- Average salaries
  - Small at the beginning

Students researchers

- PhD students
  - See later
- "Pre-doctorate"
  - Master's degree in a lab

Postdocs

- Post-doctorate
- Usually not in the PhD lab
  - Discovering other research topics, other ways of doing research, getting in touch with top notch researchers…
  - Can be in another country
- Objective
  - Building a record sufficient for obtaining a position
- Various stories
  - "Eternal postdocs"
  - Difficulties to get back in France
- Special case in France: ATER
  - Temporary teaching + research position
  - Can be used to finish a PhD

Engineers and technicians

- Research engineer
  - Development
  - Project leadership
  - Network administration
  - Technical team management
- Technicians
  - Development
  - Network administration
  - Equipment administration
- Computer science : low salaries

Administrative staff

- General management
- Human resources
  ◦ Interns, temporary staff
- Secretary
  ◦ Missions, expenses
- Communication
  ◦ Events
- etc.

Others careers

- Private companies
  - Same as public, maybe more oriented towards applications
- Funding bodies jobs
  - Consultant
    - Europe, Region, ANR, etc.
  - Better if these guys have a PhD!

Putting it all together (in France)

1. PhD Thesis
2. Postdoc
3. First job
   - University/Eng School → Ass Pr, Engineer
   - Research Institute → Junior Researcher, Engineer
   - Private companies → various jobs
4. HDR
5. Evolution of the job
   - University/Eng School → PR, Engineer
   - Research Institute → DR, Engineer
   - Private companies → various evolutions

Internationally?

- As many situations as there are countries and academic system
- PhD mandatory
  - For research
  - But not only!
- Mainly temporary positions
  - Quite long, e.g. 5 years
- Tenure position difficult to obtain

Outline

- Research bodies
- Funding and evaluation bodies
- Careers in research
- **PhD Thesis**

What is a PhD thesis?

- The period of time during which a student researcher becomes a researcher
  - 3-5 years
- The thesis is validated by
  - A dissertation
    - Various forms: 100 to 1000 pages
  - An examination
    - Various forms: number of examiner, type of presentation, duration, etc.
- Being able to get to examination requires sufficient publications
- The student is supervised by
  - a director (Professor)
  - an adviser (eg. Ass Prof)

What is a PhD student?

- A good student with a master's degree, willing to become a researcher, i.e. prove that
  - she can master a subject within a discipline
  - she has valuable insights
  - she is able to carry her research independently
  - she can communicate her results
- Double status
  - student of the university
  - and professional with a real job (at the university)
- Can be weird with family and friends

What do you do during your thesis?

- **At the beginning:**
  - assimilate the domain, the discipline, the research topic that has been proposed to you
    - read, read, read
  - decide what is really your research question
    - why it is important, why you could bring new solutions
- **In the middle:**
  - focus on your proposal(s), develop and test them
    - write, experiment, read
  - do some publications, modest at first
    - write
- **At the end**
  - pack everything up, write serious publications
  - write your dissertation
    - write

What do you do during your thesis? (cont)

- +

  - implication in the scientific community
    - participate to conference
    - organize workshops
  - implication in the lab/team
    - councils
    - seminars

- +

  - Teaching (undergraduates or higher)

- +

  - not forgetting there is life outside of the lab

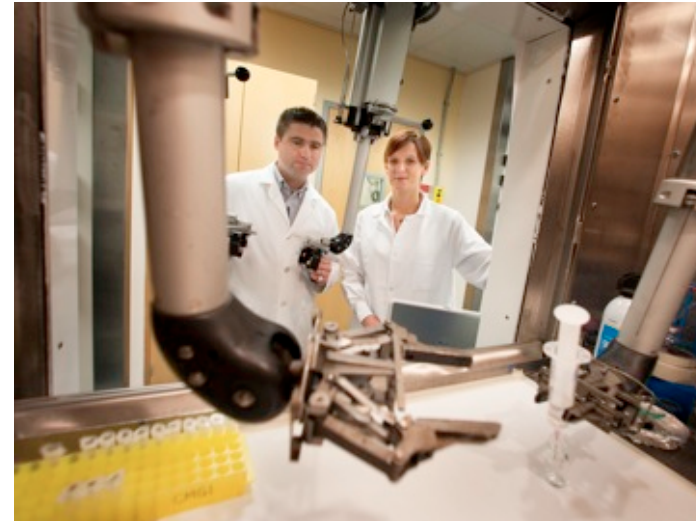# Several types of funding (in France)

- Having 3 years of funding is mandatory for computer science PhD thesis

- Ministry, Region, CNRS, Foundations grants
  - Salary: 1400€ net / 1700€ with teaching
- Collaborative projects (Europe, ANR…)
  - Salary: depends on the project
- CIFRE (industrial PhD thesis)
  - Salary: min 1600€ net, can be much higher
- Foreign country grant
  - Salary: depends on the country, can be low

Finding a PhD thesis

- Usually PhD thesis begin in sept/october
  - lots of proposal between may and september
- Master's degree
  - or equivalent
- Carefully choose, w.r.t.
  - subject
  - director and advisor
  - lab/university
  - city
  - material conditions
  - …
- Visit the lab, discuss with current students

Finding a PhD student

- ## Some criteria
  - ◦ easy to check:
    - • good grades
  - ◦ not so easy to check:
    - • good motivation
    - • autonomy
    - • insight
    - • tenacity

The director / PhD student marriage lasts 3-5 years

- ## How to check
  - ◦ Interview: ability to roughly understand the subject and make insightful comments rapidly, personal contact
  - ◦ Recommendation letters, phone calls to previous advisers
  - ◦ Web surfing
  - ◦ …

Difficulties of a PhD thesis

- A successful thesis means that you have changed your way of seeing things
  - changing can be difficult
- Moments of doubt
  - is it worth it?
  - paper rejection (your paper has been rejected)
- Difficulty to write
- Research never stops
  - Family life, social life

- See PhD comics (http://www.phdcomics.com/comics.php)

Benefits of a PhD thesis

- Become a real researcher
  - acknowledged by the community
- Very rich experience
  - Meeting brilliant people
  - Being able to thoroughly apprehend, rightfully discuss important subjects, change your mind on important and different subjects
- Good moments
  - Publication accepted (your paper has been accepted)
  - Social events
  - Defence
- Being able to decide what should be studied next on *your* research field

- See PhD comics (http://www.phdcomics.com/comics.php)