

Research methods for innovation (management)

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Introduction

Aims:

- Broad understanding of main research activities
 - ✓ Technology watch and literature review
 - ✓ Read scientific papers
 - ✓ Management of research projects
 - ✓ Experimentation and validation of results
 - ✓ Writing research papers
 - ✓ Presenting experimental results
 - ✓ Ethics and deontological practice

Game rules – 3AI

Grades

1. For sessions 1, 2, and 4 there is an activity to submit on **ARCHE**
-
- All activities are to be submitted on **ARCHE** and **only on ARCHE!**
 - deadlines, validation, automatic verification of text to avoid plagiarism
 - **ARCHE** → forum for exchange, course materials, internships and final reports examples

Game rules – Master IDEAS + IUVTT

Grades

1. For sessions 1, 2, and 4 there is an activity to submit on **ARCHE**
2. A final report

The final report « **Estat de l'Art** » is due on May 4th 2020

- All activities are to be submitted on **ARCHE** and only on **ARCHE**!
 - deadlines, validation, automatic verification of text to avoid plagiarism
 - **ARCHE** → forum for exchange, course materials, internships and final reports examples

Sessions Schedule – 3AI

Séance		Activité
1	13-déc	8h30-9h30 CM - Introduction au module
		9h30 - 10h00 CM - Veille technologique et VOSviewer
		10h15 - 12h TD 1 - VOSviewer
		13h30 - 15h30 TD 1 - VOSviewer
		16h00-17h30 CM - Conférence sur les laboratoires de recherche
2	17-janv	8h30 - 9h30 CM - Conception et implémentation d'un atelier expérimentale
		9h30-12h00 TD 2 - définition et mise en place du protocole expérimentale
		13h30 - 15h00 TD 2 - Mise en pratique du protocole
		15h00 - 17h30 CM - restitution des résultats
3	20-janv	9h00 - 12h00 CM - mendeley zotero / rédiger un papier
		14h00 - 17h30 conférence - séminaire recherche
4	24-janv	8h30 - 10h00 CM - recherche reproductible - traitement des données
		10h00-16h00 TD 3 - Atelier recherche reproductible
		16h00 -17h30 CM donnés

Sessions Schedule – Master IDEAS + IUVTT

Séance		Activité	
1	06-janv	8h30-9h30	CM - Introduction au module
		9h30 - 10h00	CM - Veille technologique et VOSviewer
		10h15 - 12h	TD 1 - VOSviewer
		13h30 - 15h30	TD 1 - VOSviewer
		16h00-17h30	CM - Conférence sur les laboratoires de recherche
2	13-janv	8h30 - 9h30	CM - Conception et implémentation d'un atelier expérimentale
		9h30-12h00	TD 2 - définition et mise en place du protocole expérimentale
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4	23-janv	8h30 - 10h00	CM - recherche reproductible - traitement des donnés
		10h00-16h00	TD 3 - Atelier recherche reproductible
		16h00-17h30	CM données
5	04-mai		Rendu rapport Etat de l'art

Outline

1. Introduction to research

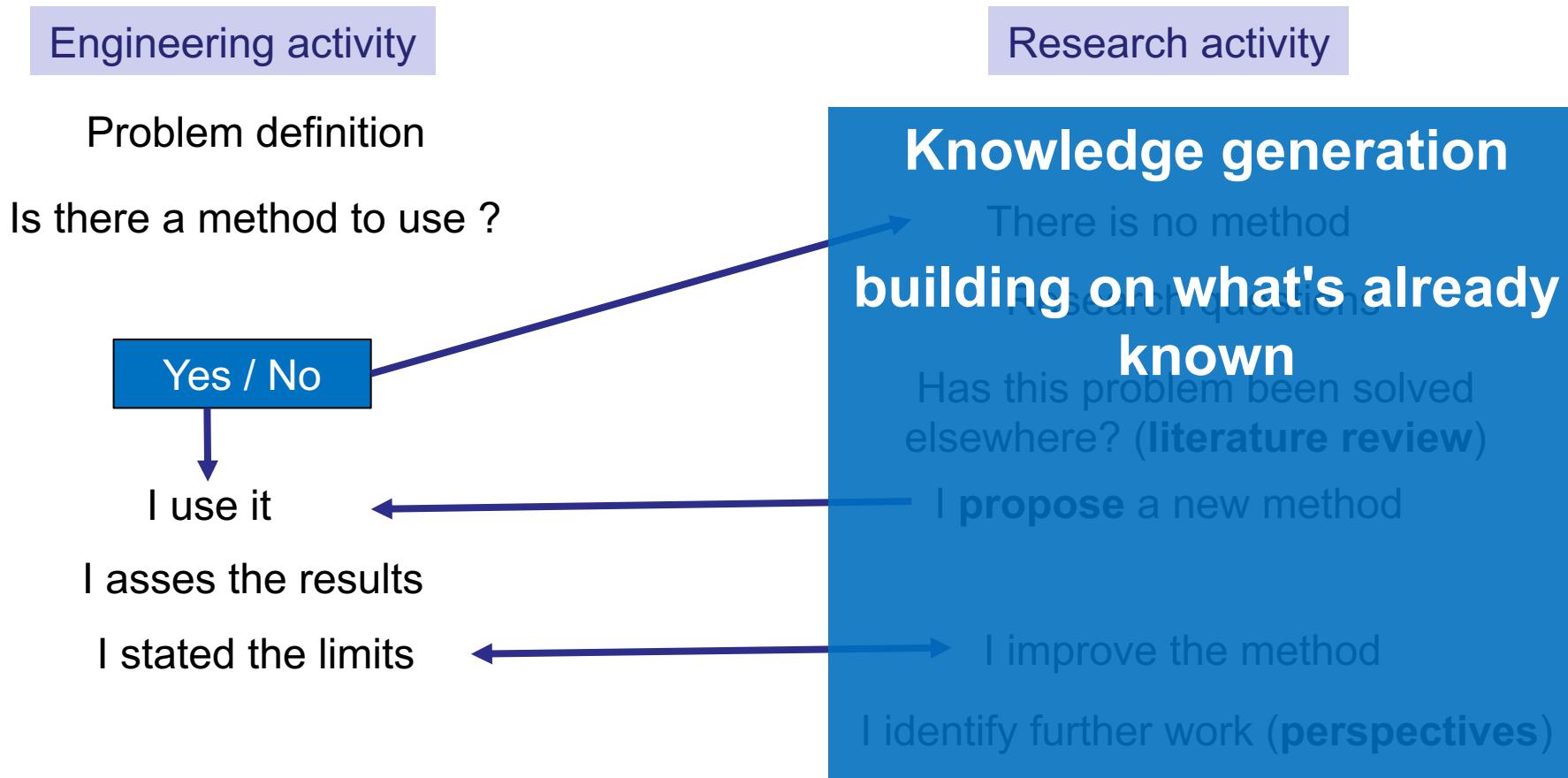
- The scientific approach and alternatives
- In France

2. Literature review – using what's already known

3. Presenting research results

- Research papers
- Research conference (project examples)

What is research ?



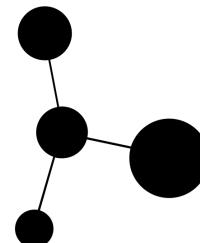
What is research ?

“the process of finding solutions to a problem after a thorough study and analysis of the situational factors.”

(Sekaran and Bougie 2016)

Based on two research elements:

- Observations (information or data)
- Theory (arguments)



Research and the manager

The research project:

- Budget and time constraints (like every project, but...)
- High degree of uncertainty

You know where you start but don't where you will end!

- like on innovation ?

- But no direct commercialization → knowledge or IP transfer →
- “Failures” are also a good final outcome
→ new knowledge in the quest for answers



Research and the manager

Why should I learn about the research process ?

- To work as a researcher (Ph.D., R&D department...)
- As a manager you are going to face problems that your R&D department or and external researcher (open-innovation) can help you to solve.
 - Help to make evidence-based decisions

Type of research (on industrial engineering)

Applied research (technology)

- to improve a system performance
- to improve the user performance when using the system
 - Improve usability

Basic research (a.k.a. fundamental – pure)

- mechanics (e.g. statics, kinematics, dynamics)
- mathematics (e.g. calculus, statistics)
- ...

Type of research at ERPI

Research domains

- Innovation assessment
- User-centred design, OI, Living-Labs
- Recycling for additive manufacturing



[La Fabrique Nancy Grand Cœur](#)

Un démonstrateur partagé
avec le Grand Nancy



[Lorraine Smart City Living Lab](#)

Living lab Lorrain



[3D Soil Test](#)

Soil organic matter
degradation Additive
Manufacturing, Participatory
research



[Green Fablab](#)

Circular economy and 3D
printing: Towards a distributed
recycling paradigm



[Innovation on Health](#)

Innovation on the health field



[REVES - Renaissance
Ecologique des Villes](#)

Chaire partenariale autour de la
transformation urbaine



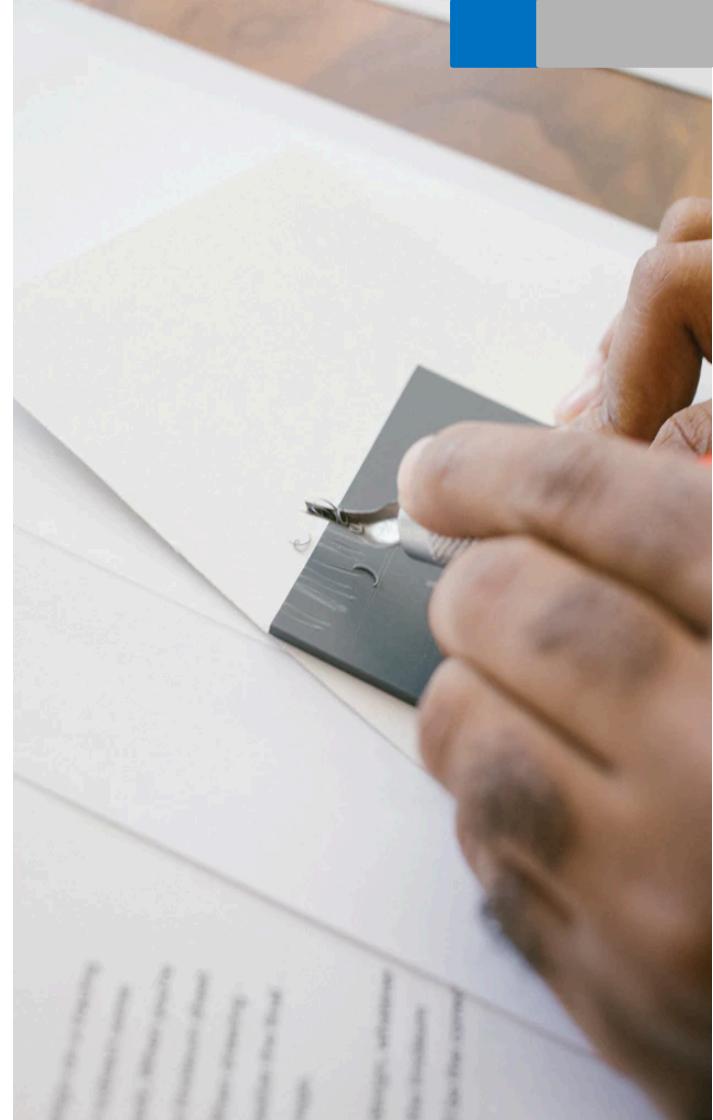
[PRINCIP -Pôle de Recherche
sur l'Innovation et la
Capacité à Innover des Pmi](#)

Pôle de recherche sur
l'innovation

The scientific approach

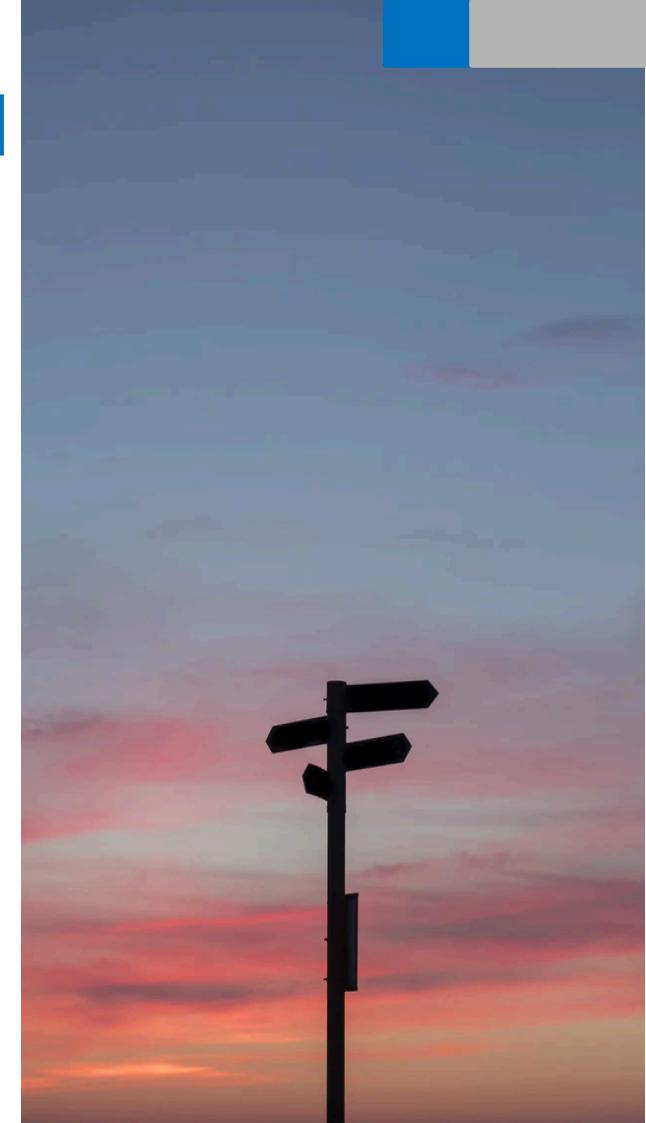
The hallmarks of the scientific method

- Purposiveness
- Rigor
- Testability
- Replicability
- Precision and confidence
- Objectivity
- Generalizability
- Parsimony



The hypothetico-deductive method

1. Identify a broad problem area
2. Define the problem statement
3. Develop hypotheses
4. Determine measures
5. Data collection
6. Data analysis
7. Interpretation of data



Research institutions in France

- Teaching and research
 - Universities (IUT, Ecoles d'ingénieurs)
 - INSA , ENSI , CNAM , ...
- Research only
 - CNRS
 - INRIA
 - DGA
 - CEA
 - CEREMA
 - IFSTTAR
 -

Private companies

- Mostly big groups
 - Sagem
 - Véolia
 - PSA
 - France Télécom
 - Thales
 -
- But also SME
 - TEA
 - JEI → FITLE, myXtramile ...

ANR
EU
...



Ministères, EU, privée

EU, privée

Literature review – using what's already known

Where to look at ?

- Scientific databases
 - Research papers
 - Books
- Institutional reports → WHO, EU...
- Societies → conferences proceedings (IEEE, IAMOT, IFAC...)
- Institutional repositories → dissertations
- IP registrars → Patents



Literature review – using what's already known

The screenshot shows the left sidebar of the Université de Lorraine website. It includes a logo, the name "UNIVERSITÉ DE LORRAINE", a search bar with a magnifying glass icon, and a list of categories: Redirection, Bureau, Université, Pédagogie, Services, BU, and Veille documentaire. Under the BU category, there are links for BU Ingénieurs GM-GSI, BU Sciences, Les bibliothèques, Ressources en ligne, Revues en ligne, Ulysse, Thèses et Mémoires, Ressources pédagogiques, Archives ISTEX, Ce livre en BU ?, Recherche, Personnels, Métier, and Veille documentaire.

Arts, Lettres et Langues
Biologie et Santé
Droit
Economie - Gestion
Encyclopédies et dictionnaires
Maths, Physique, Chimie
Normes et brevets
Presse
Psychologie
Sciences de l'ingénieur
Sciences humaines et sociales
Staps

- ▶ ACM Digital Library
- ▶ ACS American Chemical Society
- ▶ ASME Digital Collection
- ▶ BASE - Bielefeld Academic Search Engine
- ▶ Cairn - Encyclopédies de poche
- ▶ Cambridge University Press Archives (licence nationale)
- ▶ Current Contents Connect
- ▶ Cyberlibris Scholarvox
- ▶ Dawsonera
- ▶ De Gruyter (licence nationale)
- ▶ Derwent Innovations Index
- ▶ Diane
- ▶ DOAJ Directory of Open Access Journals
- ▶ GreenFile (sur EbscoHost)
- ▶ Harmathèque (L')
- ▶ IEEE Xplore Digital Library
- ▶ Incites
- ▶ JCR Journal of Citation Reports
- ▶ Kompass
- ▶ Nature. Nouveau : accès à la collection "Complete" (80 titres) !
- ▶ Oxford journals (licence nationale)
- ▶ Sagaweb (normes AFNOR)
- ▶ ScienceDirect Freedom (Elsevier)
- ▶ Springer - Archives
- ▶ Taylor & Francis
- ▶ Techniques de l'Ingénieur
- ▶ Wiley Online Library
- ▶ WoS Web of Science



Literature review – Ethics

Report on your literature findings and beware of:

- Purposely misrepresenting the work of other authors.
- **Plagiarism** – the use of another's original words, arguments, or ideas as though they were your own, even if this is done in good faith, out of carelessness, or out of ignorance.

→ References



Presenting research results

Research papers and conferences papers

- Title
- **Abstract**
- Introduction
- Literature review
- Methodology
- Results
- Discussion
- Conclusion
- References

Trends in design of distributed energy systems using hydrogen as energy vector: A systematic literature review

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ABSTRACT

Currently, a significant transformation for energy systems has emerged as a result of the trend to develop an energy framework without fossil fuel reliance, the concerns about climate change and air quality, and the need to provide electricity to around of 17% of world population who lacks the service. Accordingly, the deployment of power plants located close to end-users and including multiple energy sources and carriers, along with the growing share of renewable energies, have suggested changes in the energy sector. Despite their potential capabilities, the design of distributed energy systems (DES) is a complex problem due to the simultaneous goals and constraints that need to be considered, as well as to the high context dependence of this kind of projects. For these reasons, in this work a systematic literature review of DES including hydrogen as energy vector, was made analyzing 106 research papers published between the years 2000–2018, and extracted from Scopus[®] and Web of Science databases. The aim was to identify how hydrogen is employed (technologies, uses) and the criteria that are evaluated (economic, technical, social and environmental) when these systems are designed, planned and/or operated. The results constitute a baseline information covering the type of technologies, equipment sizes and hydrogen applications, that could be valuable for the preliminary stages of research or project planning of DES involving hydrogen. Furthermore, other factors have also been identified, such as the focus on techno-economic issues, and the lack of considering socio/political aspects and the uncertainty about input data like weather conditions, energy prices and demands. Additionally, a more integrated approach is needed including all the hydrogen supply chain stages and project stakeholders, to tackle issues like safety of the energy systems that could produce consumer rejections.

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Project examples

Defended Thesis

2018

Thèse

[From product design to supply chain design : Which methodologies for the upstream stages of innovation?](#)

Brunelle Marche

Other. Université de Lorraine, 2018. English. [\(NNT : 2018LORR0155\)](#)



2017

Thèse

[Biorefinery supply chain design optimization under sustainability dimensions](#)

Andrea Teresa Espinoza Pérez

Computational Engineering, Finance, and Science [cs.CE]. Université de Lorraine, 2017.

English. [\(NNT : 2017LORR0222\)](#)



[Intégration du point de vue de l'usager et du citoyen dans le processus d'innovation](#)

Julien Hubert

Génie des procédés. Université de Lorraine, 2017. Français. [\(NNT : 2017LORR0083\)](#)



2016

Thèse

[Analyse des mécanismes de captation et d'exploitation des connaissances pour accompagner l'innovation](#)

Hélène Gitchenko

Gestion et management. Université de Lorraine, 2016. Français. [\(NNT : 2016LORR0293\)](#)



[Methodological proposition to evaluate polymer recycling in open-source additive manufacturing contexts](#)

Fabio Alberto Cruz Sanchez

Chemical and Process Engineering. Université de Lorraine, 2016. English. [\(NNT : 2016LORR0291\)](#)



[Gestion des connaissances lors d'un processus collaboratif de créativité](#)

Alex Gabriel

Système multi-agents [cs.MA]. Université de Lorraine, 2016. Français. [\(NNT : 2016LORR0209\)](#)



[Méthodologie d'analyse de la capacité à innover et à exporter des PME manufacturières et de procédés : identification et caractérisation d'un espace commun en vue de l'élaboration d'un outil multicritères d'aide à la décision](#)

Manon Enjolras

Gestion et management. Université de Lorraine, 2016. Français. [\(NNT : 2016LORR0149\)](#)



TD1 - VOSviewer **EN PRATIQUE**

References

- Sekaran, Bougie. 2016. Research Methods For Business: A Skill Building Approach. Wiley & sons.
- Sørensen, Flemming, Jan Mattsson, and Jon Sundbo. 2010. Experimental Methods in Innovation Research. *Research Policy* 39 (3): 313–22.

A photograph of a person working at a wooden desk. In the foreground, an open notebook with blue pages is open, showing handwritten notes in blue ink. A hand is visible, holding a red pencil and writing in the notebook. In the background, another hand is visible on a silver laptop keyboard. The person is wearing a black t-shirt and a pink and blue fitness tracker on their left wrist. The overall scene suggests a professional or academic environment.

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