Research & Innovation
The Eco-System of Research

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Credits

MANY THANKS TO

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Part 1 : Actors and processes

1. Introduction

Why this course?

- Learn what is research: actors, methods, etc. (in our field)

To be able to

- Possibly chose to do research later
- Work with the researchers (as an engineer, an end-user, an entrepreneur, etc.)

Why this course?

- Academic research vs. Industry
  - Different approaches
  - Different objectives
  - Different valorization processes
- Requires mutual understanding for Innovation

Introduction
What is research?

- Research
- Engineering
- Innovation

7

Introduction
What is research?

- Engineering
  - Solve a problem with current state of the art techniques
- Research
  - Add knowledge or processes to the state of the art
- Innovation
  - Implementation of novelty

8

Introduction
Engineering

- Typical steps in engineering
  - Need
  - Analysis of existing solutions
  - Selection of a solution
  - Implementation and preliminary test
  - Installation and test
  - Maintainance

9

Introduction
Research

- Typical steps in research
  - Topic description
  - State of the art (knowledge on this topic)
  - Proposal elaboration
  - Evaluation, comparison with other proposals
  - Publication in the community

10

Introduction
What is innovation?

- Implementation of new products, ideas, concepts, organization into a company
- Way of development of the company: competitivity, differentiation, creation of value
- Innovation can be supported by research results

11

Research results

- **Publications**
- **Patent**

But also

- Demo (demonstrations)
- Knowledge (state of the art, techniques)
- Know-how
- Contacts in the research area

12

Agenda

1 Introduction

2 Research organisms

3 Actors of Research

4 Research processes

5 Research need in the society

Types of research organisations

- National research institutes
  - CNRS, DFG
- Universities (public, private)
  - University Jean Monnet, Carnegie Melon University
- Companies
  - Or Private research institutes
- Associations, NPOs (non profit organizations)
  - DFKI, Fraunhofer

National research institutions

In France
- CNRS
- INSERM
- INRIA
- INRA…

Germany: DFG, Max Plank Institute
Japan: MEXT, JST
USA: NSF, NASA, NIH, DARPA

CNRS

33 000 personnes
- 1/3 researchers
- 1/3 engineers, assistants and secretary
- 1/3 temporary contracts

Budget 3,3 bilions euros
25% from contracts, projects, etc.

(sources: cnrs.fr)

CNRS, institutes

Institute of Biological Sciences
Institute of Chemistry
National Institute for Earth Sciences and Astronomy
Institute of Ecology and Environment
Institute for Engineering and Systems Sciences
Institute for Humanities and Social Sciences
Institute for Information Sciences and Technologies (INS2I)
National Institute for Mathematical Sciences
National Institute of Nuclear and Particle Physics
Institute of Physics

INRIA

INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

2 400 members (1200 PhD students)
183 project-teams (5-year duration)

Budget (yearly): 231 millions d'euros,
25% from contracts, projects

INRIA scientific domains

- Applied Mathematics, Computation and Simulation
- Algorithmics, Programming, Software and Architecture
- Networks, Systems and Services, Distributed Computing
- Perception, Cognition and Interaction
- Digital Health, Biology and Earth

19

Others (in France)

- INSERM: national institute for health and medical research
- INRA: …Agronomy
- INRETS: Transport and security
- Etc.

20

Universities and their research labs

(France)

- Equipe locale (Local team)
- Equipe d'accueil, EA (recognized by the Ministry)
- Unité Mixte de Recherche, UMR (also accredited by CNRS and/or other national research institutes)

- Notice: Universities = Higher education and research institutions (like UJM and EMSE)

21

Universities and their research labs

A Laboratory:

-Permanent staff: 1 to 100 (Researchers, Technicians, Secretaries)

-Short term contracts: 1 to 100 (interns, PhD students, postdocs)

-Visitors

Organized in teams

22

How is a lab organized? (in France)

Governance

- Director (legally responsible), vice-dir.
- Lab council (for current life)
- Scientific council (coordination, discussion)

The People

- Technicians
- Administrative management
- Researchers
- Non permanent members (PhDs, Posdocs, interns)

23

Doctoral schools

- Grouped by disciplines
- Administrative management of PhDs (registration, courses, credits' validation…)
- Control the quality (and duration) of PhDs (internal /external peers' reviewing)
- Carrier preparation

- Notice: In some countries the Graduate schools include Master + PhD degrees

24

Companies

- Small or big companies (more or less reactive, powerful)
- Various reasons for acting
  - Keep up to date
  - Visibility, patenting
  - Market extension
  - Gain public money
- Departments called R&D, R&I: Development, Innovation. Can be driven by custumer/market requirements

Agenda

Researcher

- In a national institute
  - As a PhD candidate
  - As Postdoc
  - As staff member (application on open positions)
- In a company
  - During the PhD (student+employee)
  - As a regular employee (generally with a PhD degree)

Teacher-researcher

- Staff member of a University
- 2 levels: Associate Professor (=Maîtres de conférences); (Full) Professor
- After PhD and postdoc; Application on open positions
- Teaching duties (fixed or negotiated)
- Belong to a research lab: research activity, publications
- Initial salary: 1654 €/month net
- Up to 5000 €/month

PhD student

- Time limited position in a research lab
- Concentrate on a topic (research question)
- Duration: 3 years (+ some more months)
- PhD supervisor: Full professor or Associate professor with « habilitation »
- Supported by
  - Ministry or Project-based position (PhD student is an employee of the University)
  - Company
  - Own financial support (not recommended)

PhD statuts and incomes in France

Employee of a university

Around 1200€/month net (+some more in case of teaching duties)

Employee of an enterprise

Agreement Company-Research lab (CIFRE PhD: the Ministry supports financially the company)

Around 1600€/month net (negotiated)

Post-doc (post-PhD degree)

- Mature the research experience
- May prepare for a permanent position, enlarge the research network
- Different strategies
  - Deepen the research topic
  - Broaden views
  - Make teaching experience (French ATER)
  - Or just "survive"
- Depends on opportunities, different salaries

31

Internship student

- Bachelor, master, engineering students
- Short term contract or Internship convention

32

Research communities

- Set of researchers around a topic
  - Sub + Super communities, intersections, etc.
- Fuzzy evolving « structure »
  - Participants, topics, meetings, conferences, association
- Community-dependent rules, practices, organization… Not all formalized

33

Technician, engineer

- Support research experiments
- Maintain research installations

34

Administrative management

- Budget management
- Personal management (HR)

35