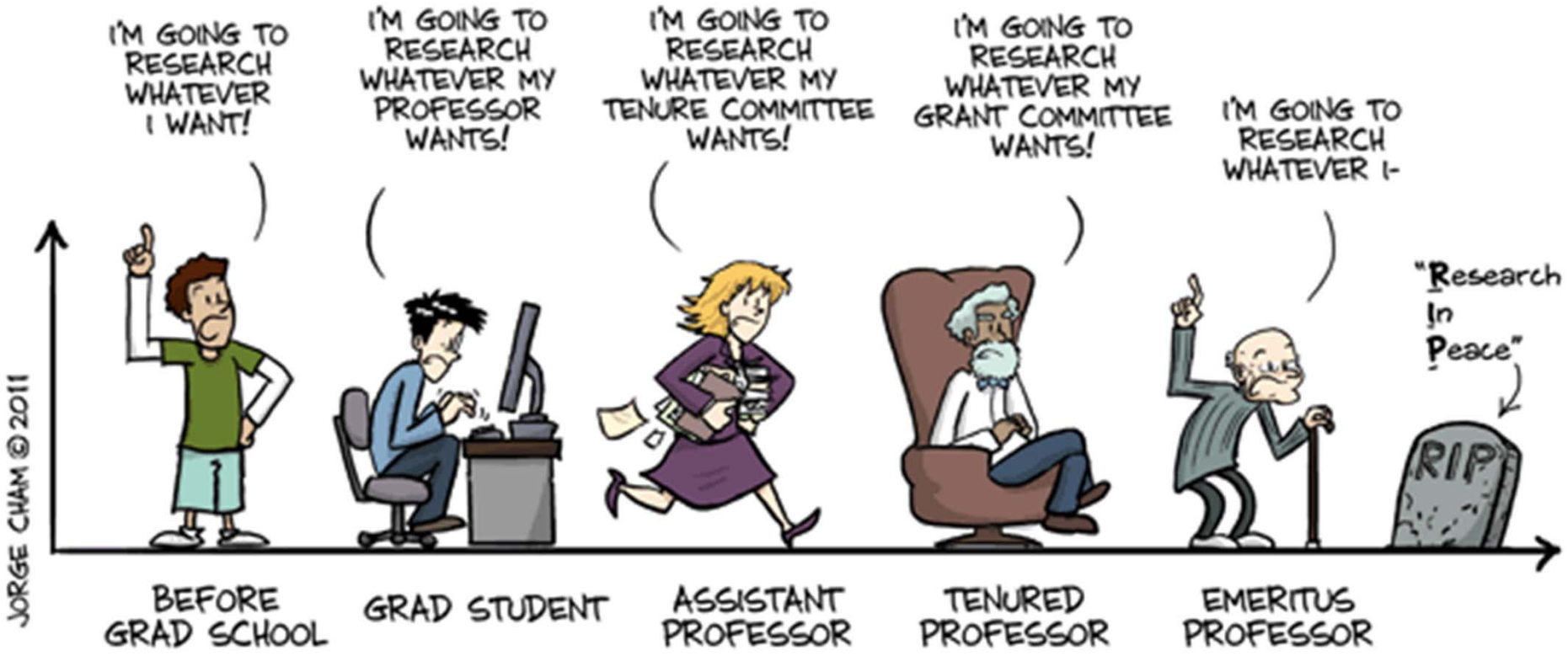
THE EVOLUTION OF INTELLECTUAL FREEDOM



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CAP7003E
Doctoral Research Strategies in Engineering
or *"Ensuring a successful doctorate"*
(Session 3)

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B-450.19

WORLD-CLASS ENGINEERING

POLYTECHNIQUE MONTRÉAL

What you learned and appreciated the most (session 2)

Aspects	#
Aspects/difficulties related to the production of a publication	++++
How to write a research proposal, outlines of proposal	++++
Goals, requirements / preparation for comprehensive exam	+++
Timelines, Milestones of a Ph.D. journey, project	+++
The CAMEL graph, importance of motivation	++
Importance of having a strategy of publications	++
How to collaborate, communicate with supervisor	++
Hints for preparation of written and oral exams	++
What is a good Ph.D. dissertation, defence	++
Activities / discussions in group, in class	++
Difference between general and specific objectives/hypothesis	++
Importance of Ph.D. time management / duration of Ph.D.	++

Aspects to discuss more during the workshop (session 2)

Aspects	#
How I can write / publish good quality paper	**+++**
How to prepare my comprehensive exam, my research proposal	**+++**
Time management during my Ph.D.	++
How to defend my thesis, criteria of completion	++
If failure of the comprehensive exam, what to do?	+
How to reply to paper reviewers	+
Planification/management of my research project, difficulties	+
How to present expected results	+
How to start my literature review	+
Definition of my research project; writing objectives	+
How to mitigate risks	+

What is your publication strategy?

Importance to establish early your publication and dissemination strategy

- **What do you want ?**
- **What does your advisor want?**

  → You have to have an agreement at the beginning!

Publication strategy:

- When to publish
- What to publish
- How to publish: criteria, authors, in which journal ?

When/What to publish

Content of a paper:

Normally:

One paper = 1 question (not 2 or 3), 1 idea, 1 concept or 1 topic (not 2 or 3)

One paper = 1 result or one group of results which answer 1 question which bring to 1 conclusion…

Ask you this question:

What is this scientific contribution of this paper?

Publication criteria
Example: Biomacromolecules - American Chemical Society

Your article must meet the inclusion criteria of the journal!

- Biomacromolecules is an interdisciplinary journal publishing original research focused on the science occurring at the interface of polymer science and the biological sciences. The emphasis will be on original and fundamental research that **integrate knowledge** in both **polymer science** and the **biological sciences**.
- Biomacromolecules will provide a home for interdisciplinary investigations exploring the interactions of macromolecules with biological systems and their environments as well as biological approaches to the design of polymeric materials.
- Applications include biomedical polymers, tissue engineering, bioresorbable polymers, coatings and adhesives, polymeric drugs, bioinspired polymers, biocompatible surfaces, multifunctional surfaces, active surfaces, and polymers for electronics, photonics, packaging and consumer products and engineering applications, e.g. in life sciences.

Tiré de : www.acs.org

Publications

- **Journal selection**
  - Prestige (→ Impact Factor): Look for high Impact Factor based on paper excellence, or lower if paper is less good or urgency to publish
  - Effectiveness of diffusion
  - Investment, feasibility
  - Nuance taking into account the specificities of journals: specialized journal vs new ideas vs geography (USA, Europe)
- **Order of authors:**
  - 1^{st} = principal investigator / writer (normally, the student)!
  - 2^{nd} = research supervisor / principal investigator
  - 3 - $(n-1)^{th}$ = collaborators with scientific contribution
  - n^{th} = leader of the research team (senior researcher), with scientific contribution
    - Must reflect the effort provided
    - Max: ~ 6
    - Each author must be able to understand and defend the entire article
    - Exclude: technicians / research assistants, observers, proofreaders, computer scientists / statisticians (unless they have made a significant contribution).

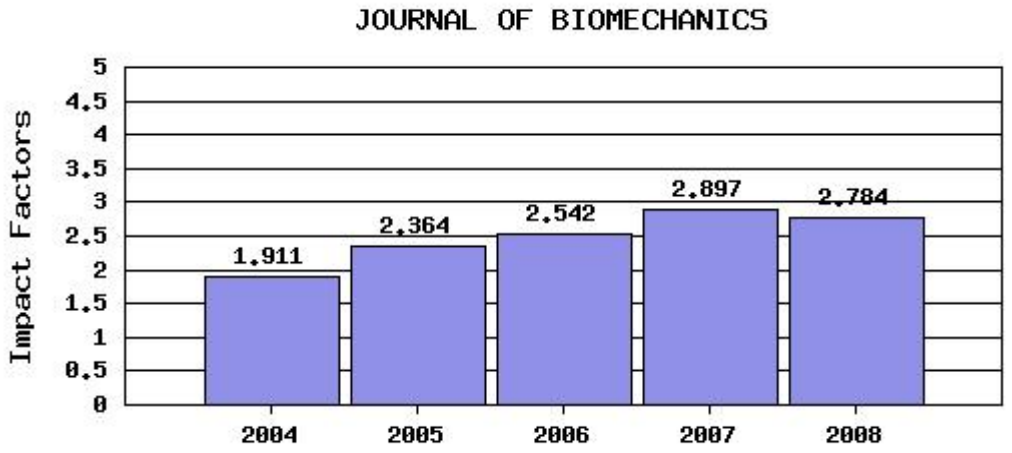
Example of Impact Factor (*J Biomech*, 2008)

Journal Impact Factor

Cites in 2008 to items published in:	2007 = 1003		Number of items published in:	2007 = 473	
	2006 = 1269			2006 = 343	
	Sum: 2272			Sum: 816	
Calculation:	Cites to recent items	2272	= **2.784**		
	Number of recent items	816			

5-Year Journal Impact Factor

Cites in {2008} to items published in:	2007 = 1003		Number of items published in:	2007 = 473	
	2006 = 1269			2006 = 343	
	2005 = 1213			2005 = 278	
	2004 = 969			2004 = 220	
	2003 = 903			2003 = 208	
	Sum: 5357			Sum: 1522	
Calculation:	Cites to recent items	5357	= **3.520**		
	Number of recent items	1522			



MThanks to Carl-Éric Aubin

CAP7003E – Work Plan

Session 1 – A successful doctorate at Polytechnique: What are we talking about?

Objectives of doctoral research and of an engineering research project. General process governing a research project. Quality criteria and characteristics of doctoral research: strategies and resource mobilization. Expertise. Original and significant contributions. Collaboration and research partnership. Research results and impacts. Objectives and content of a thesis.

Session 2 – Doctoral journey, milestones, and expectations

Transition from research topic to research project. Major steps of a research project: organization and structure of the project. Emergence of the project and publication strategy. Phase of realization. Application: development of a first version of your research proposal and methodology of implementation.

Session 3 – Leading a research project

Processes associated with basic research, applied research, technological development and innovation. Conduct and management of a research project: definition, planning, execution and completion. Work breakdown structure. Organization of time, schedule. Milestones. Deliverables. Management of risks, risk mitigation. Human Resources and Industrial Partnerships. Cost planning. Application: critical evaluations of research proposals of doctoral colleagues.

Session 4 – Strategy for success during and after the doctoral program

Potential pitfalls related to a research project; strategies to avoid them. Management of time. Management of intellectual property. Research ethics Research ecosystem. Career management and expected skills of an engineering researcher. Application: self-assessment and review of your first version of your research proposal.

Typical doctoral journey

Beginning

USER of knowledge or technology

Starting up

- Courses
- Ideas for project
- Agreement with advisor on interactions

Draft project description

- Limits of knowledge
- Trigger
- Strategy

Comprehensive exam

- Assessment of knowledge (breadth and depth)
- Defense of the project proposal

Exploration

- Preliminary results
- Adjustments

Diffusion

- Conferences
- Publications

Maturing / Final developments

- Increasing originality
- Increasing impact
- Increasing autonomy

FINISH LINE

- CREATOR of knowledge or technology
- Additional publications
- Thesis defense
- Next career steps

Milestones — **16th month** — **32th month** — **48th month**

The research proposal: Key elements

The detailed structure of your proposal will strongly depend on the culture of your field and on the specific requirements from your advisor.

- YOU HAVE TO DISCUSS IT WITH YOUR SUPERVISOR!

Good proposals typically comprise:

- A clear, concise title that reveals the originality of the research
- An explanation of what triggered the project (the trigger!)
- A research question and/or hypothesis and research objectives
- A statement of originality, expected contributions, **impacts**
- A critical review of the literature leading to the proposed project
- Proposed methods (WBS)
- Potential risks and their mitigation
- Anticipated results (or preliminary results)
- Deliverables, publication strategy
- Proposed timeline (Gantt)
- Conclusion
- References

Question

Why plan your research project?

On the duration of the Ph.D. program

Dael Wolfle, « *Of Time and the Doctorate* »,
Science, Volume 148, Number 3673 (1965)

« Both the Ph.D. recipients and their mentors were asked whether the usual delay could or should be shortened... Much emphasis was given to changes in organization and planning. Students and teachers both recommended that more and earlier counseling be given graduate students, that program planning be more systematic, that students be given a clearer understanding of their own responsibilities and of institutional and departmental expectations, and that faculty advisers provide more continuous monitoring of student progress. »

On the duration of the Ph.D. program

- *« Much of the explanation for lack of quality and failure to complete lie in **the inability of students to plan and control** – that is to manage – their work »* (Sharp)

- *« **Yet few scientists receive any formal training in project management**. Their result is a serious and far-reaching training deficit that slow scientific progress and keep young scientists from reaching their full potential »* (Austin)

"PROJECT MANAGEMENT": A definition

"Project management is a series of flexible and iterative steps through which you identify where you want to go and a reasonable way to get there."

Burroughs Wellcome Fund and Howard Hugues Medical Institute, Making the right moves: A practical guide to scientific management for postdocs and new faculty – 2nd edition (2006)

“PROJECT MANAGEMENT”

Question: Given the uncertainties in research, is project management feasible?

Excerpt from Burroughs Wellcome Fund and Howard Hugues Medical Institute, Making the right moves: A practical guide to scientific management for postdocs and new faculty – 2nd edition (2006)

"PROJECT MANAGEMENT"

Question: Given the uncertainties in research, is project management feasible?

Answer: Project management isn't meant to be rigid or blindly restrictive. Indeed, by reexamining goals and circumstances in a systemized way, project management encourages you to reconsider which path is best many times during the course of a given project.

Excerpt from Burroughs Wellcome Fund and Howard Hugues Medical Institute, Making the right moves: A practical guide to scientific management for postdocs and new faculty – 2nd edition (2006)

What is managed in a research project?

Scope of the project
→ **aims, objectives, activities, critical points, limits…**

Progress: quality, time, resources

Risks

Communication

Intellectual property

Ethics

Human relationships

Project completion

Demands of the industrial partner (if applicable)

Question

What skills and competencies are associated with the management of a research project?

(Answers in large group)

A few research project management skills

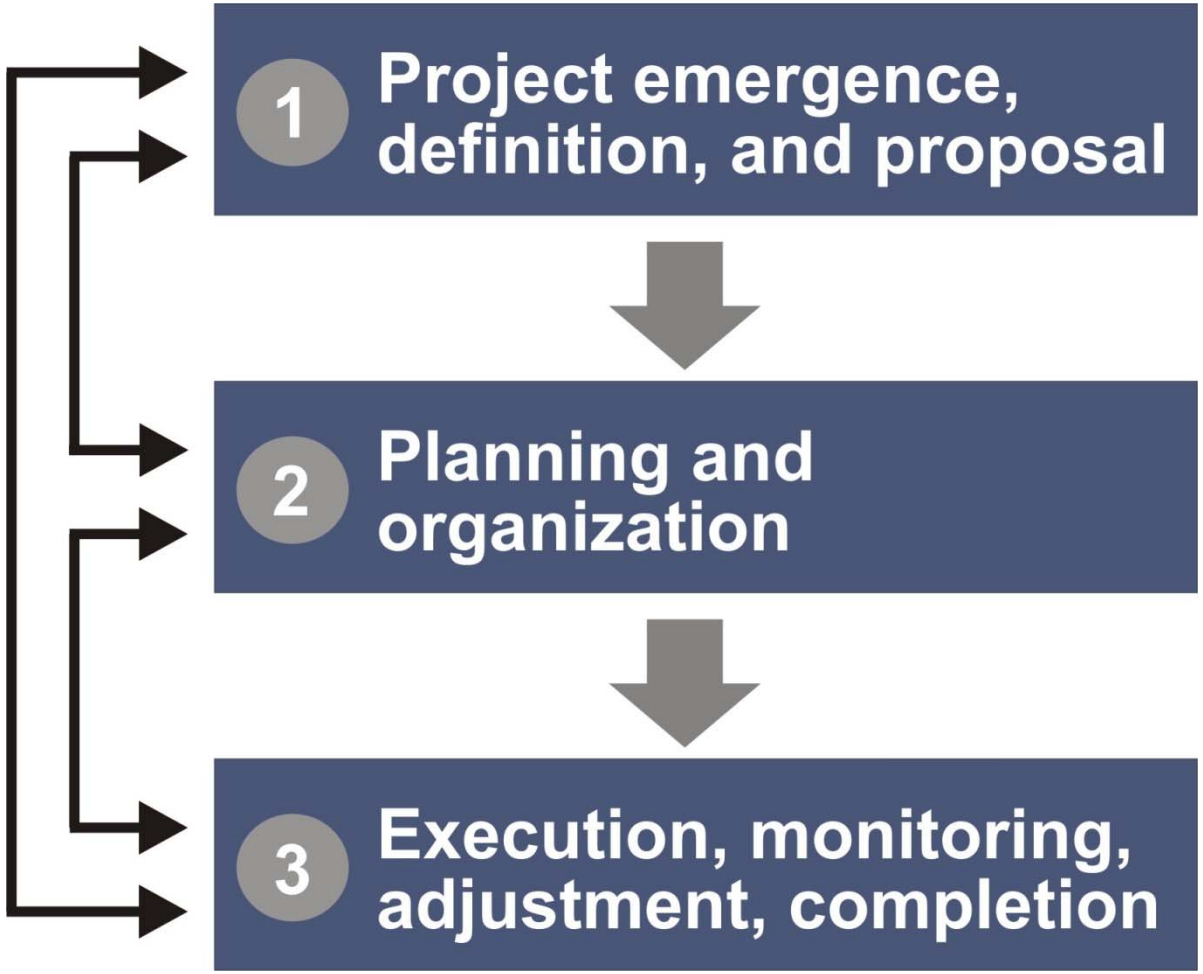
- Ability to formulate innovative research issues
- Ability to perform interdisciplinary and multidisciplinary work
- Ability to integrate existing research, technologies, and knowledge
- Communication (sell the project, manage the research teams)
- Ability to assess or evaluate (project progress, the contribution of others)
- Ability to manage and direct research teams
- Management (financial, partnerships)

From Yves Langhame, CAP7015 classnotes

Question

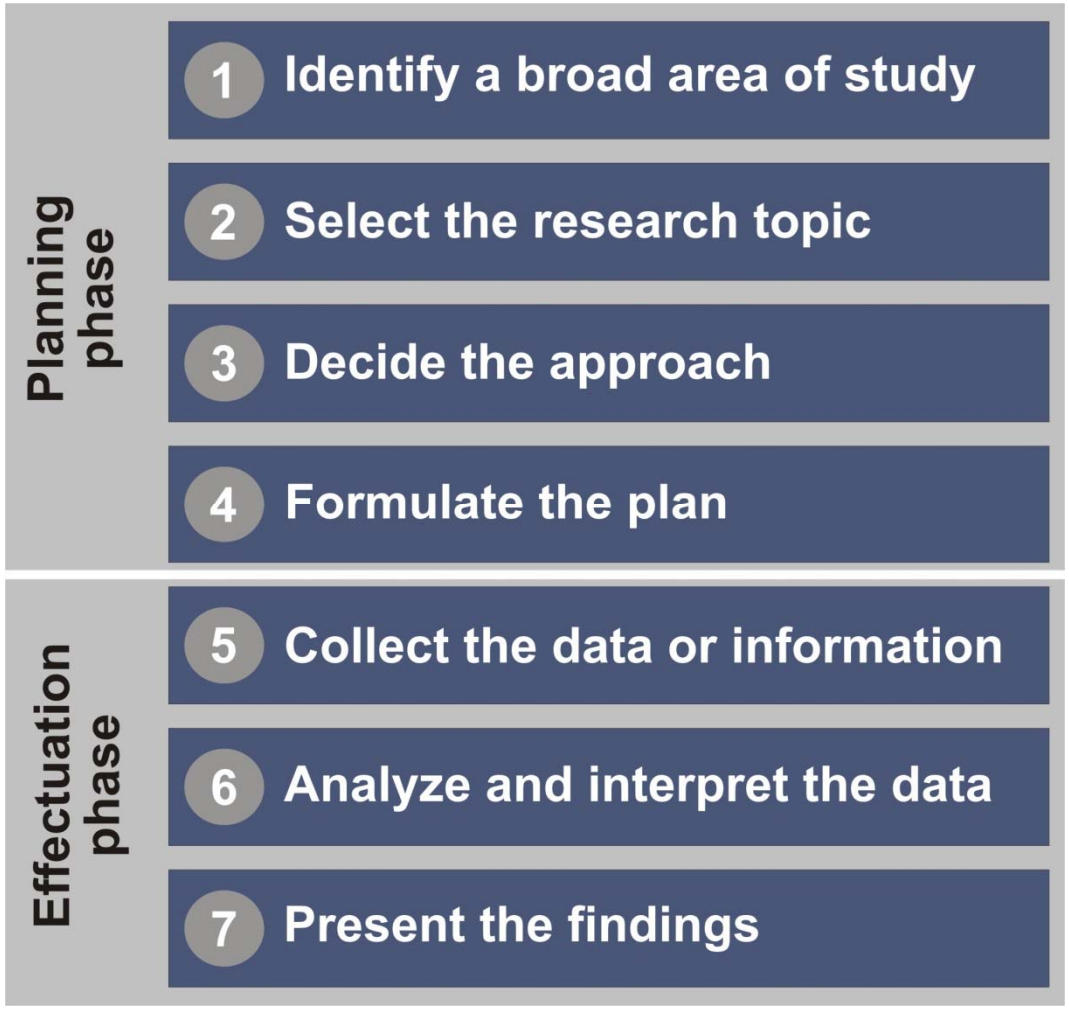
What are the main stages of research project management?

Leading a research project



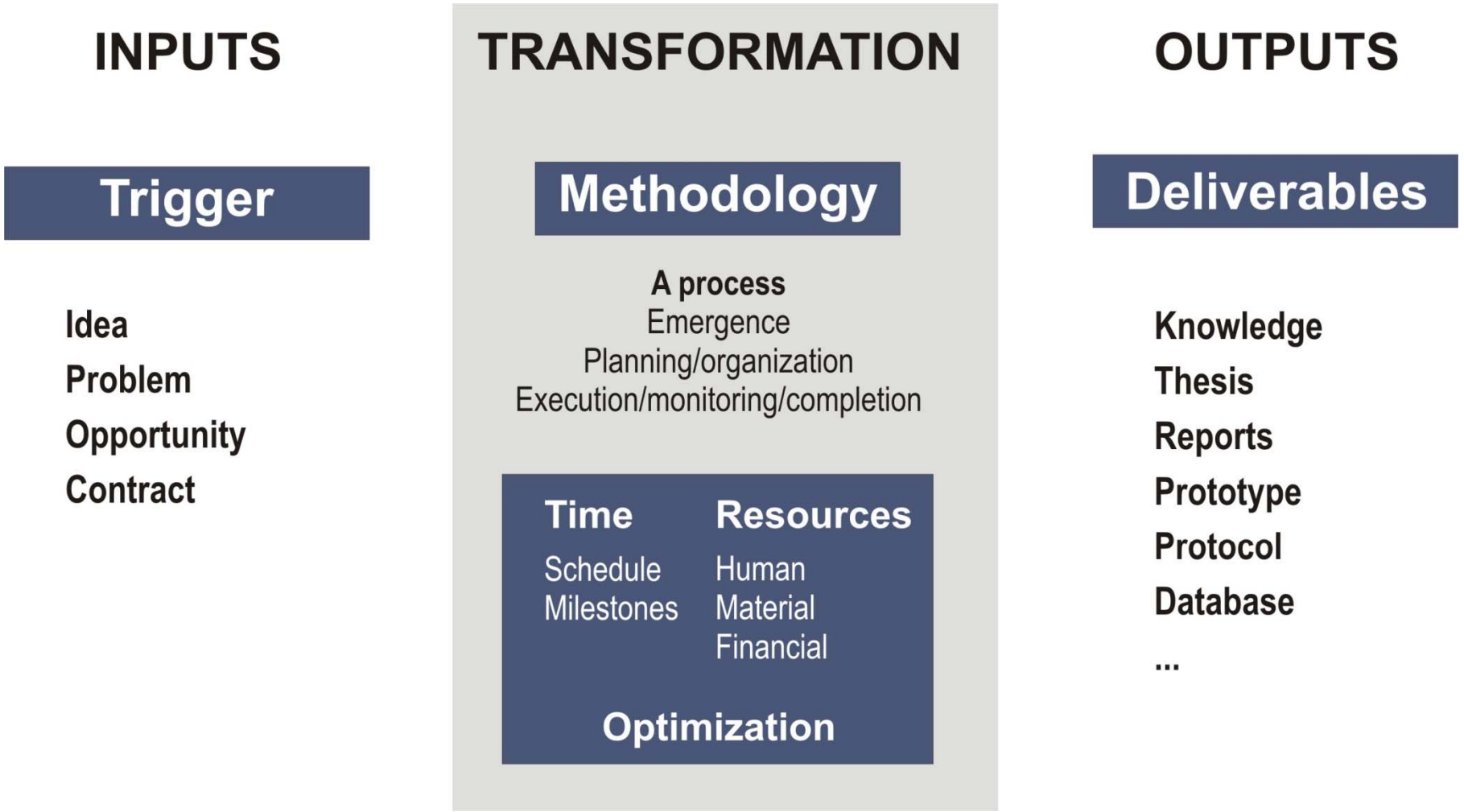
Adapted from J. Nicolas, CAP7001 Classnotes

Leading a research project



John A. Sharp, John Peters, and Keith Howard, The management of a student research project – Third edition, Gower Publishing Company, Burlington (2002).

Leading a research project



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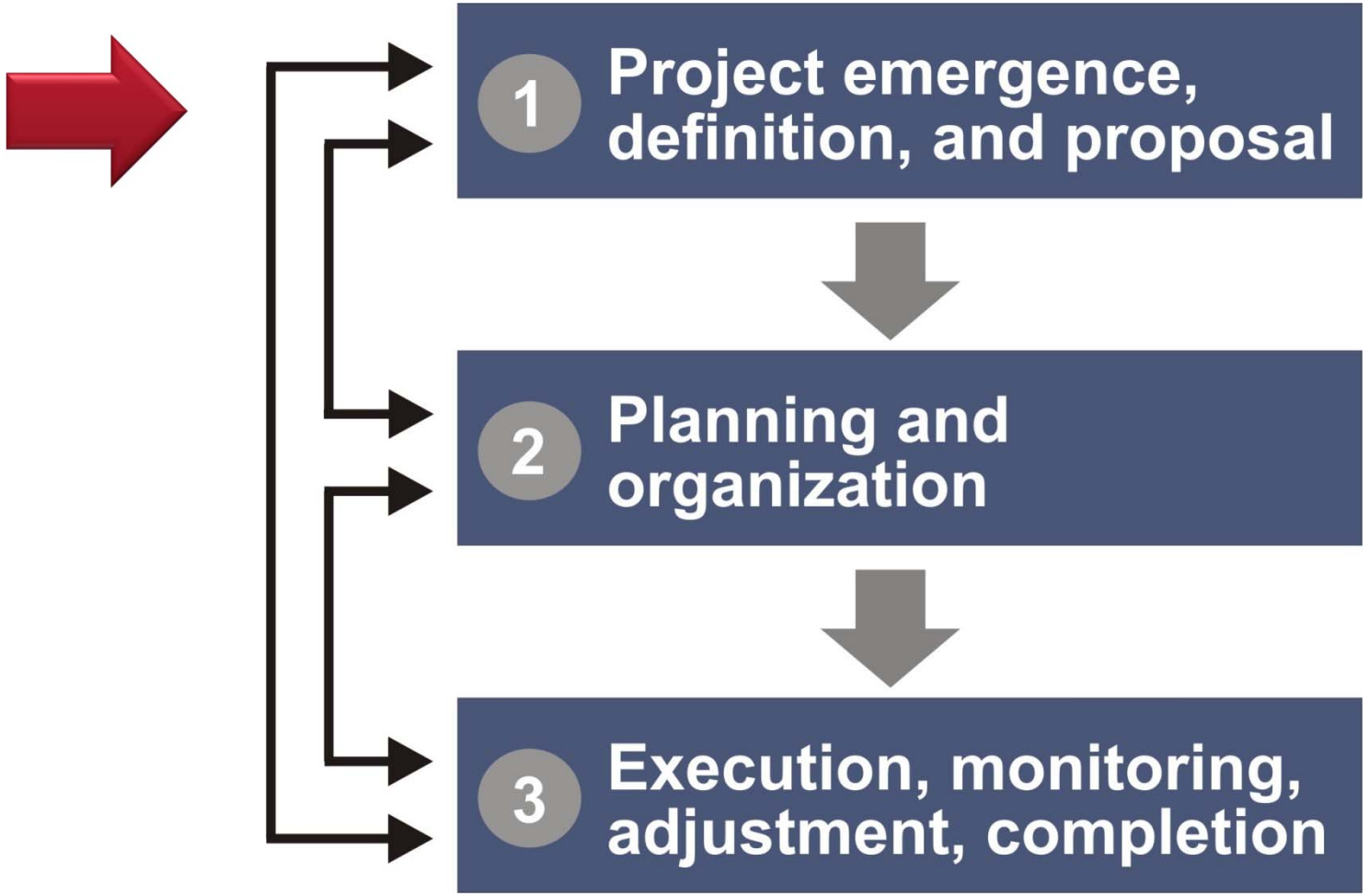
Emergence of a project



Adapted from J. Nicolas, CAP7001 Classnotes

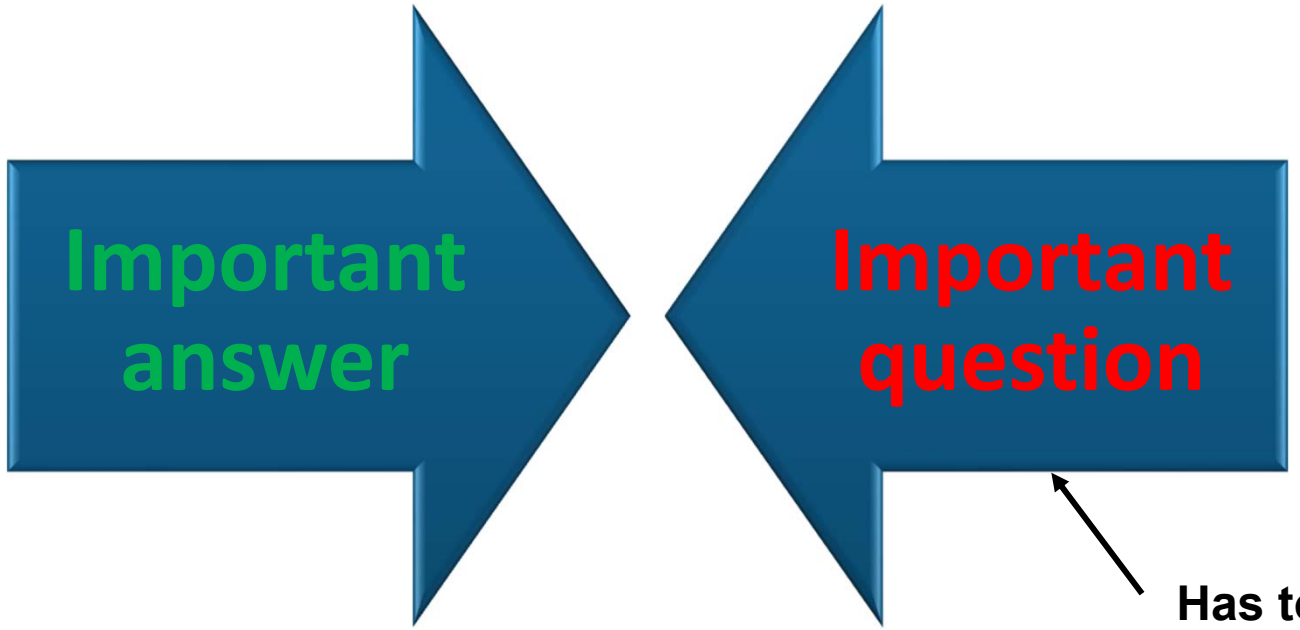
Emergence

Research is driven by:

- **An hypothesis**
- **A question**
- **Objectives**

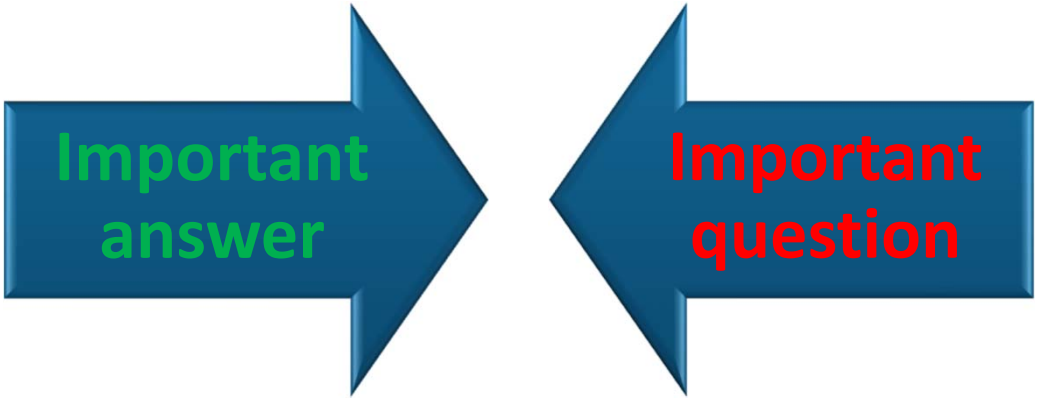
It means that the first and more important thing to do when defining your research project is to formulate or write your hypothesis and/or research question and general objective !

Emergence of a research project
→ research question…



Do the right thing !

Emergence of a research project → research question…



- Organizes the research project
- Provides direction and coherence
- Delimits project and marks boundaries
- Keeps the research focused during the project
- Provides a framework for conducting the project
- Indicates the information that will be required

Adapted from Yves Langhame, CAP7015 classnotes

Research question / Research hypothesis

Research question :

- a question arising from a perceived gap between a state of existing knowledge and an anticipated / desired state of knowledge; let appear originality ...
- a single sentence that accurately includes what will usually have to be answered, and which ends with a ?

Research hypothesis :

- an anticipated answer to the question that guides the research;
- assumption that is made in response to the question;
- should be testable, to be confirm or infirm.

Emergence of a research project

***The general objective** concerns the global contribution that the researchers hope to bring through the study of a given problem.*

→ *Only 1*

***The specific objectives** concern the activities the researchers plan on undertaking with a view to achieving the general objective.*

→ *Between 3 and 5*

From Yves Langhame, CAP7015 classnotes

Question

Emergence of a research project;

What kind of project…

What are the differences between basic research, technological development, and innovation?

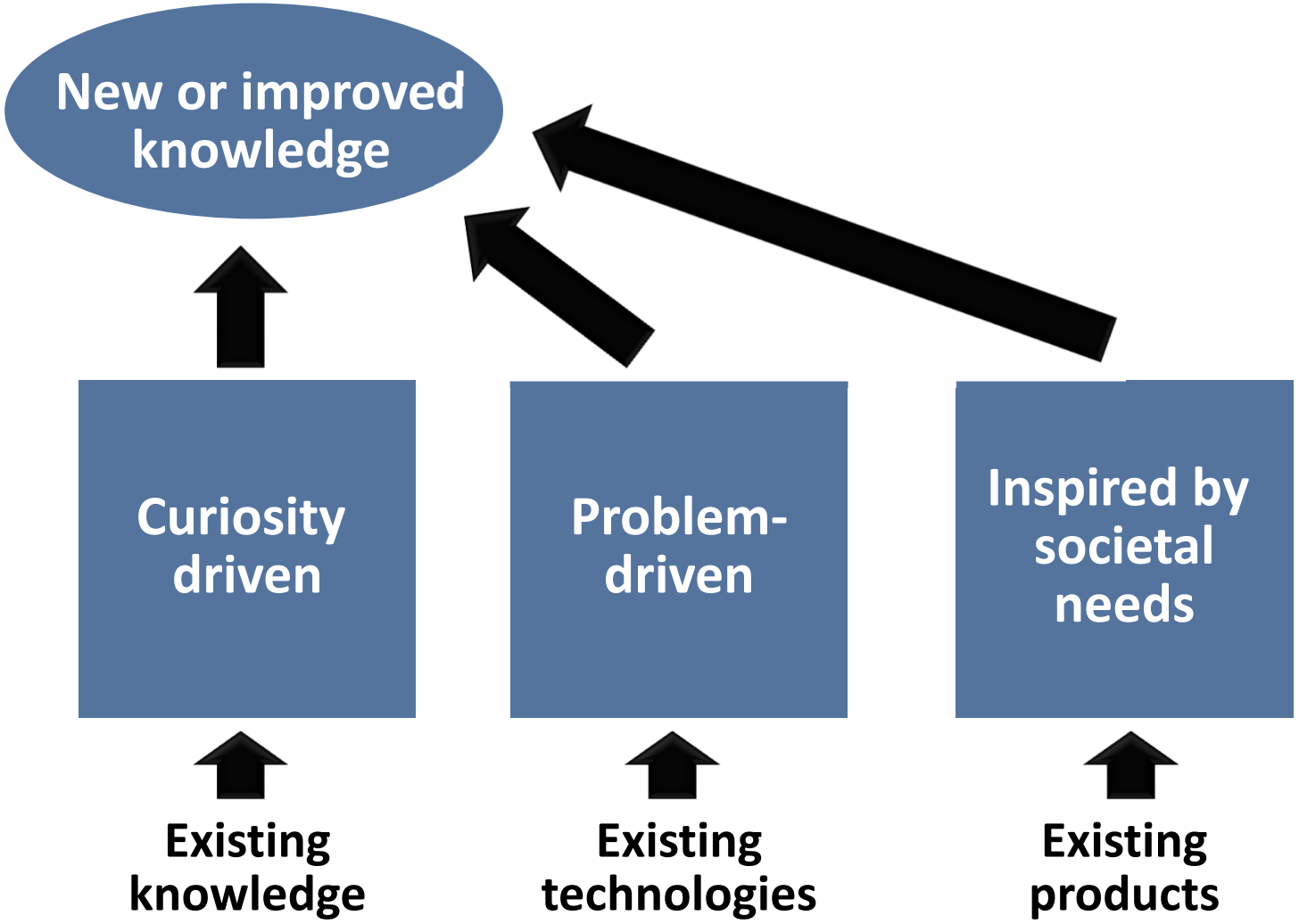
(Answers in large group)

Basic research, development, innovation

Traditional model

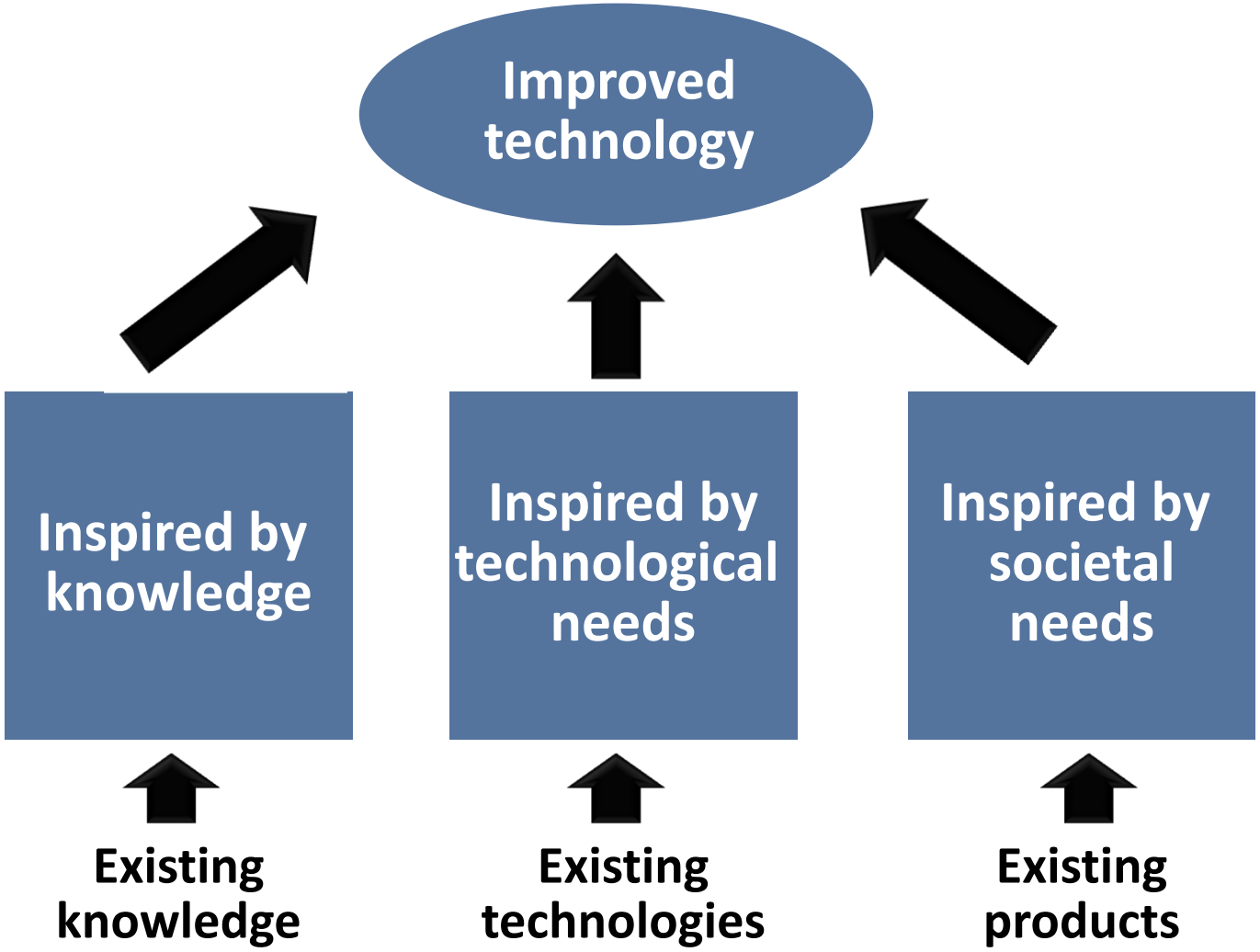
Donald E. Stokes, « Pasteur's quadrant : Science and technological innovation », Brookings Institution Press (1997)

BASIC RESEARCH
Increasing knowledge



Adapted from Jean Nicolas, CAP7001 Classnotes

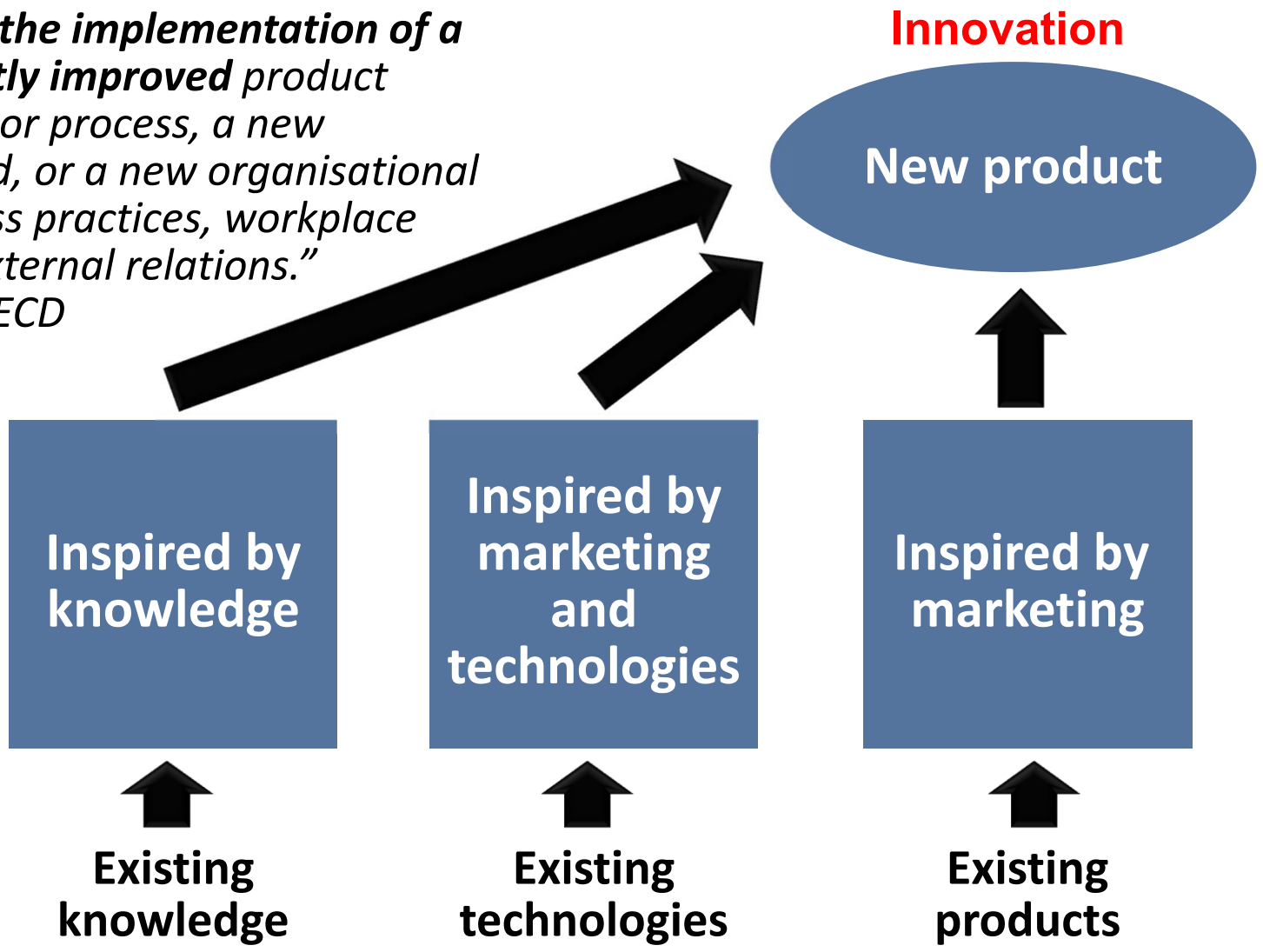
RESEARCH AIMED TO A TECHNOLOGICAL DEVELOPMENT
Developing new tools and devices, whether incremental or disruptive



Adapted from Jean Nicolas, CAP7001 Classnotes

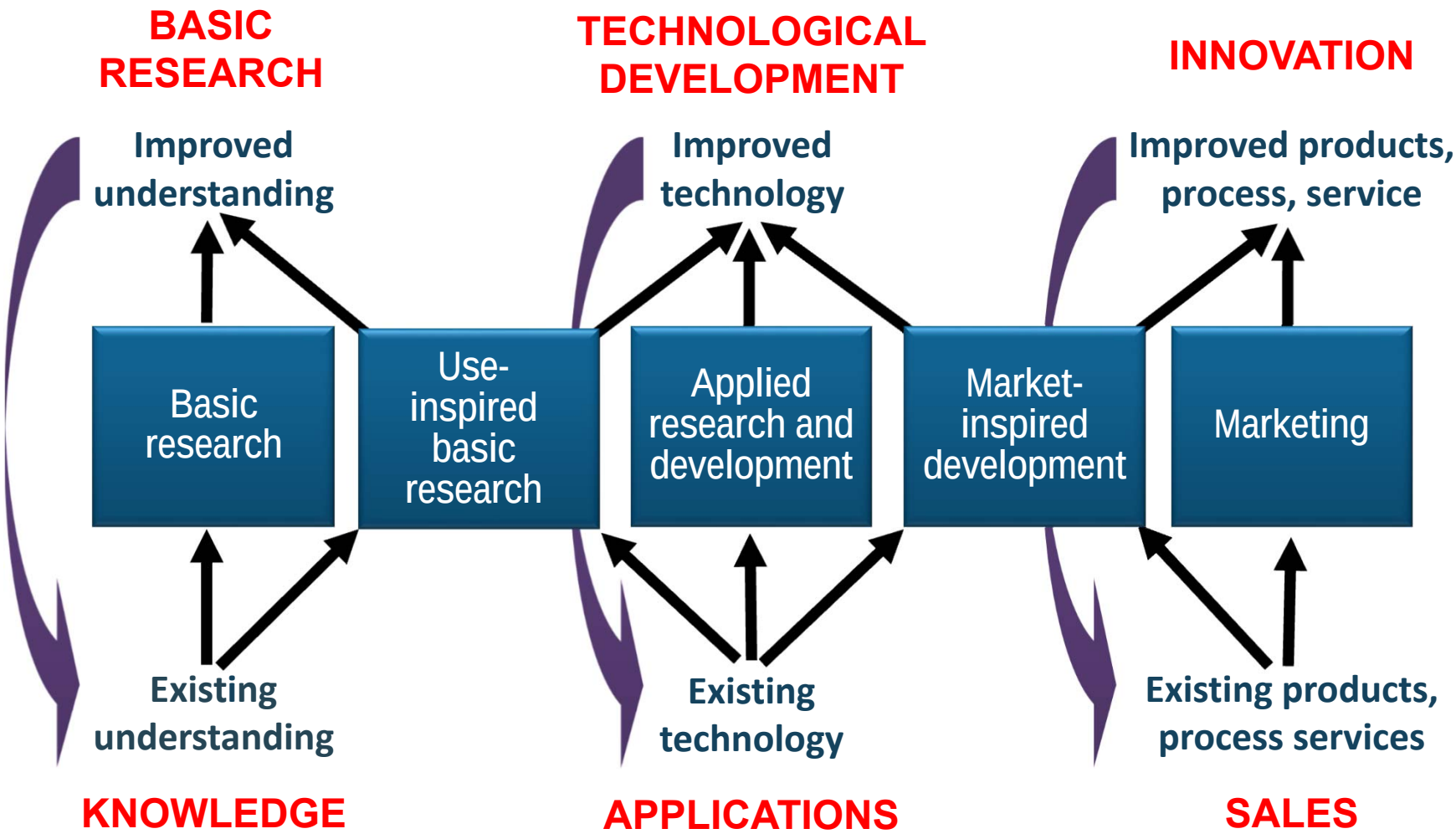
RESEARCH LEADING TO AN INNOVATION
Implementation of a new (significantly improved) product or process

*"An **innovation is the implementation of a new or significantly improved** product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations."*
- Oslo Manual, OECD (art. 146)



Adapted from Jean Nicolas, CAP7001 Classnotes

A dynamic model of basic coupling between research, technological development and innovation (Stokes and Nicolas, 2006)



Key processes

	Basic research	Research aimed to a technological development	Innovation
Trigger	Curiosity, open problem	Potential application	Expressed or anticipated need
Objective	New or improved knowledge	Creating a new tool or device	Creating a product
Process	Research project (unknown outcome)	Development project (uncertain outcome)	Innovation project (known outcome)
Deliverable	Publication	Proof of concept, prototype, publication	Approved product
Potential risk	Lack of originality	Semi-functionality	Market or anticipated needs poorly targeted

Adapted from Jean Nicolas, CAP7001 Classnotes

Emergence of a research project

Do you know better what kind of project you will do?

Basic research, Applied research - technological development, Innovation?

… I hope!

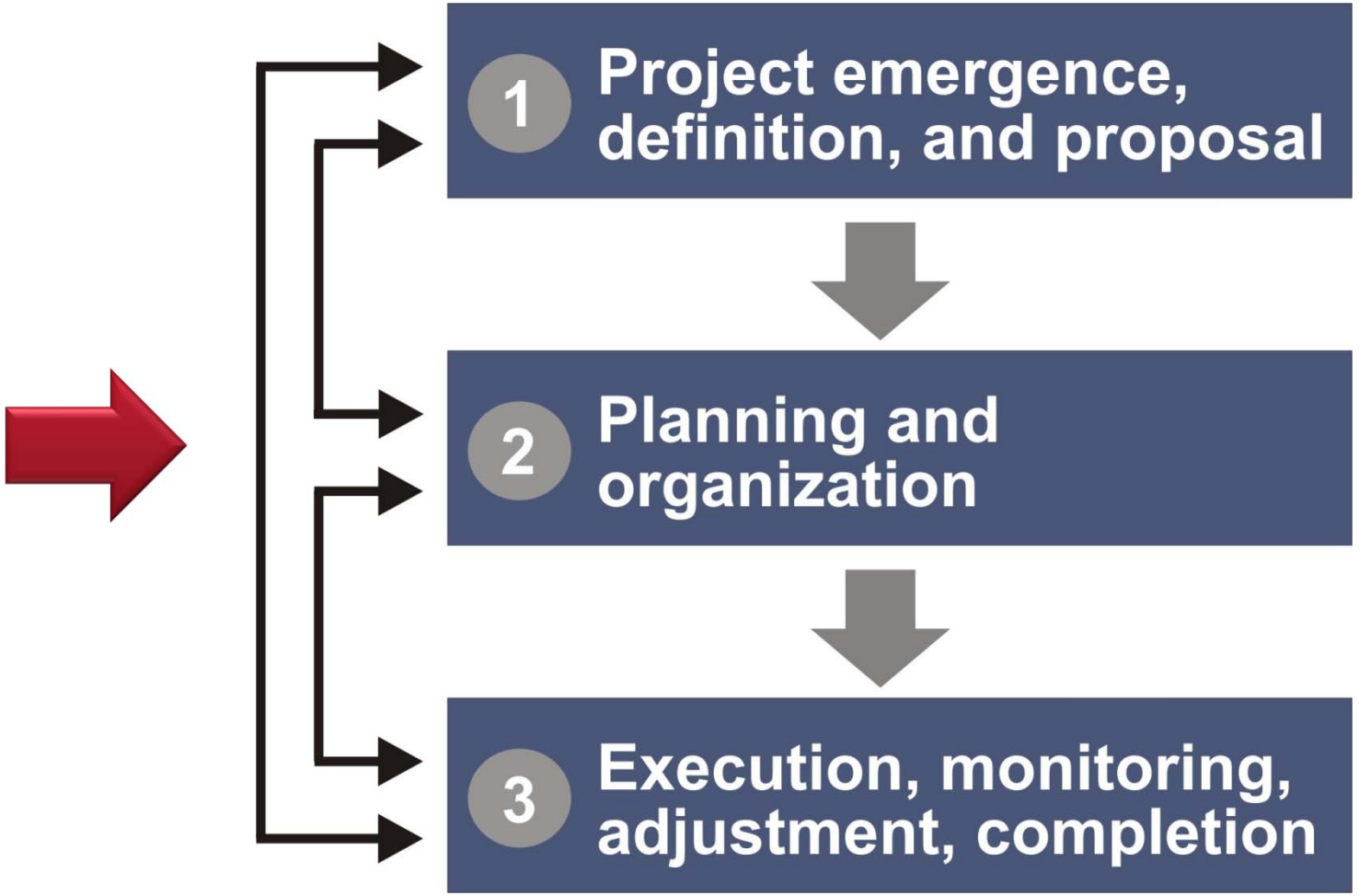
Phase 1 : Project emergence, research project definition
→ Application to your research proposal

The detailed structure of your proposal will strongly depend on the culture of your field and on the specific requirements from your advisor.

Good proposals typically comprise:

- A clear, concise title that reveals the originality of the research
- An explanation of what triggered the project
- A research question and/or an hypothesis and research objectives (general and specific)
- A statement of originality and pertinence; expected impacts
- A critical review of the literature leading to the proposed project
- Proposed methods and key resources - WBS
- Potential risks
- Expected results (preliminary if available)
- Deliverables and publication strategies
- Proposed timeline (Gantt chart)
- Conclusion
- References

Emergence of a project



Adapted from J. Nicolas, CAP7001 Classnotes

Question

How will you plan and manage your doctoral project in order to insure rapid progress?

What will you plan?

(Teams : green color)

The importance of planning

" **Effective planning requires a comprehensively analyzed schedule of activities against which research progress may be assessed, not a loose collection of estimates.**

The major purposes of such planning are to:

a. Clarify the aims and objectives of the research project;
b. **Define the activities** required to attain these aims and **the order in which they take place**;
c. Identify various **critical points or 'milestones'** in the research at which progress can be reviewed and the research reassessed;
d. Produce **estimates of times** at which the various milestones will be reached so that progress can be clearly measured;
e. Ensure that effective use is made of key resources;
f. Define **priorities** once the research is underway
g. Serve as a guide for increasing the likelihood of successful completion on time."

John A. Sharp, John Peters, and Keith Howard, The management of a student research project – Third edition, Gower Publishing Company, Burlington (2002).

What to plan

- The best approach for accomplishing the project
- The deliverables
- The resources required
- The calendar
- The project scope, i.e. limits as to be included and excluded
- Responsibilities
- Risks

From Yves Langhame, CAP7015 classnotes

Question

How will you plan and manage your doctoral project in order to insure rapid progress?

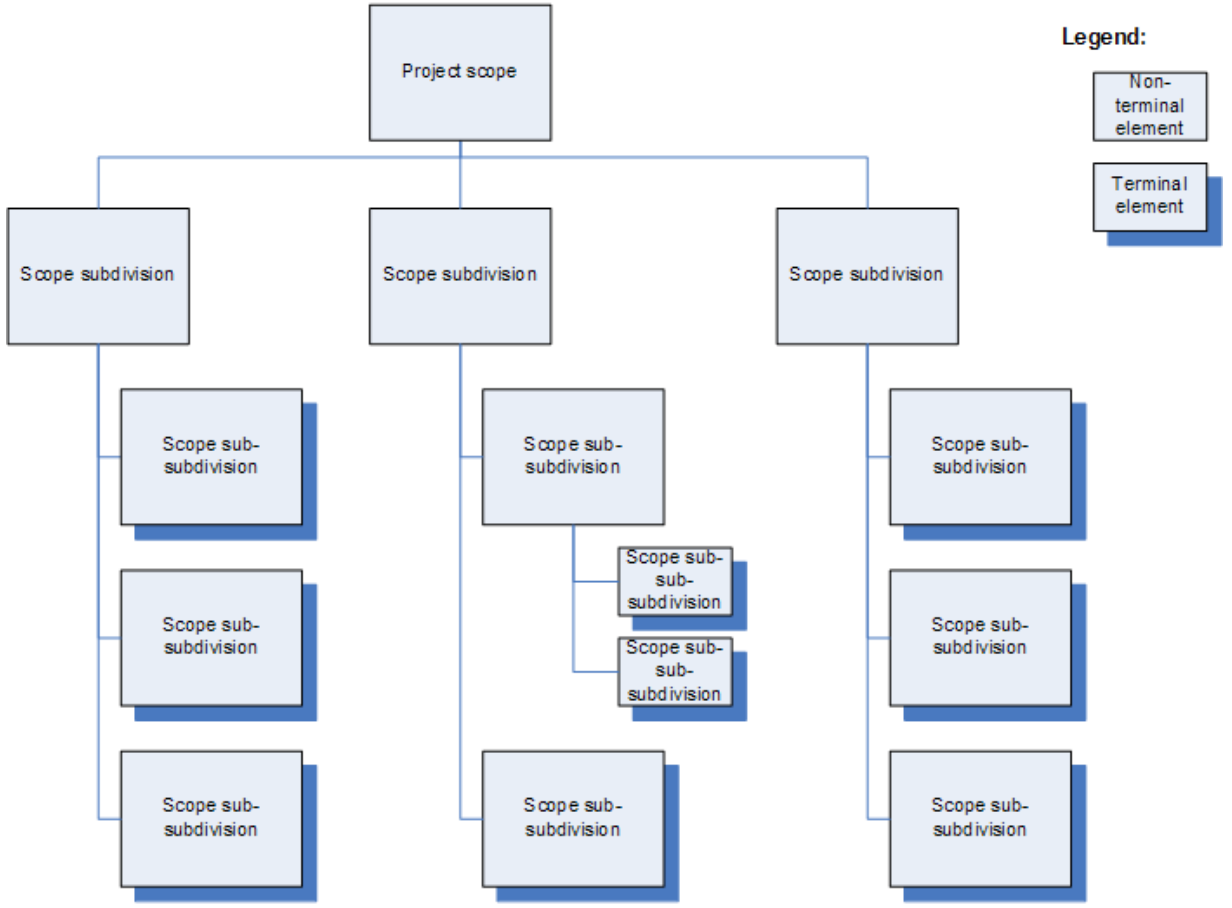
What “tools” will you use?

Work Breakdown Structure - WBS

A useful tool to insure that all aspects are considered

In project management, a **work breakdown structure** (**WBS**) is an exhaustive, hierarchical structure of deliverables and tasks that need to be performed to complete a project.

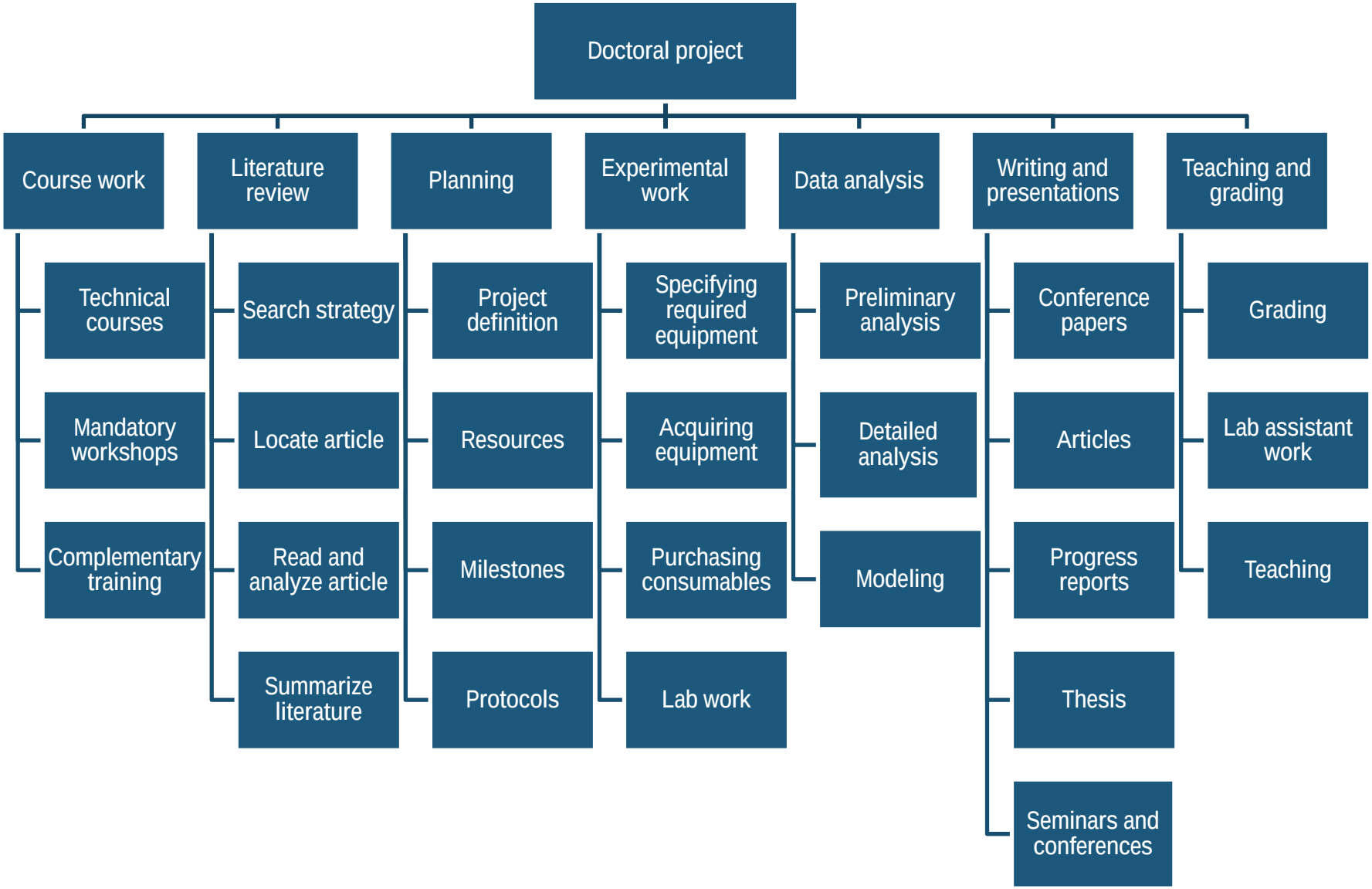
The work **breakdown structure** show the "**part-whole**" relations. In contrast, the project network shows the "**before-after**" relations.



Brigitta Schütt, Freie University of Berlin, June 2006, Project management, Proposal writing for International Research Projects

Work Breakdown Structure

A useful tool to insure that all aspects are considered



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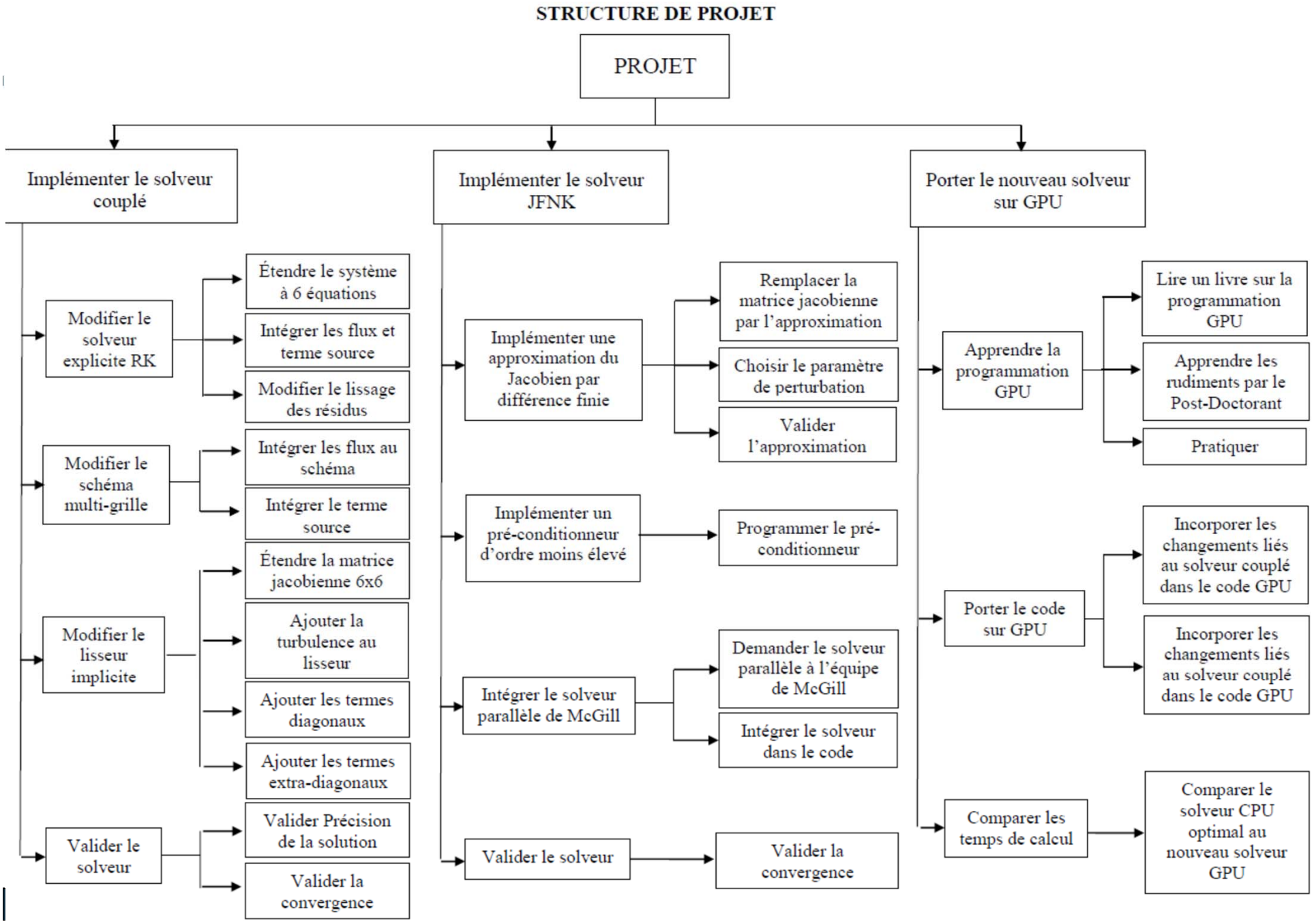

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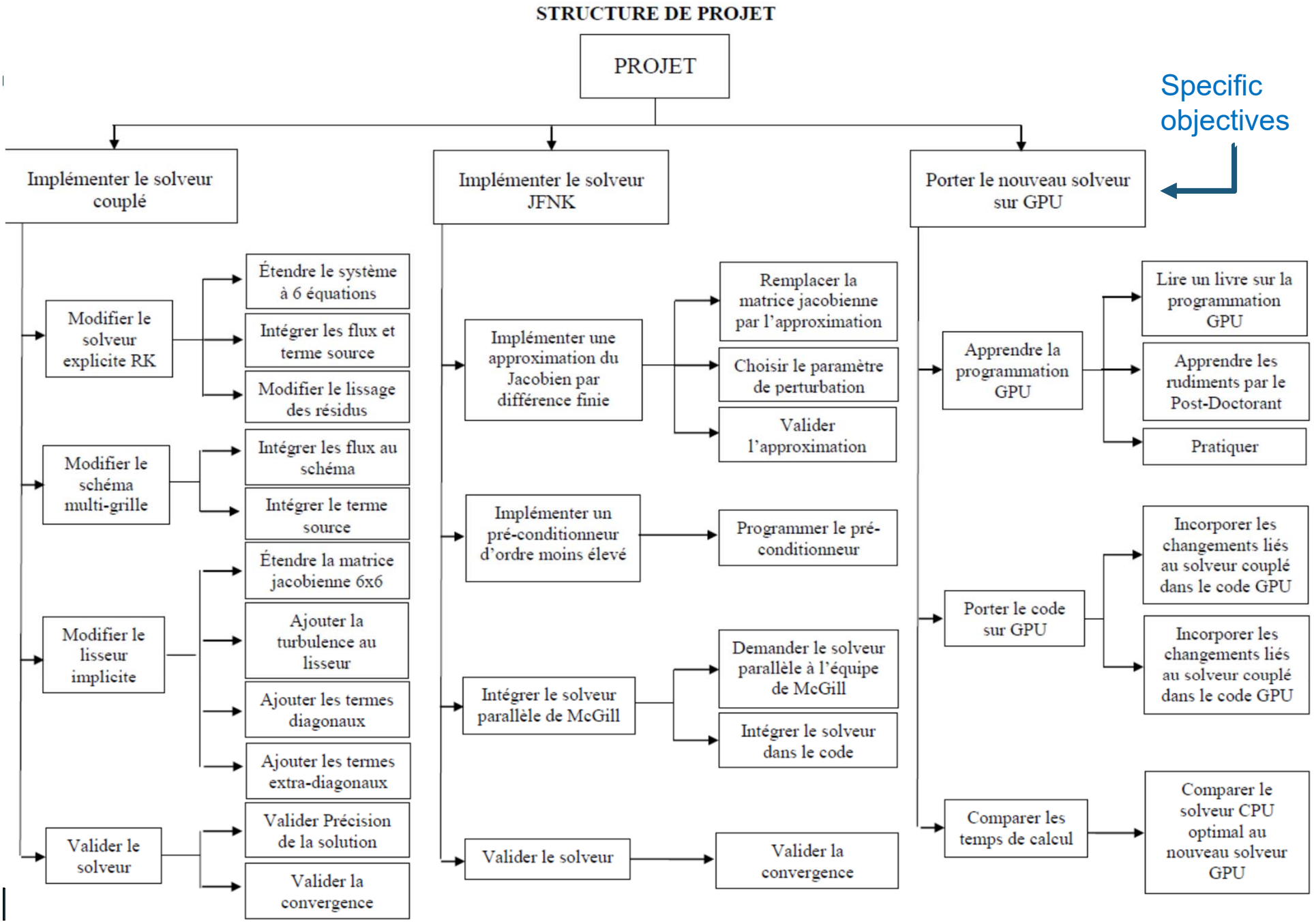


Work Breakdown Structure
A useful tool to insure that all aspects are considered

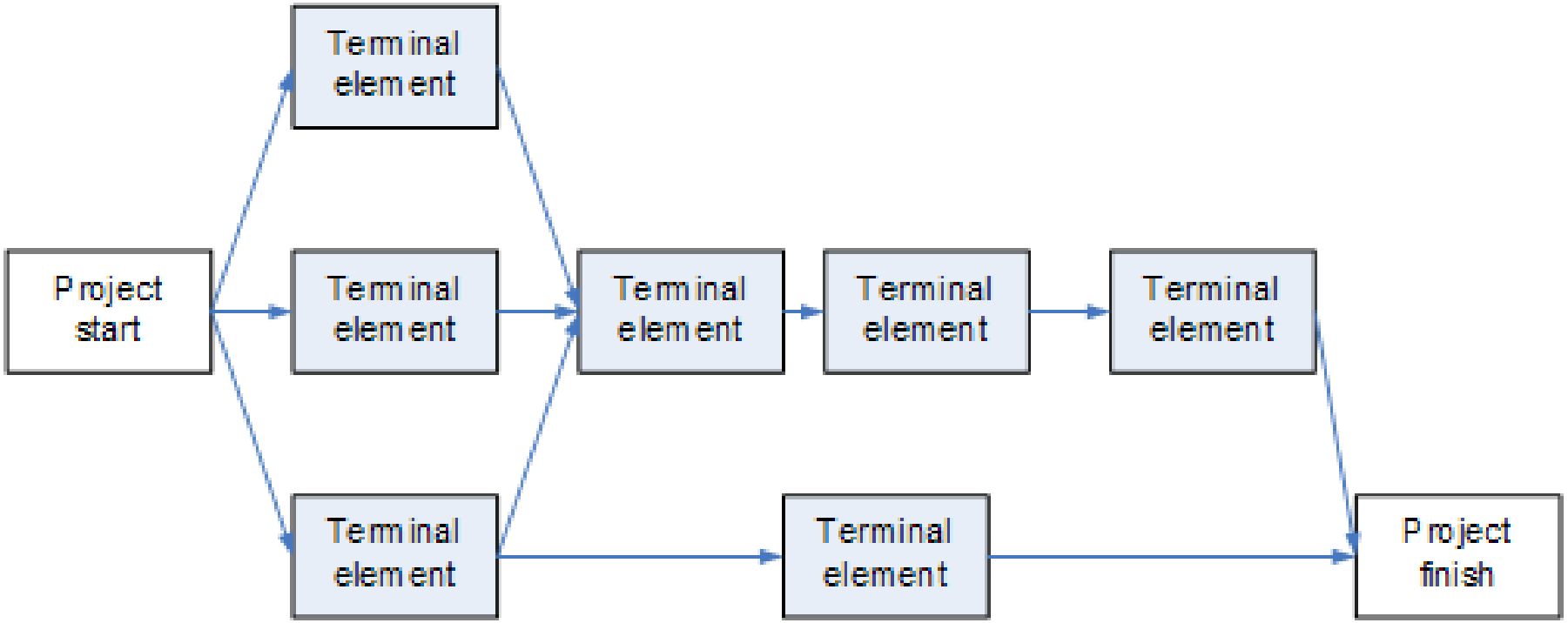
PROVIDES A GLOBAL PICTURE OF THE PROJECT

- **Identifies all the work to be done; helps avoid forgetting things**
- **Visual frame of reference for main activities**
- **Facilitates planning and assessment**
- **Facilitates identification, analysis, and mitigation of risks, hurdles and conflicts**

BUT

- **Tendency to structure the project according to resources rather than focusing on objectives and activities**
- **Must be updated**

From the “Work Breakdown Structure” to the “Gantt chart”
Revealing the relationships between the various parts of the project

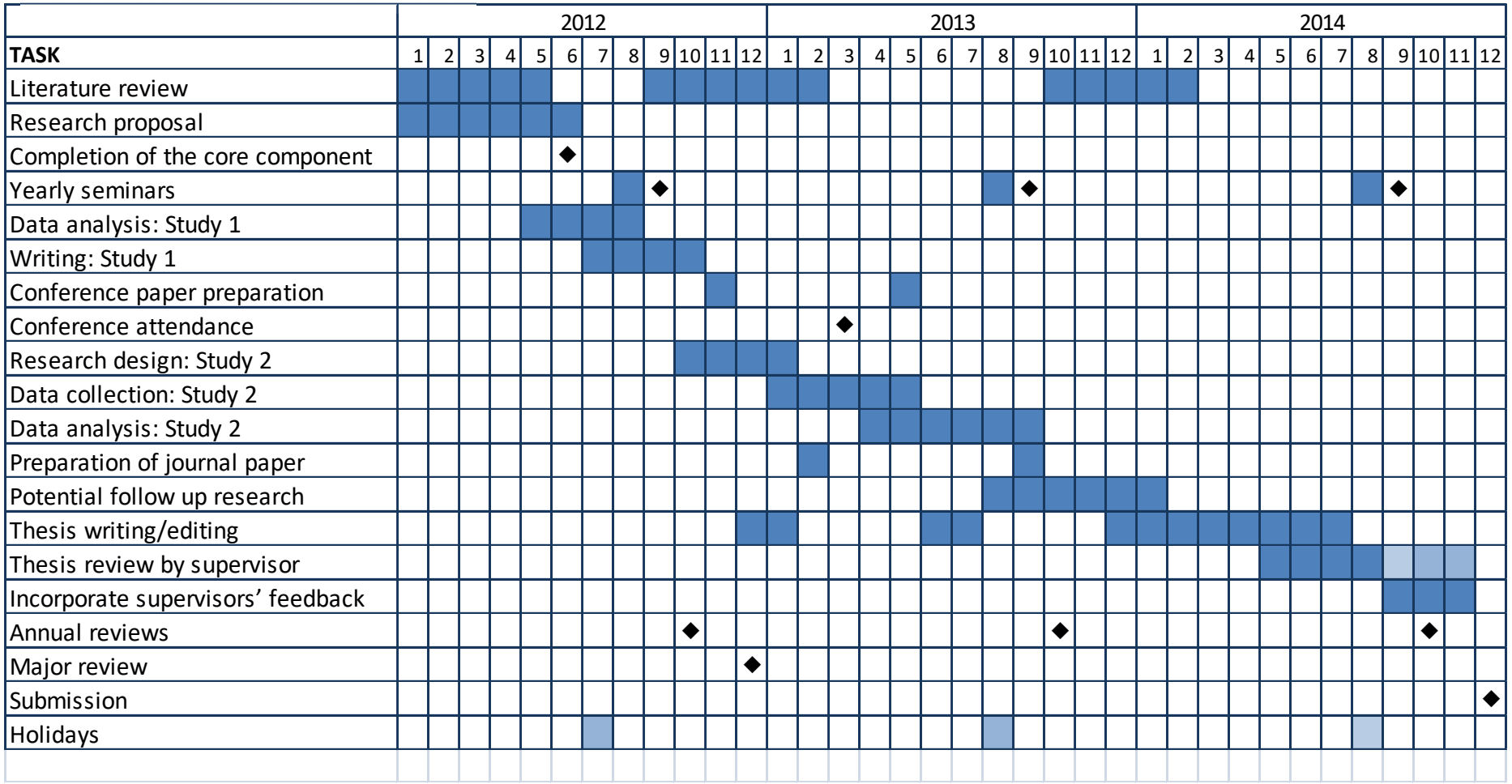


Brigitta Schütt, Freie University of Berlin, June 2006, Project management, Proposal writing for International Research Projects

GANTT chart

Reveals the relationships between the various parts of the project

EXAMPLE OF TIME LINE

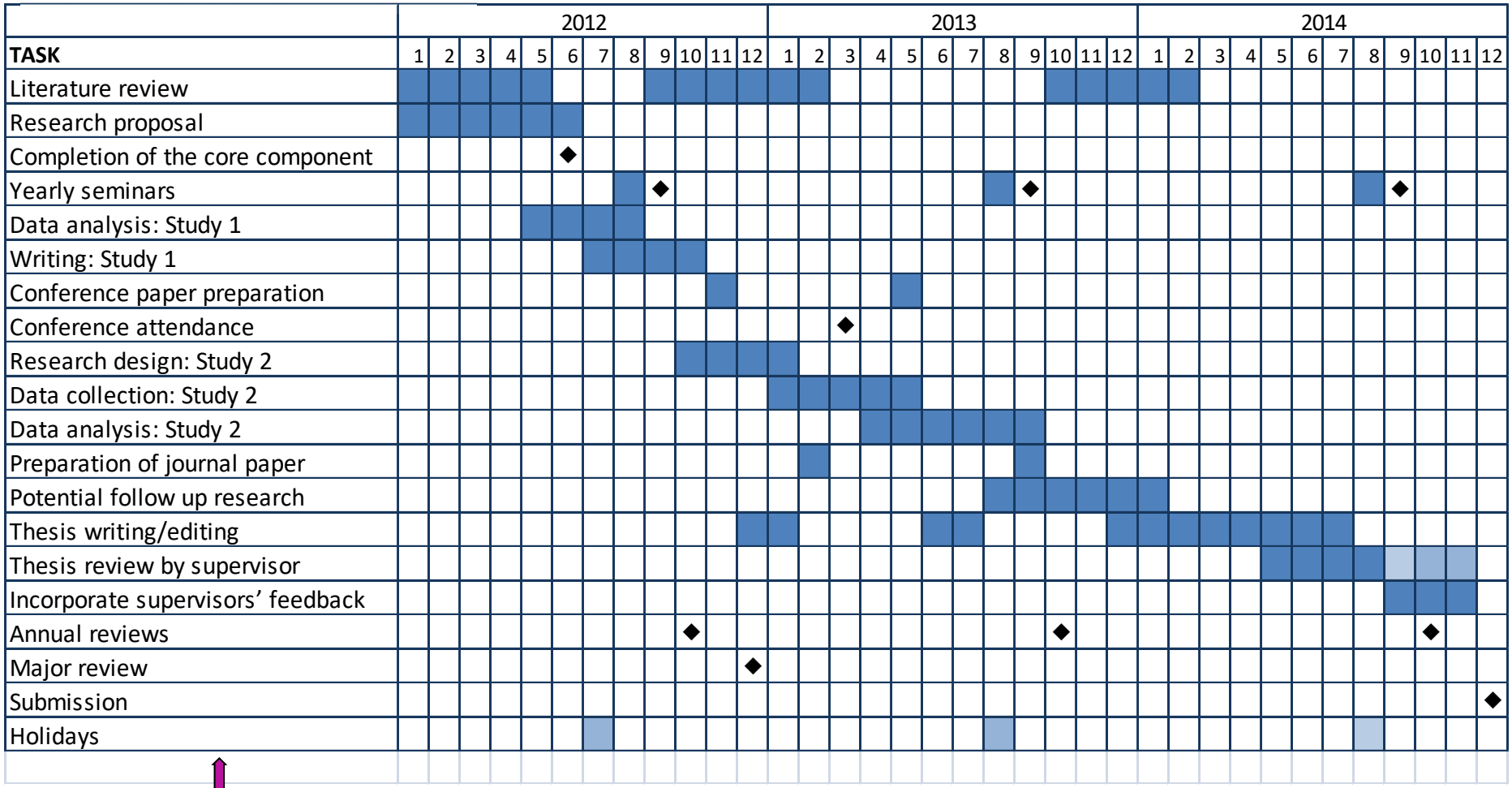


University of Adelaide, Adelide Graduate centre, http://www.adelaide.edu.au/graduatecentre/forms/gannt_chart_completed_example.pdf (visited on March 30, 2012)

GANTT chart

Reveals the relationships between the various parts of the project

EXAMPLE OF TIME LINE



Last level in WBS boxes

GANTT chart

Reveals the relationships between the various parts of the project

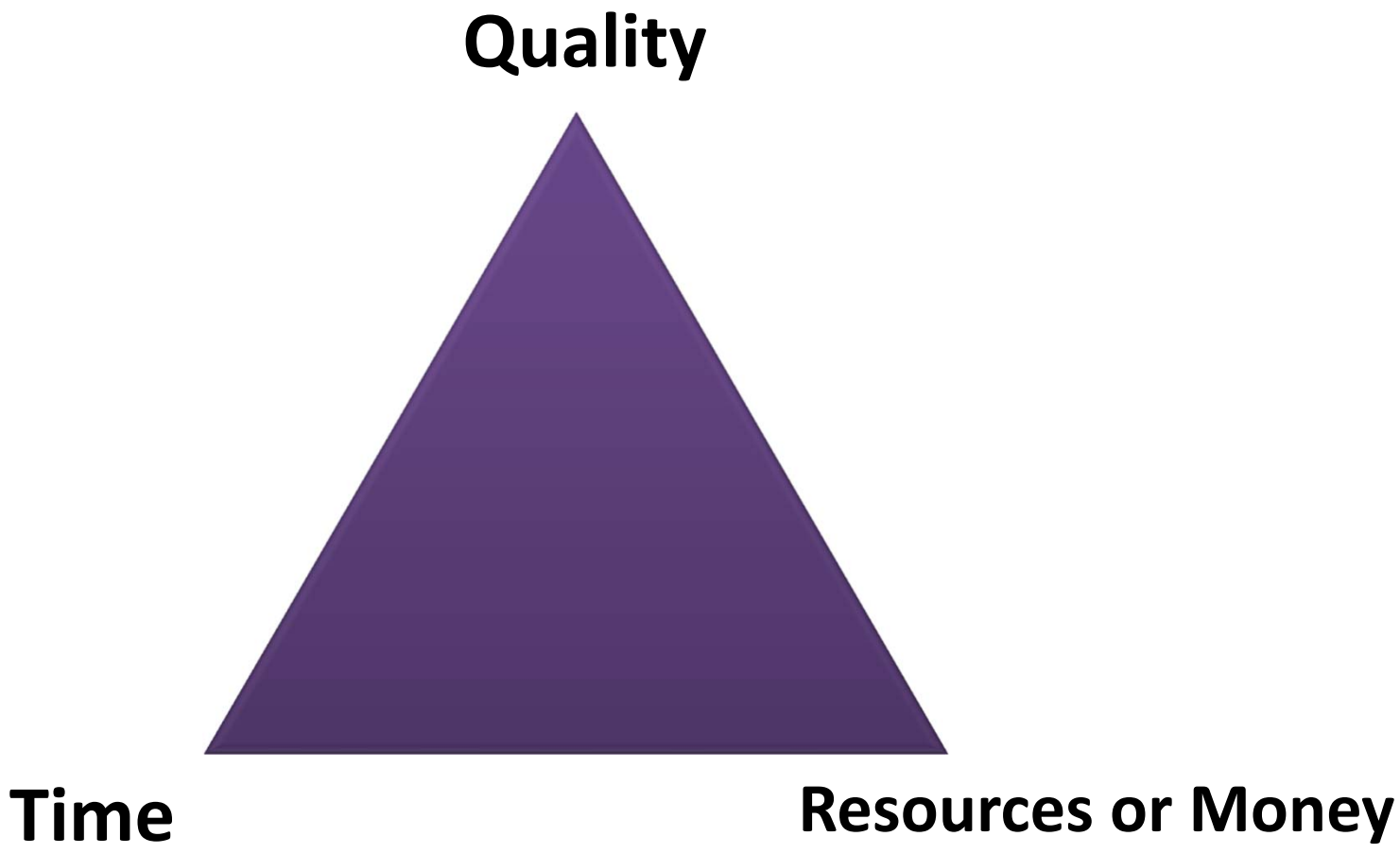
These charts are not as simple to prepare as it looks

1. **List your activities**
   - Add enough details to be able to evaluate need for time and resources
2. **Estimate the time required**
3. **Put activities in order**
   - What is needed by when?
   - What is needed from others?
   - How do I check that I am still on track?
   - What are the dependencies
4. **Chunk it up**
   - Reduce the list: combine tasks.
   - Formulate summary items
5. **Draw a chart**

Adapted from Jonathan O'Donnell, http://theresearchwhisperer.wordpress.com

Balancing time, resources, and quality

THE PROJECT MANAGEMENT TRIANGLE
Balancing time, resources, and quality



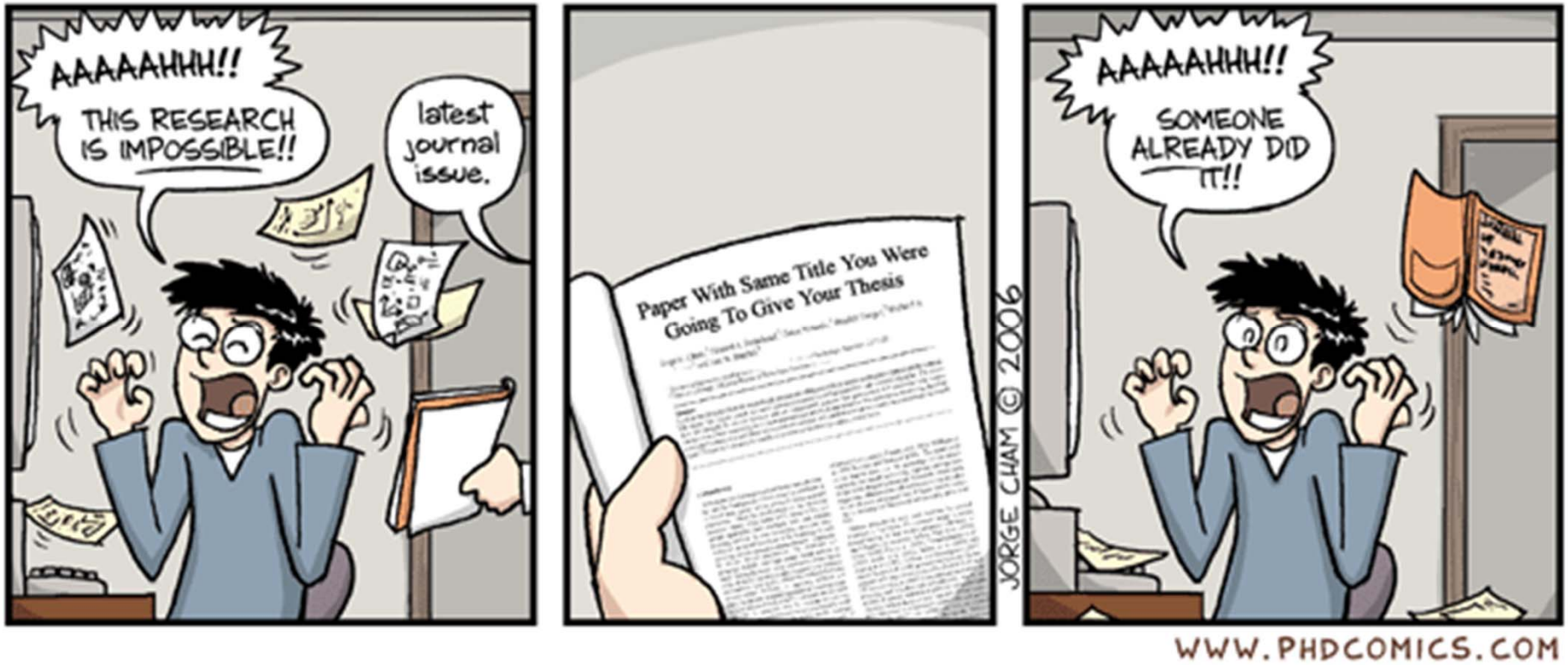
The cost of a Ph.D. project

- **Human resources**
  - Internal: You, advisor, technician, research associate, summer students
  - External: collaborators, partners, experts
- **Equipment**
  - Instrumentation, software
- **Operating expenses**
  - Supplies, consumables, travel, …

Indirect costs

- Building space
- Administrative services
- Library
- Information technology
- …

Risks related to a research project



Question

A Ph.D. project is an original research project with uncertain outcomes…

What are the inherent risks?

How will you manage them?

(Teams: Blue color)

This topic will be covered in details in CAP7015

RISKS
Before you start your Ph.D.

"The process of managing risks in a PhD project starts well before your enrollment.

Some of the questions I would ask myself to identify key risks would be:

- *Is my potential supervisor someone I can get on with?*
- *Do I understand why I'm doing this particular PhD?*
- *Do I understand what I hope to achieve by completing such a program?*
- *Am I entertaining the idea of doing a PhD because I am procrastinating making decisions about my own life goals?"*
- *Does completing a PhD deliver value to me?*
- *Does completing a PhD form part of my career strategy?*
- *Am I prepared to sacrifice my social life and financial security in pursuit of obtaining a degree?*

http://ayft*Does completing a PhD form part of my career strategy?*
an.wordpress.com/2012/10/13/risk-management-in-your-phd/

Question

A Ph.D. project is an original research project with uncertain outcomes…

What are the inherent risks?

How will you manage them?

This topic will be covered in details in CAP7015

Analysis of risks

Examples:

- Are you performing a new technique?
- Do you have to wait on a lengthy submission process with your Internal Research Board or have to apply to multiple boards?
- Could equipment delivery be delayed?

Excerpt from:
Kaitlin Gallagher, The PhD Thesis – A Crash Course in Project Management (http://www.gradhacker.org/2012/11/16/phd-thesis-project-mgmt/)

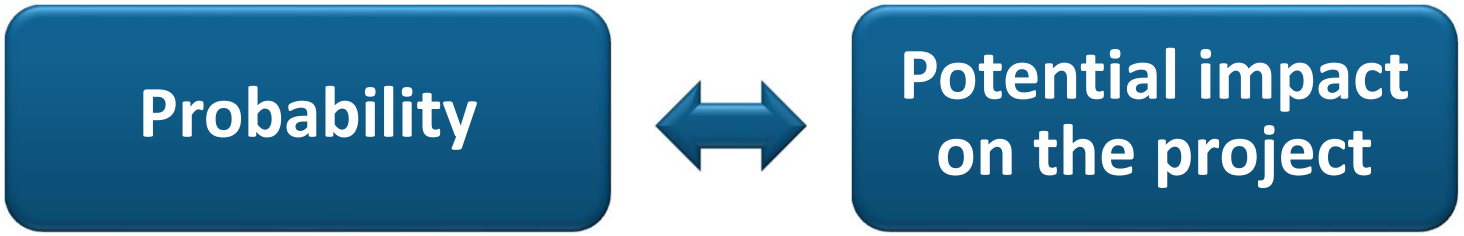
Analysis of risks

You may not be sure of what roadblocks will occur, but your goal with a risk analysis is to determine what potential risks could occur and how you'll prevent or handle each of them.

For example, you can look up ahead of time or call your ethics board to see what is required, potential length of time that the process will take, and make sure you have included everything that they've asked for so that you're giving yourself the best chance for the process to take the least amount of time possible.

Excerpt from:
Kaitlin Gallagher, The PhD Thesis – A Crash Course in Project Management (http://www.gradhacker.org/2012/11/16/phd-thesis-project-mgmt/)

RISKS
Primary aspects to consider



Potential scientific and technological bottlenecks (intrinsic to the project)

Competition from other labs (depending on the field)

Potential human conflicts

Questions

How to minimize these various types of risks?

How to change "risks" into "opportunities"?

RISKS
Technological risks – Examples

- Results and anticipated performance are not forthcoming
- Inappropriate approach, methodology
- Invalidated hypothesis
- Inadequate, unusable, and inconclusive experimental method
- Gold plating (excessive perfectionism)

Adapted from Yves Langhame, CAP7015 classnotes

RISKS
External risks – Examples

- Sudden emergence of a competitive publication or patent
- Changes in laws and regulation
- Changes in industrial partner's needs further to market conditions

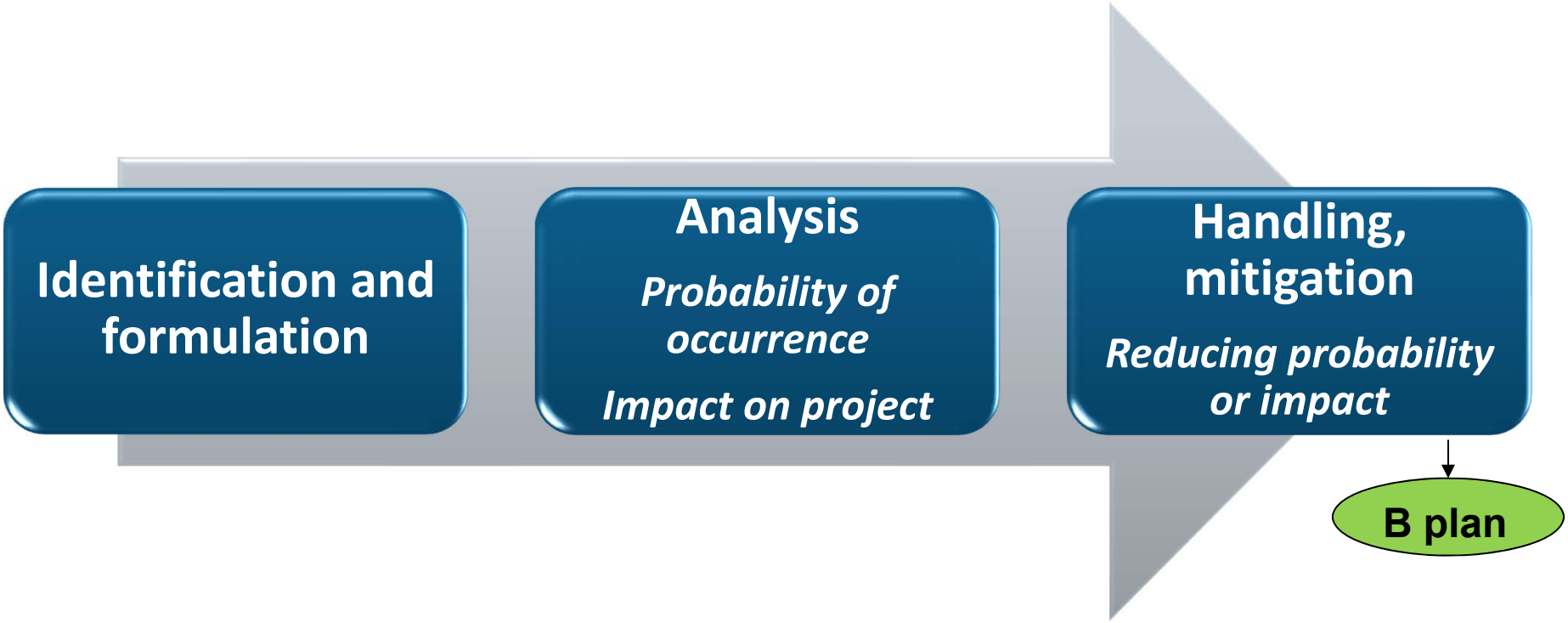
Adapted from Yves Langhame, CAP7015 classnotes

RISKS
Management and implementation – Examples

- Availability of resources may be improperly assessed or may become compromised
- Ambiguous research question
- Overly aggressive (or optimistic) schedule
- Inadequate project management
- Human resources conflicts

Adapted from Yves Langhame, CAP7015 classnotes

Risk management



Before the project: *Risk assessment*
During the project: *Risk follow-up and control*

February 17th, 2020

CAP7003E – Session 4

Élise Saint-Jacques
Coordinator, Complementary skills program, Polytechnique
Office : C-330.1

Work plan

1) Some elements to complete Session 3; Comments and questions (9:00 – 9:20)

2) Face to face in team of 4 – comment your evaluations (9h20 – 10h00)

3) Strategies for success, skills development and networking (10h10 – 12h20)

Assignment 3 – Research proposal

- Part I - *Writing the first version of your proposal*
  → Due date: Tuesday, **February 6th** at 12:00 ;

- Part II - *Critical analysis of 3 research proposals*
  → Due date: Thursday, **February 13th** at 12:00 (noon);

  "**Each student will have to evaluate the research proposals of three of your colleagues".**

  Drop 3 pdf files on Moodle. Title of the file:
  ***Team number_Family Name of Evaluated Student_by_Your Family Name* :**

  Example : **1_Johnson_by_Your Family Name.pdf**
  1_Davis_by_Your Family Name.pdf
  1_Miller_Your Family Name.pdf

- Part III - *Preparing and submitting the revised version of your proposal*
  → Due date: Friday**,** **February 21st** at 12:00 (noon).

Assignment 3 Part II

Evaluation of research proposal of 3 of your colleagues

Instructions

- The class has been divided into 7 teams of 4 students.
- For teams 1, 2, 3, 4, 5, 6 and 7: each member reviews the research proposals of the other 3 members of his team.
- The three research proposals that you have to evaluate have been dropped on the Moodle website, in the "Feedback files" section of your Assignment 3, Part I. You will have received a message from Moodle earlier, telling you the location.
- Submit your 3 evaluations on the Moodle website no later than Thursday, February 13th at noon.
- To facilitate recovery, name your assessment files (**pdf format**) as follows: Number of your team_Evaluated Student's name_by_your name.pdf (see example below). The number of your team is the first digit of the name of the documents you have received.

  Example: 1_Alva Rosa_by_Yarahmadi.pdf
  1_Nong_by_Yarahmadi.pdf
  1_Talebi_by_Yarahmadi.pdf

- The evaluations will be made available team members from Friday, February 14th and you will be able to consult them before the face-to-face session of Monday, February 17th.
- Session 4, Monday, February 17th, 9:00 AM - Face-to-face: teamwork: take turns, 10-12 minutes of discussion on each research proposal. Make sure you give everyone a voice and maintain a respectful, professional and constructive atmosphere.

CAP7003E Winter 2020

Team	Name	First Name
1	Alves Rosa	Felipe
	Nong	Yonsorena
	Talebi	Mahyar
	Yarahmadi	Asad
2	Usen	Ndifreke
	Ghorbani Golkhajeh	Aida
	Salehi	Pooya
	Zare	Zahra
3	Jha	Pankaj
	Maghzinajafabadi	Mohammadali
	Sanei	Arghavan
	Ye	Xi
4	Abbasipour	Mina
	Afkhami Varjouy	Ali
	Alves Tottoli E Silva	Cristina Aglaia
	Eftekhary	Hosna
5	Abedi	Mehrnoosh
	Da Silva	Ricardo Henrique
	Er Raqabi	El Mehdi
	Sambrekar	Akash
6	Hussien Abdelqader Hussien Elbediwy	Mostafa
	Morovati	Mohammadmedi
	Nourollahi	Masoumeh
	Waqdan	Mofareh
7	Barabi	Aidin
	Sadallah	Abouthaina
	Satari	Elham
	Yang	Bin

Assignment 3 – Evaluation sheet of a research proposal

	Score
1. Title The title is clear and concise The title reveals the originality of the research	/5
2. Trigger The motivation of the project is clearly explained	/5
3. Frontier of knowledge The literature review is sufficiently detailed and clear to situate the project The literature review shows that the writer is thoroughly familiar with his field of research The literature review is a true synthesis, not just a compilation	/5
4. Question/hypothesis The research question or hypothesis is clearly and adequately formulated	/5
5. General and specific objectives The general and specific objectives are clearly and adequately formulated	/5
6. Strategy (methodology) WBS The overall strategy is appropriate considering the scale of the proposed investigation The research design is clearly explained	/5
7. Expected results, originality and impact The proposed project is highly original The potential contribution is significant and will advance the field	/5
8. Anticipated risks and approach to manage them The researcher has considered potential problems and provided contingency plans	/5
9. Principal resources required The proposed resources are appropriate and justified	/5
10. Proposed timeline The proposed timeframe is realistic	/5

Managing intellectual property

Policy Regarding Technological Intellectual Property
(some elements)

- Applies to any person associated with research activities within Polytechnique, whose results could be the subject of a commercial approach.
- To recognize in a fair and equitable manner the respective rights of inventors, Polytechnique and, where applicable, third parties in relation to creations and innovations.
- Manage intellectual property rights and uses thereof
- Joint ownership (50/50) between Polytechnique and inventors
- The researcher initiates the marketing process of his invention.
- The invention must be declared to the BRCDT via a declaration of invention.
- The costs and revenues of commercial valuation are shared between Polytechnique and inventors.

http://www.polymtl.ca/sg/docs_officiels/en/propintel_en.htm

Question

Do you foresee ethical issues related to your research project?

Policies and procedures

Research Management

- Policy on the Ethical Conduct of Research Involving Humans
- Procedure for the Ethical Certification of Research Projects Involving Animals
- Procedure for the Certification of Research Projects Involving Biohazards
- Certification Procedure for Research Involving (or Potentially Involving) IT Risks
- Policy on Integrity and Conflicts of Interest in Research
- Policy Regarding Technological Intellectual Property

www.polymtl.ca/renseignements-generaux/en/official-documents

Question

What are the potential problems you may encounter during the course of your Ph.D. program?

Potential problems

- **Departure from the research plan**

  Having an effective plan with specific milestones and objectives will help you stay on track, identify major issues, and get advice

- **Overcommitment**

  Do not accept every offer for teaching and collaborations; learn to evaluate time requirements for various tasks (in particular lab work and writing); manage you time wisely

- **Individual problems of illness and motivation**

  Inform your advisor if an illness or other reasons could significantly affect your research; a drop of motivation is normal, temporarily switch to another aspect of the project

- **Problems threatening continuation of the study**

  Loss of data; lack of conclusion; problem to access critical resources: Stay calm, talk to your advisor

Adapted from John A. Sharp, John Peters, and Keith Howard, The management of a student research project – Third edition, Gower Publishing Company, Burlington (2002).

Potential problems

- **Problems which cause serious delays**

  Can be anticipated and often avoided with good planning

- **General support problems**

  In most cases, you will have established before beginning your program that the appropriate level of support (financial, lab, computer facilities, etc.) was available; problems arise if these working conditions change; these can in general be anticipated or mitigated by communicating your needs clearly, well in advance

- **Harassment and intimidation**

  Immediately seek advice from AECSP or the ombudsman

- **Supervision issues**

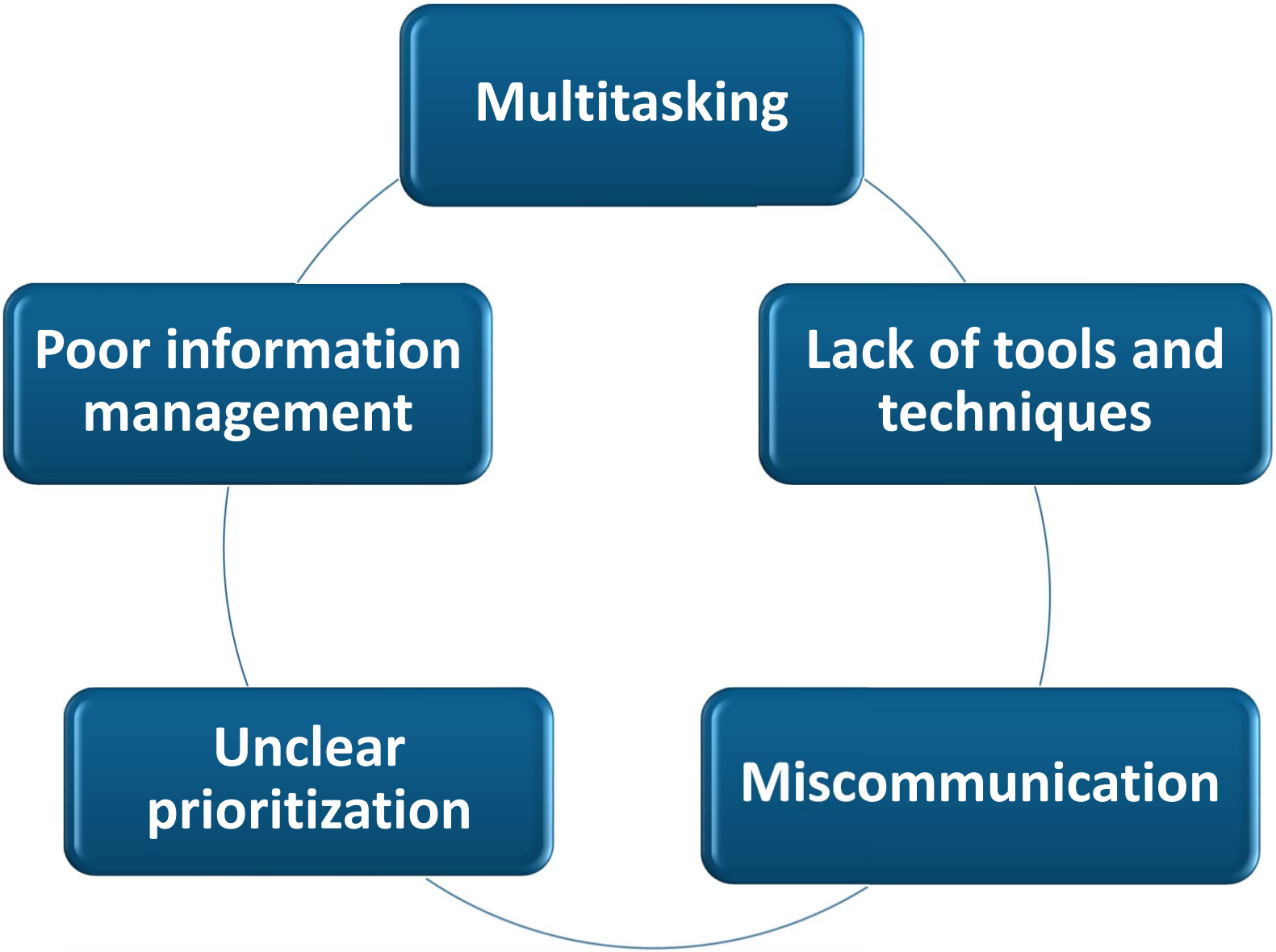
  Take the initiative to manage the relationship; clarify any issue rapidly; seek external help and advice

Adapted from John A. Sharp, John Peters, and Keith Howard, The management of a student research project – Third edition, Gower Publishing Company, Burlington (2002).

On being productive…

… why do we waste time?

Top five time wasters



11 common time wasters for student workers

- Attempting to do too much at once
- Making unrealistic time estimates
- Procrastinating
- Neglecting to plan and organize
- Failing to listen
- Being unable to say no
- Refusing to let others do the job
- Trying to involve everyone
- Making snap decisions
- Blaming others
- Being fatigued or distracted

Jo Hillman, Noel-Levitz

Question

How do you manage your time?

Answer

How do you manage your time?

Organize and execute around priorities

Three generations of time management

- **Checklists**
- **Calendars and appointment books**
- **Planning according to priorities**

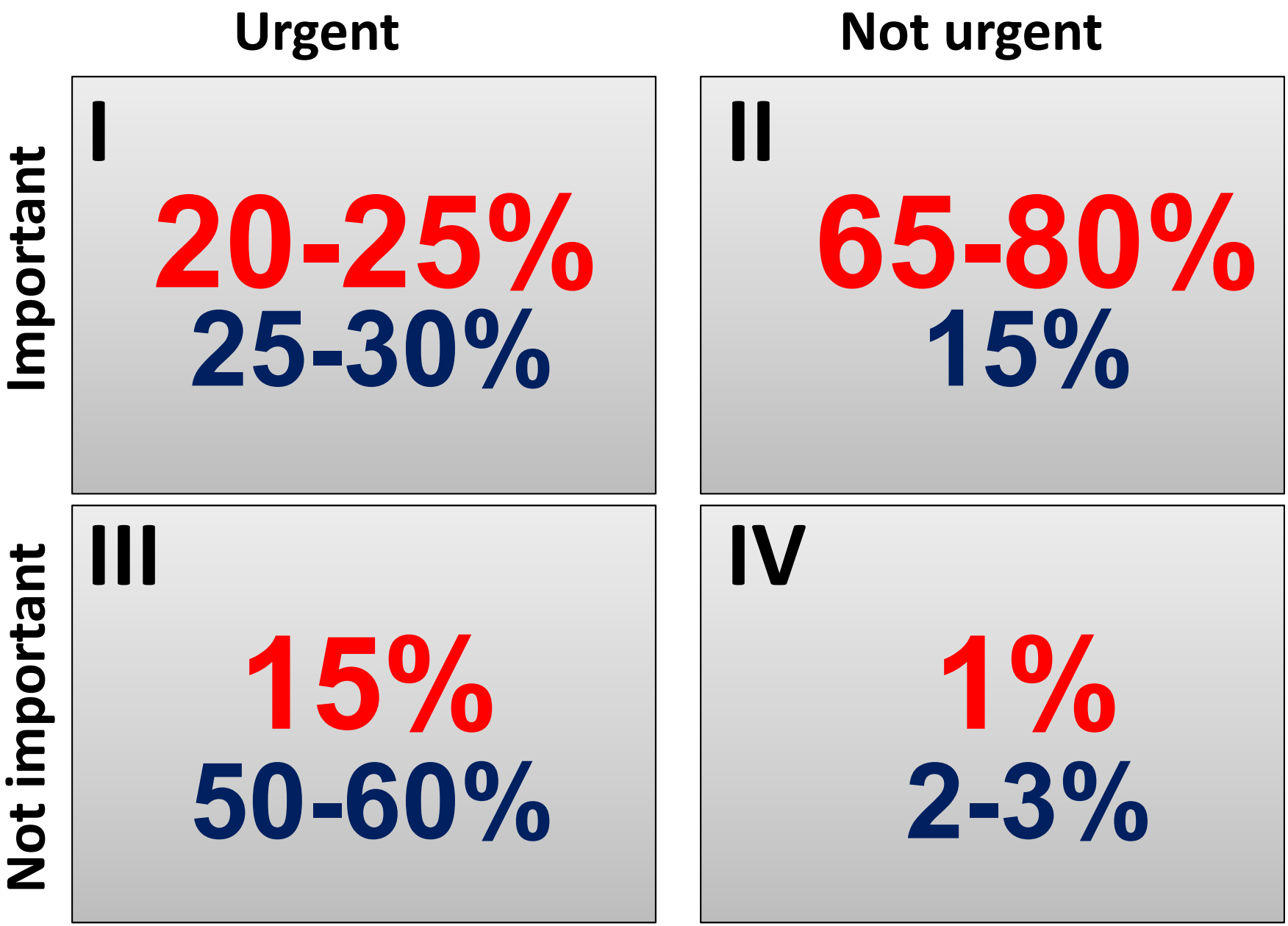
	Urgent	Not urgent
Important	**I** • Crisis • Emergencies • Pressing problems • Deadline-driven projects • Last minute preparations	**II** • Prevention • Personal development • Relationship building • Recognizing new opportunities • Planning and strategy • Exercise and health
Not important	**III** • Many interruptions • Some e-mail and phone calls • Some meetings • Some popular activities	**IV** • Trivia • Some mail and phone calls • Time wasters • Excessive Facebook, social media, gaming,…

Stephen Covey, "First things first", Simon and Schuster, New York (1994)

	Urgent	Not urgent
Important	**I** • Crisis • Emergencies • Pressing problems • Deadline-driven projects • Last minute preparations → stress… → burnout*…	**II** • Prevention • Personal development • Relationship building • Recognizing new opportunities • Planning and strategy • Exercise and health
Not important	**III** • Many interruptions • Some e-mail and phone calls • Some meetings • Some popular activities → Feel out of control, lost of reputation*…	**IV** • Trivia • Some mail and phone calls • Time wasters • Excessive Facebook, social media, gaming,… → irresponsibility, fired from job*

* If not well equilibrated

Stephen Covey, "First things first", Simon and Schuster, New York (1994)



Red: High performance companies
Blue: Usual percentages

Stephen Covey, "First things first", Simon and Schuster, New York (1994)

Question

How will you assess your progress?

How will you know that you can finish your Ph.D. project? How will you do that?

This topic will be covered in details in CAP7015

Criteria for success

Advisor's criteria

- x seminars, y lectures, z articles, w patents
- Building a prototype, instrument, sensor, …
- Creating code, developing an algorithm
- Creating a new database
- Inventing a new method

University requirements

- 0-15 course credits
- Study plan
- Comprehensive examination
- Writing and submitting a thesis
- Defending a thesis

Your criteria

- Completing the study program in X years
- Obtaining prizes and awards
- Balancing academic success and personal/family life
- Building a professional network
- Building a strong portfolio (scientific, professional, personal)
- Completing an internship (industry, academic laboratory)
- Developing professional skills
- Learning languages

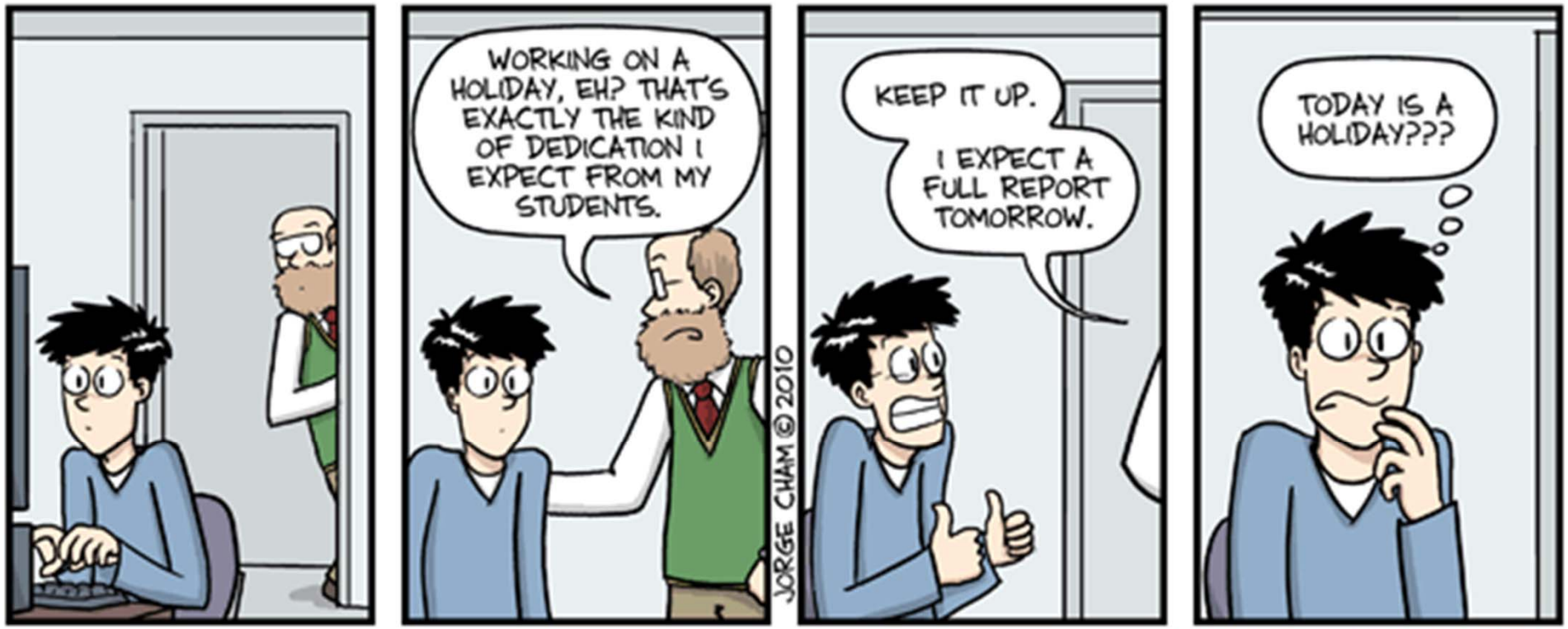
When to stop???

1. **You have worked hard to define the objectives of your project, to cut it out, to set up a timetable and to follow it, to evaluate and mitigate the risks (plan B) and to manage your project and the changes: so you have clearly and systematically defined the perimeter of your project. So you know when to stop! Respect your perimeter!**

2. **Ask yourself: Have I met the criteria and competencies set by the institution and the objectives of my project to obtain a doctorate? If so, you should stop!**

3. **Of course, discuss all this with your research director: It is very preferable that the decision to stop is common!**

4. **This is not the time to be distracted by: "We could write another paper before your defense?" ... But it's still your decision to accept or refuse!**


WORKING ON A HOLIDAY, EH? THAT'S EXACTLY THE KIND OF DEDICATION I EXPECT FROM MY STUDENTS.
KEEP IT UP.
I EXPECT A FULL REPORT TOMORROW.
TODAY IS A HOLIDAY???
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