



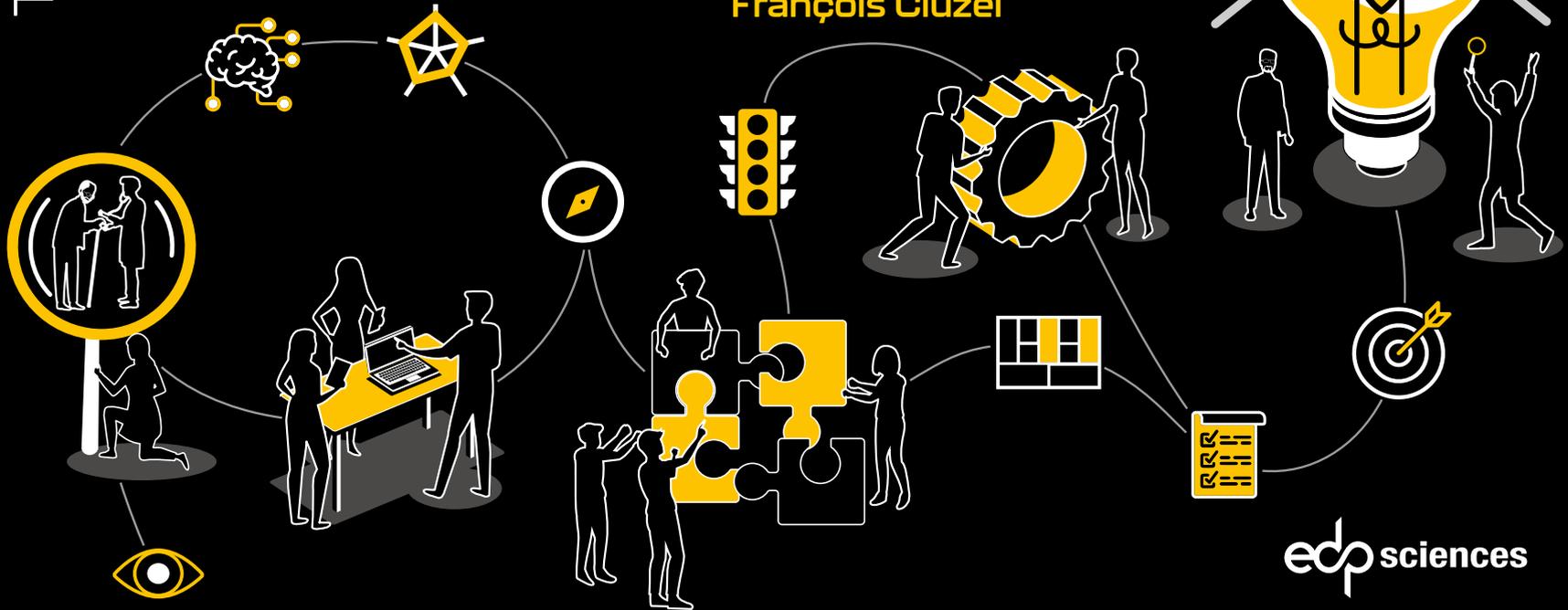
# Radical Innovation

TEASER

A systematic and usage-driven innovation methodology to ensure usefulness for users and profitability for companies

# Design

Bernard Yannou  
François Cluzel



edp sciences





# Radical Innovation

TEASER

A systematic and usage-driven  
innovation methodology to ensure  
usefulness for users and  
profitability for companies

# Design

Bernard Yannou

François Cluzel

université  
PARIS-SACLAY

edp sciences

  
CentraleSupélec

Radical Innovation Design® is a trademark of CentraleSupélec, commercialized by HyB'RID company.

This book is published under an Open Access license [Creative Commons CC-BY-NC-ND](#), permitting non-commercial use, distribution, and reproduction of the text, provided the source is cited.

© Bernard Yannou and François Cluzel, 2024

ISBN: 978-2-7598-3066-4

Published by EDP Sciences

# Radical Innovation Design

A systematic and usage-driven innovation methodology to ensure usefulness for users and profitability for companies

# This is a teaser!



Would you like to revisit some preconceived ideas on how to lead innovation processes?

In a data-rich world, data analytics should reveal essential challenges to innovation and model the effectiveness of potential solutions. A robust innovation methodology should refer to leading market solutions, constructing its innovation brief upon a comprehensive user experience analysis. To determine how well solutions satisfy a range of user needs, more sophisticated methods are required to qualify user experience and quantify its expected benefits and notable shortcomings. Once we have pinpointed the pertinent problems, assistance in organizing ideation processes would be beneficial, fostering the development of promising concepts and business models, as well as swiftly appraising the practical efficacy of innovative solutions. There should ultimately be an openness to automating, to some degree, the articulation of pertinent issues and the curation of the most useful and profitable solutions.

Whether you share these convictions or are simply intrigued about innovation, this eBook is for you, as it shows how to innovate in an organized, modern way using the Radical Innovation Design® (RID) methodology. RID, a revolutionary computerized approach to knowledge- and usage-driven innovation, excels at the in-depth exploration and exploitation of problems and solutions and has proven its effectiveness in a wide range of industries. Aimed at professionals new to innovation, students and innovation experts alike, it offers three customized journeys to explore original concepts using practical illustrations and real-life projects.

The authors, Bernard Yannou and François Cluzel, are both design and innovation engineering faculties at CentraleSupélec, Université Paris-Saclay, and have extensive teaching experience. With a long list of industrial design and innovation books to their credit, they have supervised numerous doctoral theses in industrial environments. This eBook and related downloadable material are open-access to disseminate RID-based practices.

**This document is a teaser of the full open-access eBook that will be available soon. It provides the whole introductory chapter, including an introduction to Radical Innovation Design methodology, as well as the “instructions for use” to browse the full eBook. It also presents extracts from the 360 pages, with two fact sheets per chapter, chosen to be representative of the full eBook (concepts, methodological contributions, examples, practical tools...).**

# What kind of innovation?

**Why and for what purpose  
do you want to innovate?**

**What future do you want for yourself,  
your children and your customers?**

**Is there a best method, organization,  
process to innovate?**

**Can I claim that my innovations  
have contributed to the values that are  
mine or that I wanted to promote?**



***Here are just a few  
of the many questions you have  
already asked yourself,  
or will be asking yourself  
in an innovative design situation.***



# Preconceived ideas about innovation

## Do you have doubts, or are you tired of certain preconceived ideas about innovation?

### In general

**Innovation is risky** – This belief overlooks the fact that innovation can also be a calculated, systematic process with manageable risks, especially in cases of incremental innovation or when guided by thorough research, careful planning, and systematic user evaluations.

**Innovation is expensive** – There is a belief that innovation requires significant financial investment. While this can be true, many impactful innovations have been developed with minimal resources.

**Big companies can't innovate** – This misconception suggests that large companies are too slow and bureaucratic to innovate effectively. In reality, many large companies have the resources and capabilities to drive significant innovation.

**Innovation happens in isolation** – The stereotype of the lone genius innovating in isolation is prevalent, but most innovation is collaborative, involving teams, partnerships, and knowledge-sharing across different disciplines.

## On nature of innovation

**Innovation equals technology** – People often equate innovation strictly with technological advancements, overlooking non-technological areas such as service, process, organizational, or business model innovations.

**Innovation only happens in high-tech sectors** – There's a common belief that innovation is restricted to high-tech industries like IT or biotechnology. However, significant innovations can and do occur in any sector, including traditional industries like manufacturing, agriculture, and services.

**Innovation is solely product-oriented** – There is a tendency to focus solely on products when thinking about innovation. However, innovation can occur in services, processes, business models, and organizational structures as well.

**Sustainability and innovation are incompatible** – There is a misconception that sustainable practices stifle innovation. In fact, sustainability can actually be a powerful driver for innovation, pushing companies to develop new, more efficient, and environmentally friendly solutions.

**Innovation is always technically complex** – The assumption here is that innovation must involve complex technologies or processes. In fact, some of the most effective innovations are simple and based on clear, straightforward ideas.

# Preconceived ideas about innovation



## On users and markets

**Users don't know what they want until they see it** – This idea, often associated with Steve Jobs, suggests that consumers are not a good source of ideas for innovation. However, user-centered design shows that understanding user needs can be a crucial driver of successful innovation.

**We can arouse people's needs** – Believing that we can arouse people's needs underestimates the complexity of human desires and overlooks the fact that true, lasting needs are often inherent or developed through personal experiences, rather than being easily created or influenced externally.

**True innovation does not need to study competition** – Understanding competitive landscapes can provide valuable insights for innovation, helping to identify gaps in the market, emerging trends, and potential areas for differentiation or improvement.

## On creative thinking

**Thinking outside the box is imperative** – Despite being sometimes beneficial, this is not the only pathway to innovation, and in many cases, deep understanding and working within existing frameworks can be equally, if not more, innovative.

**More Ideas mean better innovation** – It is often thought that the more ideas you generate, the more innovative you are. However, the quality and applicability of ideas are often more important than quantity.

**Innovation is only for creative types** – This misconception holds that only certain people with inherent creativity can innovate, whereas innovation can come from anyone, often through systematic methods and processes.

**Innovation cannot be at least partly automated** – Advancements in technology and data analytics are increasingly enabling automation in certain aspects of the innovation process.

# Do you have doubts, or are you tired of certain preconceived ideas about innovation?

## On the innovation process

**Managing innovation cannot be treated like any other business process** – While innovation does have unique challenges, applying structured business processes and management principles can effectively guide and support the innovation process, ensuring alignment with organizational goals and roadmaps, and efficient resource utilization.

**Most innovations are fortuitous, serendipitous or accidental** – Some innovations arise from resulting from unexpected connections or discoveries but most innovations are deliberate, and the result of intentional, structured and planned processes.

**Innovation is not linear** – Calling all innovation non-linear could lead to an over-emphasis on chaos and unpredictability, potentially overlooking the value of structured approaches and planning in the innovation process, or even justifying an organization's incompetence in organizing innovation processes.

**Innovation is unstructured and chaotic** – Some people think of innovation as a random, unstructured process. In reality, effective innovation often requires a structured approach, with clear goals and processes.

# The Radical Innovation Design manifesto

## **Do you feel concerned?**

**Shaping tomorrow's world is both an opportunity AND a responsibility.**

**We cannot go on like this.**

**Let's envision, as much as possible, and as early as possible, the added value of our innovations in usage contexts before going any further.**

**Abusive innovation practices have clearly contributed to the social, environmental and economic situation we find ourselves in.**

**Let's focus on just the essential needs, but for these, let's be uncompromising.**

**Let's always consider unresolved problems and expectations first, try to prioritize them, innovate from there without any preconceived idea that it will be impossible, then finally find a compromise between what creates progress value, and the overall cost of the solution and the company's interest and strategy.**

**Let's take into account not only user practices but also expert knowledge.**

**Let's design using a wide-angle approach.**

**This will enable us to achieve our objectives in terms of usefulness, impact control and profitability.**

*"There are professions more harmful than industrial design, but only a few. Design, if it is to be ecologically responsible and socially responsive, must be revolutionary and radical. The only important thing about design is how it relates to people."*

*Victor Papanek, 1971*

**SOURCE**

Papanek V., *Design for the real world – Human ecology and social change*, Academy Chicago Publishers, New York, 1971, ISBN 978-0-89733-153-1.

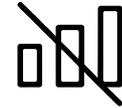
# Common pains and expectations when innovating



1. **Profusion of existing methods** and tools without knowing where and how to start
2. **Lack of knowledge** of the beneficiaries of our innovations, their activities and their day-to-day suffering and aspirations
3. **Lack of tools** to take into account and process the vast amount of data that already exists
4. **Weak metrics** on which to base our decisions



5. **Numerous** prototypes and tests with **little evaluation**



6. **Rare comparisons** of designed solutions with those already on the market



7. **Substantial investments** in projects with unproven value-creation potential



8. **Weak capitalization** on knowledge, issues and previous projects



9. **Exhaustion and demotivation** of teams



# Common innovator profiles



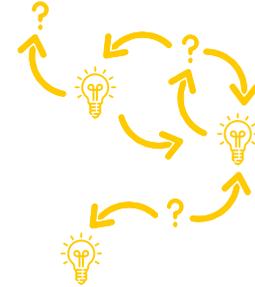
## Lost beginners

They are beginners, unfamiliar with innovation or change management methods and tools. They are simply lost when faced with the profusion of existing offers, don't know what to use and, above all, don't know where to start...



## Disilluminated regular shifters

These are the people who are familiar with innovation or change management methods and tools, who have met with great successes and, of course, bitter failures, and who now need to go further, to turn a corner, because they are confronted with certain recurring pitfalls of existing approaches.



## Unstructured one-off shifters

These are the people who have already implemented innovation or change management methods and tools from time to time, with varying degrees of success, and who are above all unstructured. They tinker, test, don't necessarily go all the way, and have now reached the limits of this very costly approach.



### **Old leaders out of date**

These are the ex-leaders, those who succeeded in innovating and implementing an efficient change management strategy, but who never really knew why or how they achieved this success. Today, they are being overtaken by new entrants, often smaller and/or more agile, who have less to lose in the development of disruptive offerings.



### **Potential leaders in scaling up**

These are the ones with the wind in their sails, the ones with promise, the future high-potential executives. There aren't too many of them, but a few are asking for our help, because they know that they're growing fast and that this change of scale is not without consequences. It's a whole way of working that needs to be gradually transformed, and it's also an agility to act and design in a disruptive way that needs to be developed and sustained.

# Our value proposition

**Learning to innovate in an organized and modern way**, when needs are complex and diffuse, is the challenge of this eBook and its associated methodology and tools. The **Radical Innovation Design® (RID) methodology** was originally developed and taught at CentraleSupélec and marks a significant leap in innovative design processes:

- **Rigorous**, it requires defining the system on which you want to innovate. To achieve this, RID proposes to innovate on the perimeter of an existing *activity* to be improved or a new one to be developed.
- **Precise**, RID offers a comprehensive framework for expressing and understanding the multifaceted nature of design solutions in relation to specific user pains and expectations, user profiles, and situational contexts.
- **Tooled**, RID enables us to build a cognitive model of the target activity and use it as a simulator to analyze existing solutions on the market, as well as the value of the new innovative solution.
- **Quantitative**, it introduces an original *quantity of pain* metric that permits the calculation of *effectiveness* indicators to compare the ability of market solutions to be dominant under certain conditions, so as to determine an *innovation brief* in a data-driven manner.
- **Rational**, its algorithms calculate value buckets to qualify questions that need to be cracked during the ideation phase.

- **Systematic**, its ideation method exploits every nook and cranny of priority value buckets.
- **Modern**, the entire method is designed to rely on data to inform the decisions rather than instinct, with these decisions being documented and capitalized on throughout the project.
- **Practical**, RID fundamentally boosts the collaborative process between different stakeholders in the early stages of innovation, leading to shared understanding and collective, assumed decisions, for the specification of innovation briefs as well as for the selection of final ideas and designs. This ensures that new solutions are not only technically feasible, but also closely aligned with real-world requirements.
- **Research-oriented**, RID promotes integrated, informed decision-making rather than superficial understanding. Naming pains and expectations, quantifying them in real-life situations, and analyzing the causes of their shortcomings, enables us to put our finger on phenomena, which are themselves sources of invention once mastered. RID is also a way of driving research by need.

*“Design must be an innovative, highly creative, cross-disciplinary tool responsive to the needs of men. It must be more research-oriented, and we must stop defiling the earth itself with poorly-designed objects and structures”*

*Victor Papanek, 1971*

**SOURCE**

Papanek V., *Design for the real world – Human ecology and social change*, Academy Chicago Publishers, New York, 1971, ISBN 978-0-89733-153-1.

# Our innovative solution

**Radical Innovation Design (RID)** is an **innovative, comprehensive, structured and traceable methodology of innovative design** that brings Design Thinking up to date.

Deliberately focused on **modelling usage situations and the user experience**, it attaches great importance to **problem setting**. A **cognitive model of the target activity** is built to capture the **effectiveness of current market solutions** on the **problems** encountered by the different **user categories** in **everyday situations**. From this, **algorithms** determine the most relevant **value buckets** from which to ideate. These are the ones that create the most **usefulness** in terms of usage, for which the solutions on the market are the least **effective**, and which correspond to the **company's strategy**.

RID enables systematic, usage-driven innovation to guarantee usefulness for users and profitability for companies, which are encouraged to move into areas where there is no competition.

RID differs fundamentally from methods based on the “fail fast” principle, by proposing a **single process ensuring traceability of reasoning** with a total of **seven original methods**, adapted **algorithms and visualization tools**, a **metric of “quantities of pain”** and two **decision-support indicators** (effectiveness and value buckets). RID is the **first computerized methodology** to implement and secure usage-driven innovation processes, and is particularly **well suited to cases where usages are complex or diffuse**. It has been applied and validated in multiple industrial and commercial sectors.

# Our innovative solution



## KNOW AND TARGET THE MARKET(S) FOR YOUR SOLUTION



### Define the target activity and

**observe** (organize your investigation and collect deep knowledge)



### Enrich your understanding of

**beneficiaries** (pains and expectations, users and key stakeholders, usage situations)



### Compare existing

**solutions** (characterize precisely the strengths of your competitors' products, in the eyes of your users)



**Decide which values are worth developing**



**Specify the innovation brief**  
of your solution



**Ideate from the values targeted**



## DESIGN A NEW SOLUTION ARCHITECTURE AND ITS BUSINESS MODEL



Assess ideas & concepts maturity



Explore solution architectures



Explore business models



Assess and validate the value creation gain of your solution and its competitive advantages

## OTHER SKILLS TO DEVELOP BY TRAINING AND CERTIFICATION



Learn and quickly put into practice RID through use



Understand and initiate the implementation to one of your projects



Master and integrate into your innovation processes

# Readership

This eBook contains 161 methodological sheets. You can follow 3 different journeys to move from sheet to sheet, or follow the internal links between the sheets, while benefiting from external links to complementary resources. The fact sheets highlight the depth of the new concepts presented, through numerous illustrations and real-life projects.

This manual is aimed at three types of reader:

- 1. Professionals not trained in innovation**, who are convinced that effectively improving some user activities is the ultimate goal, even if one starts with technology, so as to create value for their users and increase profitability for their company.

**Recommended journey:**



**Discovery**



**2. Students who are learning how to manage innovation projects**, who are looking for principles and methods to innovate products, services and organizations, and who would like to start from an ambitious base to innovate in a way that is both useful for users and profitable for the company in the modern age of information processing.

**Recommended journey:**



**Discovery** then



**Exploration**



**3. Innovation professionals, such as Design Thinking (DT)** practitioners, who have acquired the reflexes and mastered the basic tools and processes of user-centred design and who would like to go beyond DT with a more systematic and equipped approach to exploring opportunities for value creation.

**Recommended journey:**

**All!**



# Format

## The journeys

This eBook contains 161 fact sheets, making a total of around 380 pages. You can browse through these sheets following 3 different journeys:

- 1. Discovery journey:** you are new to the RID methodology and/or innovation and would like to discover the main key concepts.
- 2. Exploration journey:** you are familiar with the RID methodology and would like to apply it to a simple case.
- 3. Complete journey:** you wish to acquire all the RID expertise.

32 fact sheets presenting this icon



83 fact sheets presenting this icon



Read all the fact sheets and get ready to experience RID by yourself!



## The links

The beauty of an eBook is that there are lots of links to explore:

- Each fact sheet gives you access to several others via **internal links**. You can surf these internal links.
- A scientific reference generally gives you access to **full-text scientific articles**.
- Click and watch **videos**!
- You may download **RID Micro tools and templates** to use them in your projects.
- You may download the **RID Serious Game**, print it, and try discover the main RID concepts by the game.
- An **exercise booklet** can be downloaded along with the **solutions**.
- **4 RID studies** can be downloaded to observe a study in its entirety



## The eBook's editorial principle

The book's aims at **simplicity**, but also highlights the **depth of the (new) concepts** presented, through numerous **illustrations** and **real-life projects** (one industrial project is used as a common thread throughout the book and a second one is used at the beginning of the book as a popular overview).

# How to read the eBook?

The eBook is divided in sections. Each section contains several fact sheets. Most of the fact sheets occupy a double page. You can read the book chapter by chapter, or by journey (selection of fact sheets associated to a difficulty level), or simply by jumping from one concept to another thanks to the hyperlinks!

The screenshot shows a page from an eBook with several annotations:

- Every fact sheet has a main text located in the top left corner. Always start reading a sheet here!** - Points to the top-left corner of the fact sheet content area.
- Title of the fact sheet** - Points to the title "Reframing - The two tra... to help formulate the...".
- All fact sheets are numbered.** - Points to the large number "43" in the top left of the page.
- Navigate through the chapters and know exactly where you are.** - Points to a vertical sidebar containing various navigation icons.
- Page number (different from the fact sheet number)** - Points to the number "86" at the bottom of the page.

The fact sheet content includes:

- Reframing** involves reformulating the **initial idea** into a more legitimate innovation question: the **ideal goal**. It is of the utmost importance to fix a valuable, consistent and ambitious target in the **fuzzy front-end of innovation**. **Reframing** allows you to define a legitimate box perimeter for **thinking inside the box**. Two tools "flow transfer" and "transformation" help the **reframing process**.
- Where/when in the design stage of the RID idea** and allows you to properly, you must have **knowledge design pro** and variants of the **active**.
- Formulating a reliable front-end**  
Reformulating the innov... you to compare with p... portfolio, markets, bran... trial ecosystem... ) and to... plans to work out if the... **growth territories** for t...
- Why formulating good questions is so important?**  
*"If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask, for once I know the proper question, I could solve the problem in less than five minutes."*  
Albert Einstein



Some fact sheets have a secondary text providing more details.

All fact sheets provide more contents, that vary in nature: illustrations, examples, quotations, diagrams...

Click on hyperlinks to access either another fact sheet, or an external resource (web page or content to download).

# Transformations the ideal goal

## the RID process?

at the beginning of the **problem process**. It is defined from the **initial** determine the **ideal goal**. To do it we started the **investigation** in the process and know the goal, conditions **diversity**.

## relevant question in the fuzzy

ation question/challenge must allow previous company choices (product image, core competencies, industry position with **strategic marketing** question corresponds to identified the company.

### Two tools for formulating the ideal goal



**Example : For what purpose...**

*"Removing dust from a room and the objects therein"*



Dust is defined in the broad sense: organic residues, skin, hair, dust mites, soil, particle size  $\geq x$  microns, marks, pebbles size  $< xx$  mm, liquid. Rooms and objects are considered in a broad sense: flooring (lino, carpet, parquet, tiles, cement slab), ornaments, surfaces that can be uneven, mattresses... Remove dust or wash, remove stains, clean?

This formulation allows us to envisage designing the Dyson DC36 Allergy Parquet which harvests allergens such as pollen, mold, mites and bacteria.



**Example : For what purpose...**

*"Transforming a combination of body signals (coding) into a series of 512 discrete codes (ASCII table) in the form of electrical signals respecting standard ISO-8859 (the ASCII table - American Standard Code for Information Interchange - was invented in 1961 and standardized in 1986)"*



This formulation allows us to envisage designing keyboards like the ones already designed for blind or myopathic people, as well as virtual keyboards.

#### SOURCE

Yannou B., 2011. Réexprimer un besoin idéal, In *Design Innovation : Méthodes, outils, pilotage et cas d'étude, Les fiches pratiques - Edition 2011-2012 - Génie Industriel, eds. Paris: Techniques de l'ingénieur, ISBN 978-2-85059-129-7, pp. 307-315.*



When relevant, all sources are listed in the bottom right-hand corner of the fact sheet. You can access most of the sources on the internet by clicking on the hyperlink.

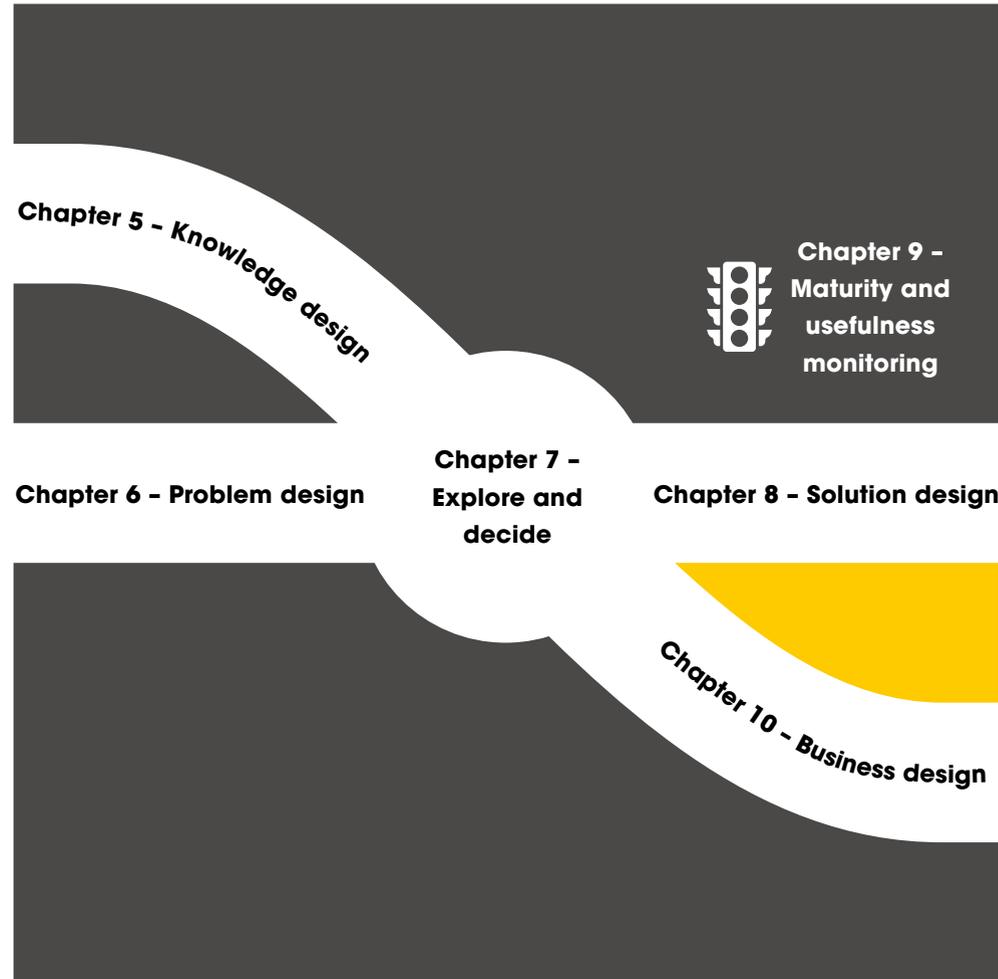
If the fact sheet is part of the Discovery or Exploration trail, navigate easily to the previous or next fact sheet of the trail.

# Table of contents

■ Introduction 	1
■ Chapter 1 – The need for a new innovation methodology 	37
■ Chapter 2 – Introducing important Radical Innovation Design® concepts 	63
■ Chapter 3 – A brief journey in a RID process 	89
■ Chapter 4 – Which activity(ies) to innovate on 	103
■ Chapter 5 – Knowledge design 	121
■ Chapter 6 – Problem design 	147
■ Chapter 7 – Explore and decide 	221
■ Chapter 8 – Solution design 	259
■ Chapter 9 – Maturity and usefulness monitoring 	293
■ Chapter 10 – Business design 	311
■ Conclusion – Summary of RID advantages 	325
■ To go further – Applying RID in practice 	347
■ Appendices – For additional theory	361

**Several chapters** directly refer to parts of the **RID process**.

**Chapter 4 -  
Which  
activity(ies)  
to innovate on**



# Copyright and funding

**Radical Innovation Design®** is a trademark of CentraleSupélec, commercialized by HyB'RID company.

Radical Innovation Design® eBook and all downloadable material:

- Are co-authored by Pr. Bernard Yannou and Dr. François Cluzel.
- The publication of this book has been authorized by **CentraleSupélec** and has been made possible thanks to the support and financial backing of the Department of Libraries, Information and Open Science of the **University of Paris-Saclay**.
- Are licensed under a **Creative Commons Attribution - NonCommercial - NoDerivs Unported License: CC BY-NC-ND**.



CentraleSupélec

université  
PARIS-SACLAY



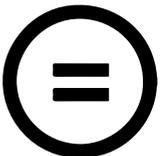


**Attribution** – All CC licenses require that people who use this work credit its authors as requested, but not in any way that suggests that the authors approve of them or their use of it. If you wish to use material from this work without crediting the authors or for approval purposes, you must first obtain their permission. For further details, please refer to the following:

*Bernard Yannou, François Cluzel, “Radical Innovation Design - A systematic and usage-driven innovation methodology to ensure usefulness for users and profitability for companies”, 2024, eBook version 1.0, Université Paris-Saclay, EDP Sciences, Paris, ISBN : 978-2-7598-3066-4.*



**NonCommercial** – You are allowed to copy, distribute, display, perform, and use this work for any purpose other than commercial purposes unless you get the authors’ permission first. This means you cannot author and/or sell a book with excerpts from this work without their our prior permission, but you can use this methodological material for completing RID studies.



**NoDerivs** – You are allowed to copy, distribute, display, and perform only original copies of the authors’ work. If you want to modify their work, you must obtain their prior and express permission.

# The authors: Bernard Yannou



## My background

I am a Distinguished Professor in Innovative Design for Engineers, covering the fields of engineering design, innovation management, and R&D management.

The prisms frequently used in my domain are those of:

- Analysis and expression of needs in a form that can be interpreted by designers,
- Innovative design processes (of the Design Thinking type or, more industrial, Stage & Gate® types),
- Performance simulation tools,
- Techniques for managing complex projects, of concurrent engineering, of modular / robust / inclusive design, and numerical techniques for multidisciplinary and robust optimization.

I am also very interested in the range of approaches to assessing value in the eyes of customers or users and in approaches to the analysis and design of complex systems.

## My motto

***"To make myself useful through the proposal of innovative design methods that enable us to invent desirable new worlds."***

## My observations

In my career, I have often observed major shortcomings in the design practices of innovative systems. Firstly, user expectations are poorly formalized and are almost always averaged, with the different contexts of use often being aggregated. An intelligent approach to user segmentation and a simplified representation of existing and ideal activities were therefore needed. I also found that innovative design methods offered no way of knowing (i) whether it was still possible or desirable to make a little or a lot of progress in an area of innovation, nor (ii) how to define from the outset a competitive innovation positioning in relation to the competitors' existing innovative solutions. My aim was therefore to propose tools for visual analysis of the problem and expectations, as well as for monitoring the design of user value.

## Bernard YANNOU

[bernard.yannou@centralesupelec.fr](mailto:bernard.yannou@centralesupelec.fr)

[bernard@hybrid-innovation.net](mailto:bernard@hybrid-innovation.net)



### Bio

Bernard Yannou is an alumnus of the École Normale Supérieure de Paris-Saclay, with a degree in mechanical engineering. He obtained his doctorate in 1994 on the subject of the automation of systems design at Dassault Systèmes. His research work led him to obtain his *Habilitation à Diriger des Recherches* in 2001, with a thesis on the phases and conditions of the preliminary design of complex systems.

Bernard Yannou is now a Distinguished Professor in the design (and innovation) of complex systems. He heads the Industrial Engineering Laboratory at CentraleSupélec (CS), founding member of Université Paris-Saclay (UPSaclay). He is also deputy director of research at CS, in charge of deeptech entrepreneurship.

In teaching, he has taught courses in 'Design Science', 'Radical Innovation' and 'Management of R&D and Innovation'. He created the final-year minor "Design and Industrialization of Innovative Systems" at CS, and the MS in Complex Systems Engineering at UPSaclay.

In research, he has supervised more than 35 doctoral theses, most of them in industrial contexts. He is the author or co-author of more than 400 peer-reviewed articles, including 90 journal articles. He has also coordinated 10 books on design and innovation of industrial products.

He is the inventor of the Radical Innovation Design® methodology, and he co-founded HyB'RID for which he is Chief Research and Strategy Officer.

# The authors: François Cluzel



## My background

I am a researcher in engineering design, particularly looking at innovative and sustainable dimensions.

To design is, in Herbert Simon's words, to draw up action plans aimed at transforming existing situations into preferred ones; and products and services are, therefore, only useful in these situations. Their use provokes changes and impacts multiple stakeholders and the environment.

As a researcher in product design, I aim to assist industrial organizations and inspire designers to rationally develop products with the best possible impact, namely maximizing usefulness for well-defined beneficiaries while minimizing negative consequences. It means that these products and services must be designed on their entire life cycle (including possible usages) with respect to the planetary boundaries and by taking great care of social implications.

I have developed models, processes, methods, and tools to allow the transition of organizations designing such products and services by questioning the needs, assessing and improving their environmental performance through circular economy strategies. These research objects are designed to be useful for and usable by their users (the product designers!).

## My motto

***"To assist people designing engineered artefacts for human activities by maximizing usefulness and sustainability!"***

## My observations

Most companies designing and delivering products and services still fail to consider multiple dimensions (beyond very technical and economic performance) at the early stages of the design process. The notion of value is often restricted to money and rarely encompasses user-centric, social, societal and environmental considerations. In an innovation process, instead of thinking outside the box with no predefined constraints, there is an urgent need to re-think inside the boundaries required to draft desirable futures. It will ensure the (re-)design of useful and sustainable products and services.

## François CLUZEL

[francois.cluzel@centralesupelec.fr](mailto:francois.cluzel@centralesupelec.fr)

[francois@hybrid-innovation.net](mailto:francois@hybrid-innovation.net)



### Bio

François Cluzel is an assistant professor and head of the Design Engineering research group at Laboratoire Génie Industriel (Industrial Engineering Research Department) at CentraleSupélec, Université Paris-Saclay. He holds a PhD in industrial engineering from Ecole Centrale Paris (2012), a master's degree in industrial engineering from Ecole Centrale Paris (2008) and a mechanical engineering degree from Supméca Paris (2008). He is a member of the Design Society and the French network of eco-design researchers EcoSD.

His research and teaching projects deal with innovation engineering and circular economy. In teaching, he created the final-year specialization "Design & System Sciences" at CentraleSupélec, where he teaches engineering design. He also created several courses on circular economy, eco-design and industrial ecology. He has taught Radical Innovation Design® methodology since 2008 and has coached numerous RID student projects with industrial partners. He has co-supervised 8 PhD theses, most of them in industrial contexts. He has authored or co-authored 24 peer-reviewed journal articles.

Since 2008, he has collaborated with Bernard Yannou in developing the Radical Innovation Design® methodology. He is a founding partner of the start-up HyB'RID, founded in 2018, and he is currently the company's Chief Operation Officer.

# Acknowledgements

## Special thanks to ...

### ... people who contributed to inspire this work

Alexandre Bekhradi, Benjamin Zimmer, Claudia Eckert, Emilie Vallet, Flore Vallet, Guillaume Lamé, Jean-Sébastien Gros, Lucile Picon, Marija Jankovic, Michele Gatti, Olivier Feingold, Patrick Ternier, Pierre Talbot, Robin Lecomte, Romain Farel, Roman Weil, Thierry Devèze, Tom Formont, Yiming Ma

### ... long-standing collaborators in tutorial supervision

Aurélie Randazzo, Hanen Kooli-Chaabane, Isabelle Nicolai, Michael Saïdani, Ouail Al Maghraoui, Sarra Fakhfakh, Titouan Levard, Vincent Holley, Yann Leroy, Yasmine Salehy, Youssef Damak

### ... long-standing industrial partners

Adryana Brutails, Alexis Roche, Antoine Vallette, Aurélien Pauriche, Catherine Papillon, Cedric Delbos, Cédric Hutchings, Christophe Larue, Christophe Remontet, Clément Houlier, Dorothee Chaillou, Éric Julier, François Lelièvre, Georges de Pelsemaeker, Gilles Le Calvez, Gilles Rougon, Guy Caverot, Jérôme Arnaud, Laëtitia Del-Fabbro, Laurent Miralles, Laurent Monet, Michel Caplot, Nathalie Gouget, Olaf Maxant, Olivier Sellès, Pascal Doré, Pierre Abou, Rebiha Bacha, Sara Aid, Thierry Delahaye, Yves Page

**... some of the brilliant students and colleagues who took part in the RID studies for this eBook**

Aleksandrs Kohno, Alexandre Morel, Alicia Pommelet, Andrea Schirato, Antoine Dupont, Antoine Marchand, Camille Audra, Caroline Miribel, Christian Soukoundjo, Clarys Citounadin, Devang Thakkar, Emmanuelle Mörch, Evren Sahin, Fabio Antonialli, Ghani Sbihi, Ilyas Benadada, Ismail Tahri, Jeremie Hemmert, Laura Honig, Laure Gatin, Laurène Schuster, Louis Niffoi, Luca Benini, Naila Abdelatif, Nathalie Bui, Nicolas Klaeyle, Nikolina Gendre, Pierre-Alexis Ngo, Quentin Warcollier, Terry Huang, Tobias Lang, Zyad Tabat

**... the proofreaders, graphic designers, editors, translator, sponsors  
and supporters who contributed to the publication of this eBook**

Benoît Dabouis, Christelle and Bertrand Defretin, Flore Vallet, France Citrini, Hélène Huard, Maël Ninu, Marie-Estelle Créhalet, Nathalie Lac, Roland Cahen, Steve Brown, Victor Paschenda, Vincent Boccara

**... you, for your patience and love**

Gwenola and Elena

# 01

## What is innovation?



**Front-end innovation** is both a process and an outcome, in which **something new** is **created** that brings **value** to particular **people**.

**Innovation** is considered synonymous with **design** when of novelty factor is high.



**Creating / Designing** – One should be able to use a process, tools, methods and even **methodologies** to converge towards a satisfactory **outcome**, starting from the situation actually experienced by people.

**Something** – How to represent, name, or describe the **outcome** of an **innovation** process? Are the different **innovation** outcomes of different nature and, if so, do we need to use a different creation/design methods, depending on the nature of the expected outcome?

**New** – To appreciate that something is novel, one must use models to characterize the nature of the **innovation** and metrics to measure the **intensity of the innovation**. You must also ensure that this **newness** is desired and desirable.

**Value** – **Newness** is not enough to guarantee value. How do you assess that this **newness** could improve something?

**People** – Value created by an **innovation** may be beneficial to users, customers, company development, company employees, company shareholders, investors, existing value chain actors, nations...

## Need for a new innovation methodology

- **Solution representation:** Represent the outcome of an innovation process
- **Universality:** Get a universal innovation process or methodology whatever the nature of the resulting innovation outcome
- **Newness appraisal:** Appraise the newness of the outcome
- **Value measurement:** Measure the value brought to people
- **User categorization and prioritization:** Identify the categories of people that you want to serve as a priority



# 10

## Design Thinking in practice

### Verbatims collected from Chief Innovation Officers

"I'd like to go **BEYOND the shallow user experience** with a consideration of his/her **full activity in situations**"

"Usually, due to industrial pressure, we spend **too LITTLE time in problem setting** and we have **poor learning coming from this problem exploration**"

"**TOO MANY trials and errors** to find the right innovation"

"I **DO NOT** really put my feet in the shoes of my current, non- and future customers to **simulate their future augmented activity**"

"We generally **FAIL to sufficiently explore** when innovating and we **lack traceability** of this exploration"

## Verbatim collected from Chief Innovation Officers

"**TOO MUCH data to manage to innovate** (customers' usage, preferences, competition...)"

"I have **NO metrics and dashboards to co-decide under uncertainty**"

"We do **NOT** have a **culture of innovation**"

"It is **DIFFICULT** to find innovations **aligned with technology and market road mappings** of our company"

## Need for a new innovation methodology

- Aid to collect and leverage **user data**
- Aid to **explore problems and solutions**
- Aid to imagine **users in their everyday activity** and lives
- **Metrics and dashboards** to collectively understand and decide

# 13

## Activity



**Activity** is at the core of RID's approach to innovation.

As designers, we propose to apprehend the world around us through **people of different kinds (user profiles<sup>1</sup>)** who practice an **activity**, itself made up of different **moments/episodes/scenes (usage situations)** during which people experience different **pains/dissatisfactions** or have **expectations (problems)** that are more or less taken into account by existing **solutions**.

1. Note that user profiles can be generalized to systems, components or other non-living stakeholders



Users all have their own **way of practicing** an **activity**, of being **satisfied** or **frustrated** with it, of using **particular solutions**, adapted or not, to do so.



A universal solution never fits all. A particular solution suits a **category of people** at a **given moment**. Knowing how to identify **situations** where there are no **effective solutions** is fundamental to **useful** and **profitable** innovation.

In RID, it is possible to model the state of (a) **current activity**, (b) **ideal activity**, (c) **augmented activity** thanks to a useful innovative solution, by modeling the mosaic of usage situations experienced by users of different profiles and experiencing problems or degrees of satisfaction according to the existing solutions used.

# 20

## RID – The intermediate process



At an intermediate level, the **RID process** is broken down into two **Problem Setting** and **Problem Solving** sub-processes, made of **8 elementary stages**. Another view is the **“Observe & Learn”, “Explore & Decide”, “Ideate, Design & Assess”** breakdown — the central “Explore & Decide” stage being at the end of the Problem Setting sub-process, and representing a kind of control tower between the problem that has been selected and the appropriate solution to be designed.

### OBSERVE & LEARN

1

Which activity would you like to augment?



2

Investigate activity



3

Build a cognitive model of how people live today's activity (or a component interacts in a system)

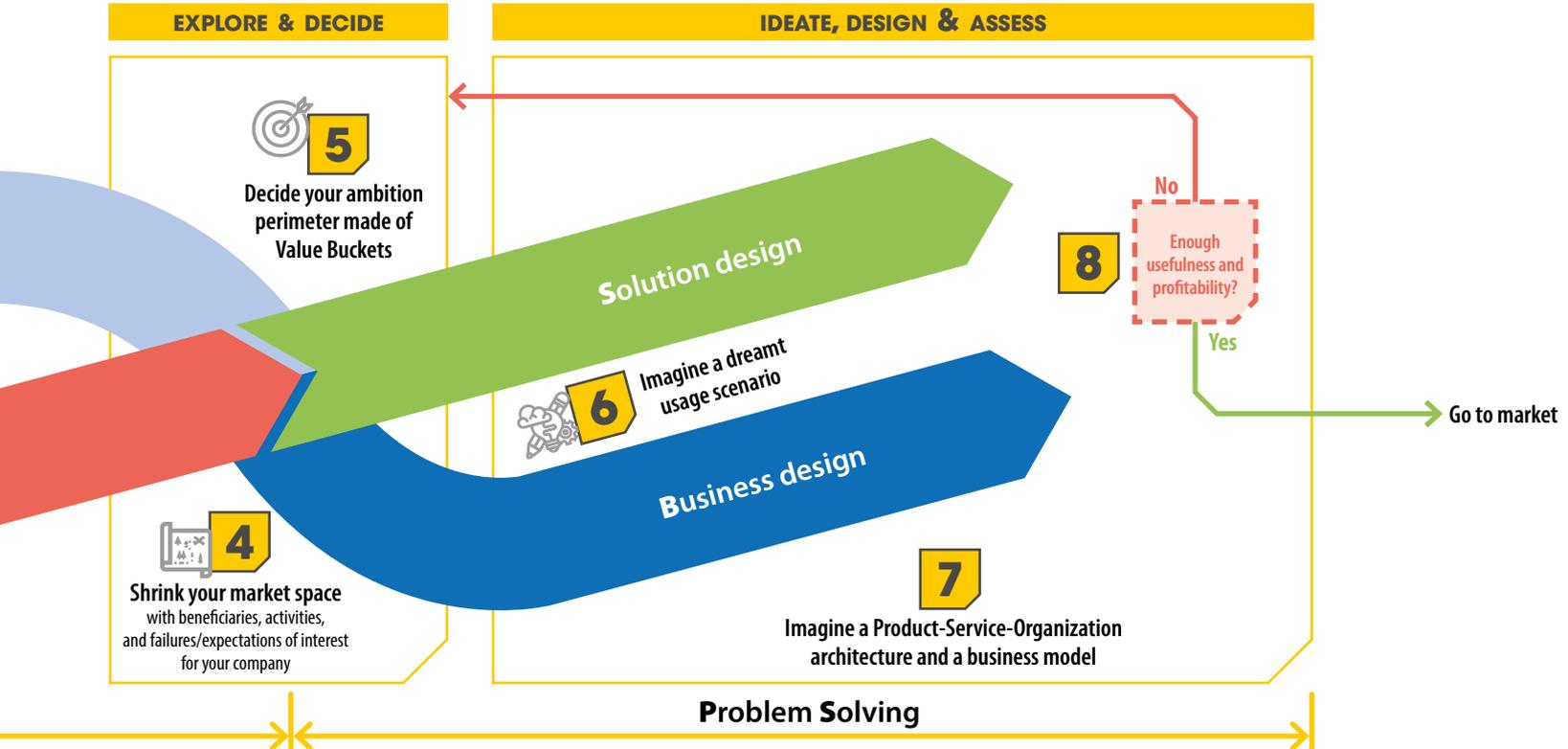
Knowledge design

Problem design

Activity Exploring

Problem Setting

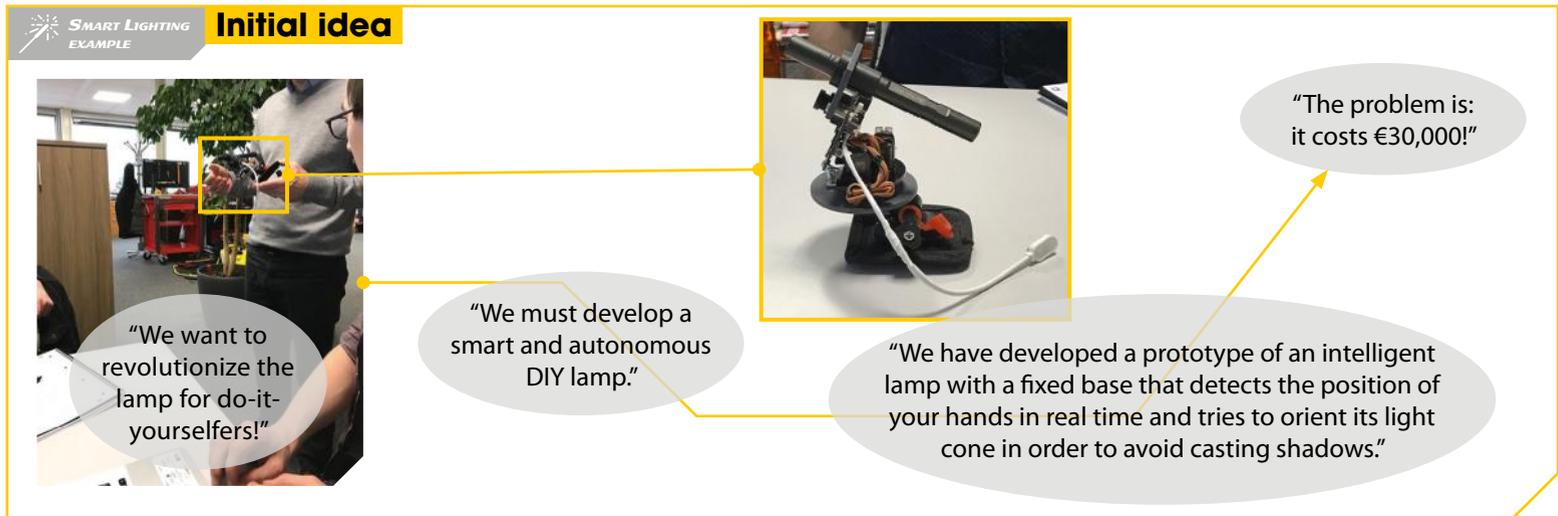
## The problem setting and problem solving sub-processes & the 8 stages



# 24

## Evaluate initial ideas carefully!

**The RID process presented in this chapter is a real example.** An innovation manager of major international household hardware company asked us to rethink a lamp for do-it-yourselfers. Which can appear as a vain injunction (see **nature of an idea**) as such an expression is not based on something tangible...



# 25

## Define an activity

Define the **activity** as a system boundary and don't be influenced by current product segmentation when considering user categories. The **ideal goal** corresponds to when the **activity** outcome performance is set at 100%.

 **Activity, ideal goal and (non-)users**

Bring additional light to perform a task

Define activity boundary

Optimize the comfort of vision in the realization of a task without restraining movements and attention

Define ideal goal of activity

All these users need an additional lamp to perform their activity

Define user categories (user profiles)

**Ground observations and interviews:** dentists, electricians, mechanics, plumbers, plasterers, truck drivers, sewer inspectors, firemen, surgeons, security agents, DIY activities, sport activities

Generate **observation sheets** and **books of knowledge**

Investigate all the sub-activities or activity variants

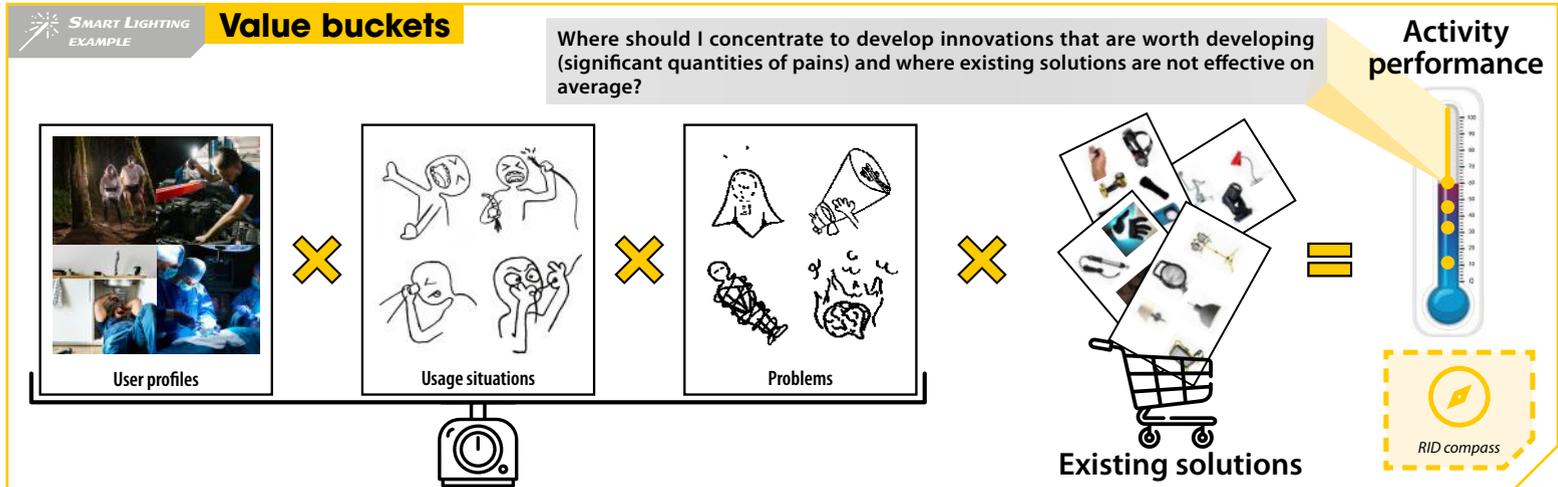
# 32

## Value Buckets

### A second decision-making set of indicators

We invented **value buckets** to precisely express high value and differentiating innovation leads in order to start ideation with qualified questions.

**Value Buckets** are areas (*users, situations, problems*) with an intensity that is both proportional to the amount of pain and inversely proportional to the average effectiveness of existing solutions. **They indicate where you can create relative and specific usefulnesses.**



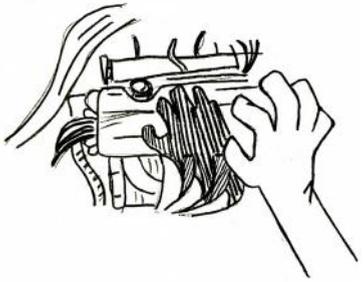
# 33

## Ambition perimeter

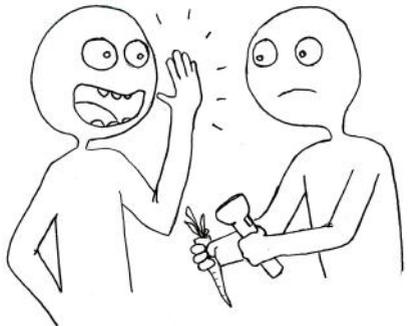
The subset of selected value buckets that the company finds strategically adapted to its growth is called an **ambition perimeter**.

An **ambition perimeter** is much more valuable and justified than a traditional marketing brief, since the systematic RID problem setting stage and its metrics and algorithms guarantee its legitimacy.

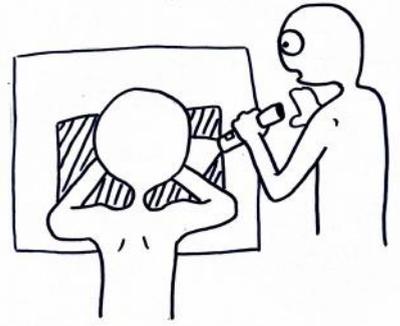
 SMART LIGHTING EXAMPLE **Ambition perimeter**



Being able to manipulate an object precisely without casting shadows



Being well lit while manipulating an object precisely with both of my hands

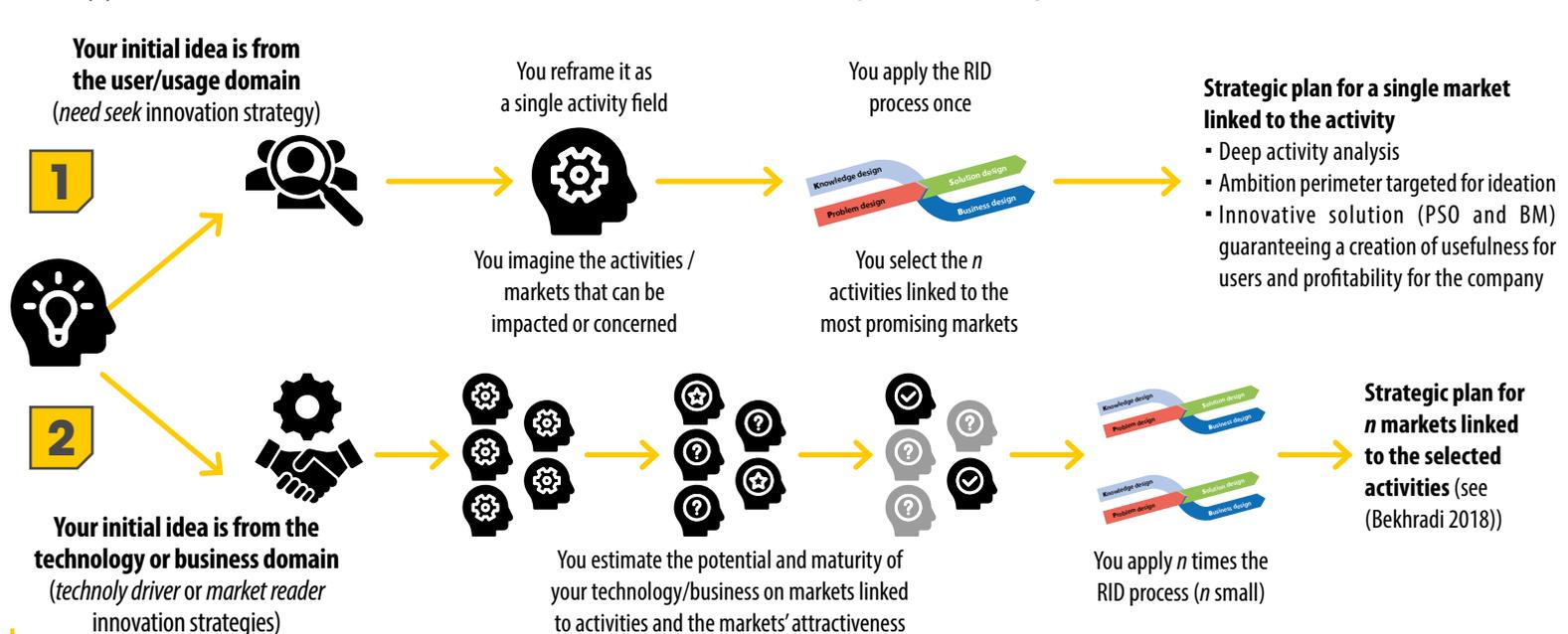


Being able to manipulate an object precisely without the help of another person with a light

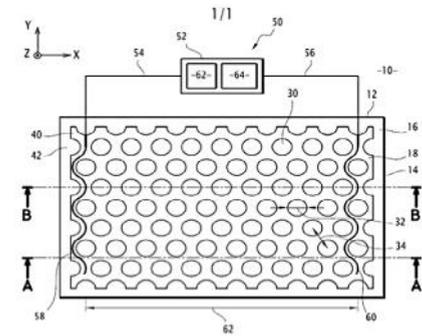
# 40

## What to do when your initial idea comes from the technology or business domains?

In RID, by default (outlined in *case #1* below and in the following of the present eBook), your initial idea is from the user/usage domain. But, in case where your initial idea is from the technology or business domain (outlined in *case #2* below, and cf. example on the right-hand page), you must re-express your initial idea(s) into **one or several activities** of interest to investigate, leading to several RID studies in practice.



## Example of **2** an initial idea from the technology domain: *LOMA Innovation*



Innovate on products linked to body shapes using the LOMA technology



Patented shape-shifting technology



Brainstorm on useful body shape applications

Ability to cover bony parts of the human body  
 Ability to immobilize parts of the human body  
 Ability to cover foldable parts of the human body  
 Adaptation to complex and polygonal surfaces  
 Speed of shape shifting  
 Practicality in terms of volume  
 Hardness of the deformable surface  
 Acceptability for a long-term contact with skin  
 Ability to vary the thickness of the deformable surface  
 Number of possible shape shifting  
 Possibility to set the heat threshold (thermal comfort)

List the key properties of a shape-shifting technology linked to body shape applications



Fast selection of promising markets

- M1) Cosmetic Masks
- M2) Shin Guards
- M3) Ski Boots
- M4) Orthopedic Insoles
- M5) Earphones

Evaluation of needed and *current* technology maturity for markets

Evaluation of markets attractiveness



Two RID studies

R&D activity



What LOMA innovation launch on the market

### SOURCE

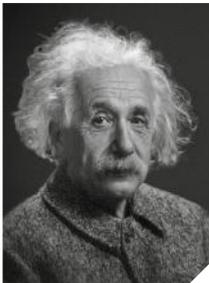
Bekhradi A. Planning technology maturation by exploration of useful problems in markets: The case of innovative startups. PhD thesis, Université Paris-Saclay (2018).

# 43

## Reframing - The two transformations to help formulate the ideal goal

**Reframing** involves reformulating the **initial idea** into a more legitimate innovation question: the **ideal goal**. It is of the utmost importance to fix a valuable, consistent and ambitious target in the **fuzzy front-end of innovation**.

**Reframing** allows you to define a legitimate box perimeter for **thinking inside the box**. Two tools “flow transfer” and “transformation” help the **reframing process**.



**Why is formulating good questions so important?**

*“If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask, for once I know the proper question, I could solve the problem in less than five minutes.”*

Albert Einstein

**Where/when in the RID process?**

**Reframing** takes place at the beginning of the **problem design** stage of the **RID process**. It is defined from the **initial idea** and allows you to determine the **ideal goal**. To do it properly, you must have started the **investigation** in the **knowledge design** process and know the goal, conditions and variants of the **activity**.

**Formulating a relevant question in the fuzzy front-end**

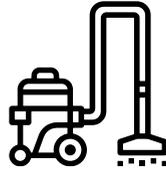
Reformulating the innovation question/challenge must allow you to compare with previous company choices (product portfolio, markets, brand image, core competencies, industrial ecosystem...) and to with **strategic marketing** plans to work out if the question corresponds to identified **growth territories** for the company.

## Two tools for formulating the ideal goal



### Example: For what purpose...

*"Removing dust from a room and the objects therein"*



Dust is defined in the broad sense: organic residues, skin, hair, dust mites, soil, particle size  $\geq x$  microns, marks, pebbles size  $< xx$  mm, liquid. Rooms and objects are considered in a broad sense: flooring (lino, carpet, parquet, tiles, cement slab), ornaments, surfaces that can be uneven, mattresses... Remove dust or wash, remove stains, clean?

This formulation allows us to envisage designing the Dyson DC36 Allergy Parquet which harvests allergens such as pollen, mold, mites and bacteria.



### Example: For what purpose...

*"Transforming a combination of body signals (coding) into a series of 512 discrete codes (ASCII table) in the form of electrical signals respecting standard ISO-8859 (the ASCII table - American Standard Code for Information Interchange – was invented in 1961 and standardized in 1986)"*



This formulation allows us to envisage designing keyboards like the ones already designed for blind or myopathic people, as well as virtual keyboards.

### SOURCE

Yannou B., 2011. Réexprimer un besoin idéal, In Déployer l'innovation: Méthodes, outils, pilotage et cas d'étude, Les fiches pratiques - Edition 2011-2012 - Génie Industriel, eds. Paris: Techniques de l'Ingénieur, ISBN 978-2-85059-129-7, pp. 307-315.

**Deep knowledge** (DK) is all the useful information related to the **design of the problem**. It is all the knowledge you would have if you were omniscient. In particular, it is any information related to **user activities**, or that could formulate an innovation lever. **Deep knowledge** often refers to scientific disciplines such as medicine, biology, psychology or sociology.

### **Deep knowledge** creativity session

The creativity session conducted for gathering DK in the **knowledge design** process is driven by the following idea: *“picture what you would like to know”*. DK items are selected for further **investigation** by considering the tradeoff between their priority and their time and cost of acquisition. The *“Design your Knowledge”* board serves this purpose.

### **An example of deep knowledge**

Imagine that the **ideal goal** of an innovation project is to “eradicate dandelions from an individual’s lawn”. An obvious DK item would be:

- *different ways to eradicate dandelions: mechanical, chemical, heat/fire, bugs...*
- But don’t forget to investigate:
- *finding the best botanical research on growth and diseases of the dandelion*
  - *different ways of valuing dandelions.*





## Deep knowledge (DK) checklist

What are we looking for?

- **Usage (activity fields** or existing usages and practice(s); user habits, cognitive processes, states of mind, experiences, stakeholders other than users..., **usage situations** and contexts)
- **Problems /“pains”** / dissatisfactions / frustrations /weak performances / needs... and, conversely, satisfactions, expected values, activity KPIs...
- **Consequences** of the problems
- **Causes** of the **problems**

What already exists?

- **Benchmark** of **existing solutions** and technologies
  - What are the existing or emerging products / services for the identified ideal goal?
  - Marketed solutions / costs
  - Technologies (maturity, manufacturers, quality, patents, costs...)
  - Scientific issues and expertise
- **Market survey and business models**
  - What are the innovations / manufacturers / strategies / markets / product lines?
  - What expertise do the customers and the sellers have? Or partners with an **open attitude of innovation**
  - Which **innovation strategies**?
  - Which network of people inside and outside the company?
- **Effectiveness and efficiency** of these **existing solutions**, technologies, markets and **business models**

### SOURCE

Yannou B., Lamé G., Cluzel F., 2018. Adapting the FBS model of designing for usage-driven innovation processes, *In IDETC/CIE 2018: International Design Engineering Technical Conferences / CIE: Computers and Information in Engineering, August 26-29, Quebec City, Quebec, Canada.*

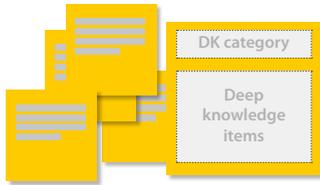


## “Design your knowledge” board



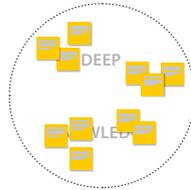
### Design your knowledge!

1



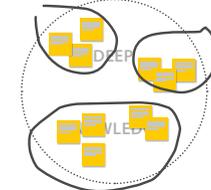
Each participant must find the maximal number of Deep Knowledge items in relation with the innovation topic in 5mn. Write them on post-it notes (one idea per post-it) and indicate the Deep Knowledge category of the checklist.

2



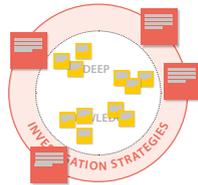
Place all your post-its in the inner circle of the template. They can be reorganized, deleted or merged. New post-it notes can be added along the team brainstorming.

3



The clusters of Deep Knowledge notes constitute a “Deep Knowledge bag” to dig in to.

4



With post-it notes of another color, your team must now define a set of Investigation Strategies that you place in the outer circle of the template. You can use the “Investigation Strategy” checklist for inspiration and for categorizing an appropriate action/strategy that may be useful to investigate one or more Deep Knowledges. Relate each Investigation Strategy to the subset of investigated Deep Knowledge items.

5



Gather “Investigation Strategies” which logically should be considered together and administrated by the same project leader and sub-team. The so-called Investigation Breakdown pieces are assigned to a project leader and a sub-team. Each sub-team must now produce a corresponding Book of Knowledge within the planned duration. Name it and recapitulate the order of actions/strategies to undertake for that purpose.

## Given that:

- Each Investigation Strategy (IS):
  - has a **duration**
  - has a **cost**
  - is likely to provide more or less **reliable information/response** to the concerned deep knowledge
  - contributes differently** to the acquisition of knowledge or not
  - is compatible with the existing or expected **open innovation network** of the company
- Time and human resources** are limited
- Deep knowledge is of **relative relevance** as an innovation lever

## Then:

- A **trade-off** is required to select a portfolio of Deep Knowledge items and Investigation Strategies to investigate
- This trade-off is necessarily **controlled** and **monitored**



## Design your knowledge!

### GOAL

"Design your Knowledge!" is a tool for naming deep knowledge relevant to investigate, starting from a targeted activity in a RID process.

### RID CONCEPTS TO MANAGE

Deep Knowledge  
Investigation strategies  
Books of knowledge

### MATERIALS

**Deep knowledge Checklist**  
Helps you find the DK category



### Design your knowledge!

#### DEEP KNOWLEDGE

The inner circle is for the purge. Write a knowledge you need to gain in relation with the topic on a Post-it note. Indicate its category at the top of each one from one of the following.

Usage Activity fields / User habits / Problems / Situations  
Consequences of problems  
Causes of problems  
Existing solutions & technologies Commercialized solutions / Costs / Maturity / Patents  
Markets and business styles Strategy / Skills / Partners / Innovation policy

**Investigation strategy Checklist**  
Helps you for categorizing an appropriate action/strategy that may be useful to investigate one or more Deep Knowledges

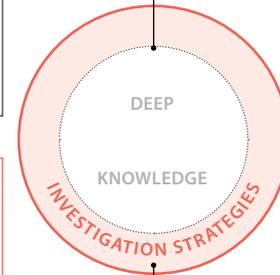


#### INNOVATION STRATEGIES

By merging and gathering the knowledge you identified, you found the deep knowledge you need to investigate; Define your investigation strategy from the list below and place a Post-it note near each cluster of knowledge.

**Watch**  
Access and read document inside/outside company  
Find an expert  
Professional exhibition  
Interview / Survey of users / Experts  
Model and simulate  
Assess  
Experiment  
Prototype

Inner circle  
Deep Knowledge area



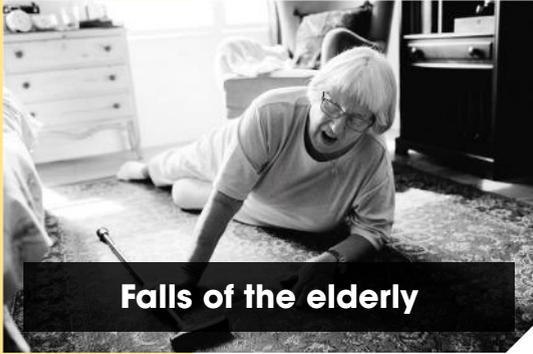
Outer circle  
Investigation strategies area



Major elements of **5 real RID studies** are made available to the reader, with further development.

- **“Mobility in Grand Paris”** served as the storyboard of the RID serious game, and as a use case for a PhD thesis (Ma et al, 2023)
- **“AutoNOM project”** served to change the care in France of (elderly) patients suffering from orthopedic deformities due to neurological pathology.
- **“Falls of the elderly”** study was detailed in a journal publication (Lecomte and Yannou, 2024)
- **“Cleaning solar panels”** led to a complete innovative PSO solution for cleaning solar farms in the desert. This example is also the most extensively detailed in this eBook.
- **“Book machine”** The “book machine” is an analysis of the needs of the book printing activity on campus and in the vicinity of the University of Paris-Saclay, and an aid to the choice of solutions, on behalf of the Lumen Learning Center, the university library revisited in the digital age.





**Falls of the elderly**



**Cleaning solar panels**



**Book machine**

**SOURCE**

Ma Y, Vallet F, Yannou B., Cluzel F., 2023. Tools to help teachers and designers complete individual tasks when co-designing industrial engineering games - Application to the design of an innovation management game. *European Journal of Engineering Education*.

Yannou, B., Lecomte, R., & Cluzel, F. (2024). RID journal paper – RID comparator and Cleaning solar panel study (Version V1). Zenodo.

# 78

## Cognitive model

### Build a **cognitive model** of how people experience current activity (or a component in a system)

Once the parameterization of the activity has been completed, the **cognitive model** is built using **seven questions** on one, two or three activity dimensions at a time (among user profiles, usage situations, problems, existing solutions).

**These questions are very simple**, and experts and users are appropriately queried on specific questions to contribute to a systemic representation of the activity practice.

We use **seven semi-quantitative measurement scales to intuitively answer these questions**. For instance, we often use scales from 0 for “never” or “no importance” to 5 for “frequently” or “very important”, or we can decide to use a percentage between 0 and 100% if more natural.

In practice, ten matrices – of 1, 2, or 3 dimensions – are completed. They all have a specific designation. Three matrices, denoted (Ref)\* permit to consider that all user profiles are behaving and perceiving the same manner, which allows to get more immediate results. Conversely, **one can refine user discrepancies as finely as necessary** with the three no-star matrices.



COGNITIVE MODEL OF THE ACTIVITY

GENERAL ACTIVITY

What is the proportion of each user profile or the importance given to them in the activity?



User profiles

1 (Upsize)



Usage situations

How often can this problem (of a given level/intensity) occur during this usage - regardless of the user, or for each user specifically -?

2 (WWRef) 3 (WWi)



Problems



User profiles

How long or how important are the current or desired usage situations - regardless of the user, or for each user specifically-?



Usage situations

4 (UsizeRef)

5 (Usize)



User profiles

How severe is this problem in terms of dramatic consequences - regardless of the user, or for each user specifically-?

6 (PimpRef)

7 (Pimp)



Problems



User profiles

ADHERENCE TO SOLUTIONS

To what extent does this solution eliminate or mitigate this problem?



Existing solutions

8 (Esp)



Problems

To what extent does this solution facilitate this usage?



Usage situations

9 (UsEs)



Existing solutions

How effectively does this user access and use this solution?



User profiles

10 (UpEs)



Existing solutions

# 94

## The quantities of pain... for dummies

An elementary **quantity of pain** is a portion of **problems** experienced by a given user in a given **usage situation**, and which can be partially or totally lessened by a given **existing solution**.  
The diagram below on the activity “*Cooking and enjoying French fries*” displays matrices of quantities of pain at 3 different stages.



**Activity:** Cooking and enjoying French fries

Knowledge Design

Problems	Usage situations
Too much fat	Digestion and Assimilation
Deteriorated oil	Storage and Cooking
Odours	Cooking and Warehousing
Burn injuries	Cooking
Fire start	Cooking

Mapping problems and usage situations, in general, whatever a particular solution.



Some **existing solutions** have the **“ability to lessen some quantities of pain”**, i.e. some problems in a given situation for a given **user**.

	Too much fat	Deteriorated oil	Odours	Burn injuries	Fire start
Digestion	Dark	Light	Light	Light	Light
Assimilation	Dark	Light	Dark	Light	Light
Storage	Light	Dark	Light	Light	Dark
Cooking	Light	Dark	Dark	Dark	Dark
Warehousing	Light	Light	Dark	Light	Light

Maybe we should try to specifically innovate on this!  
The matrix of **value buckets**

	Too much fat	Deteriorated oil	Odours	Burn injuries	Fire start
Digestion	Dark	Light	Light	Light	Light
Assimilation	Dark	Light	Light	Light	Light
Storage	Light	Dark	Light	Light	Light
Cooking	Light	Dark	Dark	Dark	Dark
Warehousing	Light	Light	Dark	Light	Light



**SEB**



A disruptive **“need seeker”** innovative solution:  
**Actify by Seb/Tefal**

The What's Wrong **WW** matrix that expresses the **“initial quantities of pain to be removed for considering an ideal activity”**

	Too much fat	Deteriorated oil	Odours	Burn injuries	Fire start
Digestion	Dark	Light	Light	Light	Light
Assimilation	Dark	Light	Dark	Light	Light
Storage	Light	Dark	Dark	Light	Dark
Cooking	Light	Dark	Dark	Dark	Dark
Warehousing	Light	Light	Dark	Light	Light

**SOURCE**

Bekhradi A., Yannou B., Cluzel F., Vallette T., 2017. Categorizing users' pains, usage situations and existing solutions in front end of innovation: The case of smart lighting project, In 21st International Conference on Engineering Design (ICED), August 21-25, Vancouver, Canada.



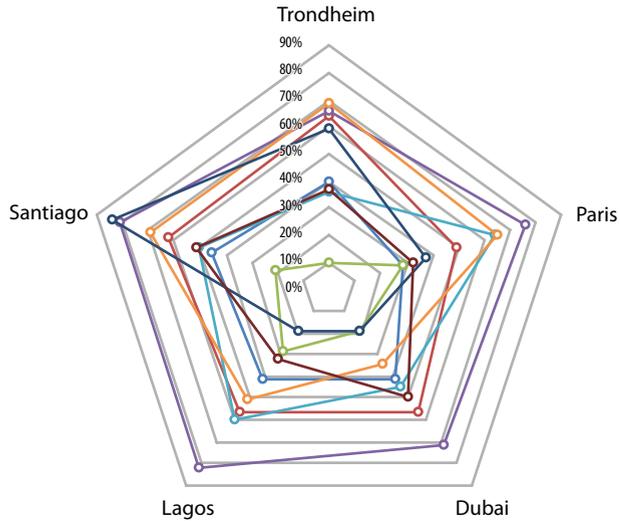
RID comparator

Effectiveness of solutions for usage situations	Trondheim	Paris	Dubai	Lagos	Santiago
Manual tools	40%	29%	41%	41%	45%
Mechanized tools	64%	49%	56%	56%	62%
Installed hydraulic systems	10%	29%	19%	29%	21%
Installed robotic systems	66%	76%	71%	82%	81%
Autonomous robots	36%	64%	45%	60%	50%
Coating system	69%	65%	34%	51%	69%
Venturi method	59%	37%	19%	19%	84%
Ampere method	37%	32%	49%	32%	51%

## Analysis

**The second indicator reveals the effectiveness of the existing solutions against the usage situations, and vice-versa:**

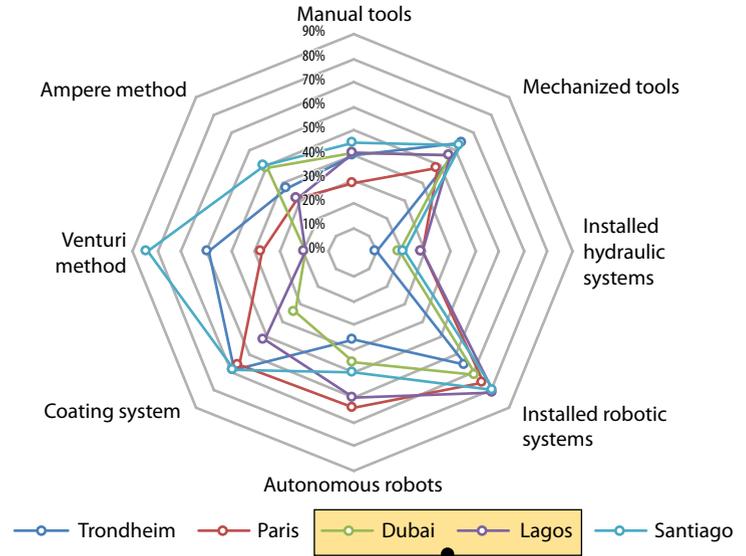
- The *Venturi method* works well in Santiago since it is a windy area.
- *Coatings* are useful in Santiago, Trondheim and Paris because cementation of dust does not occur.
- The *installed robotic systems* are a valuable technology for almost all the usage situations.
- *Autonomous robots* are suitable for an industrial environment like Paris, usually panels are positioned horizontally, and the dust can be easily removed.



- Manual tools
- Installed hydraulic systems
- Autonomous robots
- Venturi method
- Mechanized tools
- Installed robotic systems
- Coating system
- Ampere method

## Effectiveness of solutions against usage situations

## Effectiveness of usage situations against solutions



- Trondheim
- Paris
- Dubai
- Lagos
- Santiago

**Decision to shrink the market place**

Looking at the usage situations, Dubai is the archetype facing the biggest problems. Low humidity, low rainfall and high presence of dust in the air characterize the location. In addition, Lagos suffers also a lot of troubles. For these 2 locations, there is no satisfactory solution in average and there is a lot of quantity of pains remaining.

**We decide to shrink our window of attention to them.**

## The tennis wheelchair RID study



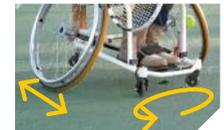
**Value bucket #1:** significant delay before being in position for receiving the ball **due to** her right hand grasping the tennis racket and moving the wheel at the same time

Does not have a racket in hand when seizing the two hand rims of the chair. Racket "retracts" temporarily.

Able to release her right hand holding the racket at any time by allowing the left hand to control the two wheels.



Emmanuelle positions herself behind the baseline and prepares to serve. She activates a system for blocking the rotation of the two caster wheels. The serve does not provoke any twist but automatically releases the blocking system, allowing her to push the hand rims propelling her on the court.



**Value bucket #2:** loss of power during service partly **due to** the observed wheelchair twist

**Ambition perimeter**

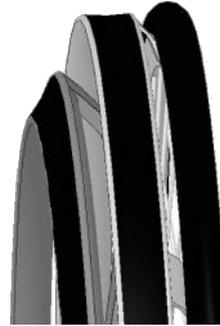
**Dreamt usage scenarios**



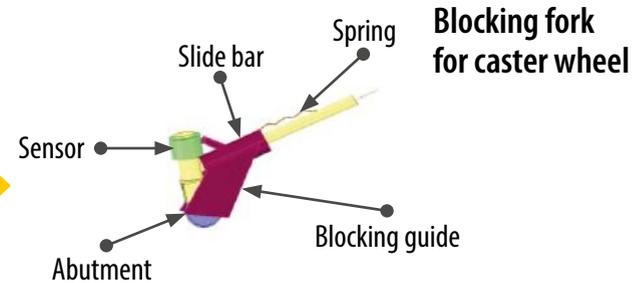
**Scenario creativity**



**Magic glove for storing racket on back side**



**Two-rim system for left hand wheel**



**Blocking fork for caster wheel**



## Concept creativity

### SOURCE

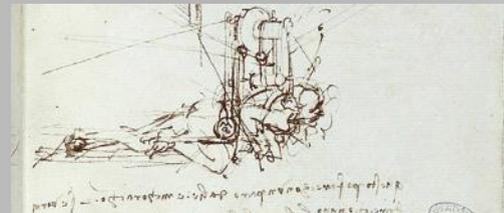
Yannou B., Cluzel F., Farel R., 2016. Capturing the relevant problems leading to pain and usage driven innovations: the DSM Value Bucket algorithm. *Concurrent Engineering - Research And Applications* (CERA), 1-16.

A **dreamt usage scenario** is a usage scenario of the **future desired activity** where the desired effects are illustrated in narrative form, without describing the entire solution. The dreamt usage scenario is like a **fairy tale**, where there is a happy ending without any problem during the activity. In RID, dreamt usage scenarios are produced in the **scenario creativity** stage at the beginning of the **solution design** sub-process.

### Some advice for a good description of a **dreamt usage scenario**:

- Be ambitious when dreaming
- Do not talk about the solution, nor describe its actions too precisely
- It is better to describe the universe in which the solution will exist and how this universe harmoniously evolves to achieve the activity
- Describe the atmosphere
- You might already be able to segment customers and set a price

**Leonardo da Vinci** wrote about how a pilot of a glider machine with nacelle could feel, moving himself in a nacelle to the right or to the left so as to move the center of gravity, then tilting the wing to the side of the displacement. He imagined how we could drive a hang-glider by using our knowledge of the pendulum equilibrium principle.



**Dreamt usage scenario** corresponding to activity “becoming bored in a retirement home”



While the elderly can no longer bend down to garden, a piece of the garden could be brought up to the right height, and the elderly could then garden alone or in groups, sitting or standing



The elderly could proudly show their little garden to their grandchildren and even share this activity with them. An elderly person could also start a horticultural club and give gardening lessons to other people in the retirement home or to others in the community.



When winter arrives, the elderly will be able to continue their passion by bringing their gardens into their heated homes.

**Steve Jobs speaking of the revolutionary user interface of the first iPhone at MacWorld 2007:** *“So let’s not use a stylus. We’re going to use the best pointing device in the world. We’re going to use a pointing device that we’re all born with - born with ten of them. We’re going to use our fingers. We’re going to touch this with our fingers. And we have invented a new technology called multi-touch, which is phenomenal. It works like magic.”*



**The AutoNOM RID study**



Video illustration (stop motion technique) of existing usage scenarios



**Innovative design**



Video illustration (stop motion technique) of a dreamt usage scenario

**UNPC stands for Usefulness -  
Newness - Profitability - Concept.**

The **UNPC innovativeness indicators** were created to assess, as early as possible, the **value** and the **maturity** of **ideas, scenarios** and **concepts** in a RID process, in order to make informed decisions about whether to continue with them and how to further develop them. **Usefulness** corresponds to the **expected gain of global effectiveness that** an innovative solution can provide compared to existing solutions. It is the most important indicator.



**When to use it?**

**UNPC** is a smart model for shaping the **innovation funnel** (see **SAPIGE® method**). UNPC assessments can also be performed:

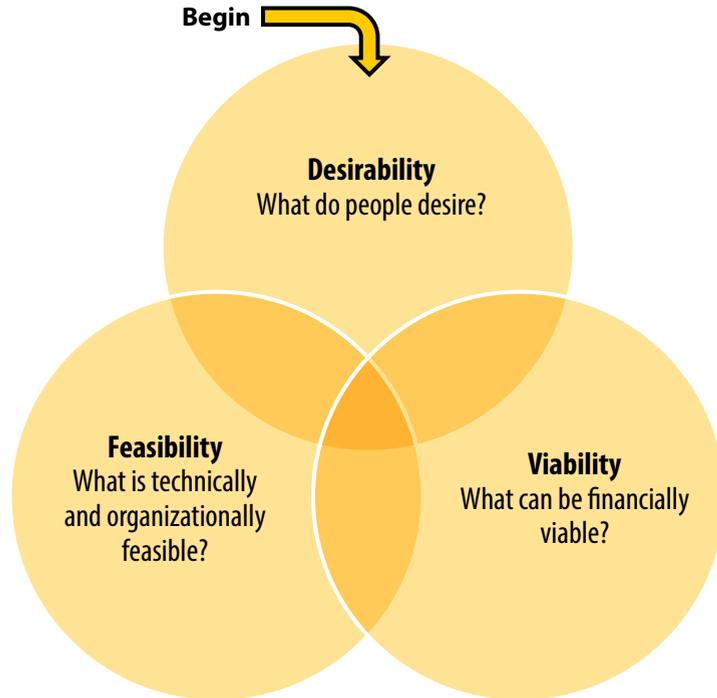
- to compare **ambition perimeters**,
- to operate the **BMC-RID** method,
- for **scenario creativity** and **concept creativity** stages to select and mature **ideas, dreamt usage scenarios** and **concepts** thanks to the **UNPC monitor** tool,
- to assess the chosen solution systematically in the **innovation dossier**.

**What is the difference with Design Thinking indicators?**

Design Thinking (DT) indicators, which are **Desirability – Viability – Feasibility**, substantially differ from **UNPC** indicators. In DT, desirability corresponds to the achievement of the “wow effect” and is also close to our **Kano survey**. It reflects a consumerist **philosophy of innovation** while RID emphasizes **usefulness** in activity contexts, a usefulness that cannot necessarily be expressed by consumers alone.

## The Design Thinking innovativeness indicators

Adapted from IDEO Human Centered Design Toolkit



## The UNPC innovativeness indicators

Begin	<b>Usefulness</b>	<i>That's useful! (Important value buckets)</i>
	<b>Newness</b>	<i>It's new! (patents, usage)</i>
	<b>Profitability</b>	<i>It's profitable for the user and the company!</i>
	<b>Concept (proof of)</b>	<i>It works and it's achievable!</i>



### SOURCE

Yannou B., Farel R., Cluzel F., Bekhradi A., Zimmer B., 2016. The UNPC innovativeness set of indicators for idea or project selection and maturation in healthcare. *International Journal of Design Creativity and Innovation*, 5 (3-4), 205-221.

## **SAPIGE® method: the two-stage idea selection process**

**SAPIGE®** is a RID method based upon **UNPC innovativeness indicators**. It is used by selection juries, both in companies and during open-innovation competitions, to monitor the innovation funnel in selecting and ranking innovative ideas and projects in a two-stage selection process. It is also used to perform **360° innovation diagnostics**, leading to appropriate SAPIGE® incubated coaching.

The **SAPIGE®** two-stage idea selection process aims first to eliminate the low **usefulness** and low **newness** ideas, scenarios or concepts, and then, for the remaining candidates, to eliminate those with low **profitability** and low (proof of) **concept** in a second round. The perfect (UNPC) projects can only be awarded prizes, whereas the good (UN) but questionable (PC) projects must not only be awarded prizes, but also granted money and incubated, as they reveal high potential for success and need help to gain in **maturity**.

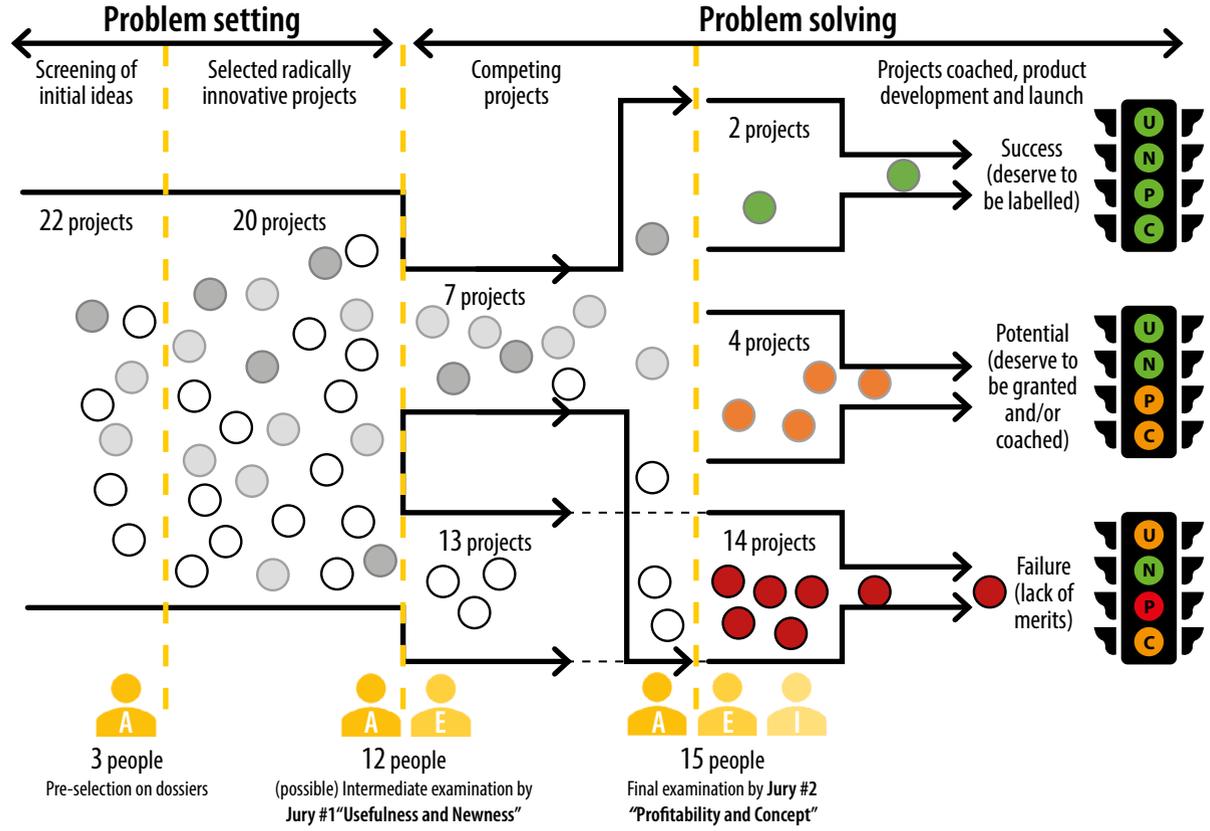


**SAPIGE®**, standing for *Système de sélection et d'Accompagnement de Projets d'Innovation en Gerontechnologie*, was coined by (Zimmer, 2012).

# How to organize a selection jury of an innovation competition?

The **selection juries** are composed of three bodies of members:

A for Academics, E for innovation Experts and I for Industry executives. The first problem setting jury is composed of members of the A and E bodies, and the second problem solving jury is composed of members of the A, E and I bodies.



**SOURCE**

Zimmer B., 2012. *Structuration d'un cluster d'innovation: Application aux projets d'innovation dans une grappe d'entreprises en gérontechnologie*. Thèse de Doctorat. Ecole Centrale Paris, Laboratoire Génie Industriel.  
 Bernard Yannou, Romain Farel, François Cluzel, Alexandre Bekhradi, Benjamin Zimmer. User-centered selection of innovative ideas and projects for incubation. [Research Report] CentraleSupélec.2017.

# 5 reasons for a bad product-market fit

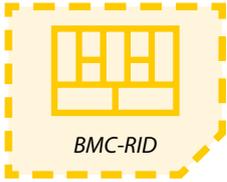
1. **False need** or the solution is unnecessarily complicated and technologically sophisticated
  - **Juicero:** Juicero was an American company that designed, manufactured and sold the Juicero Press, a fruit and vegetable juice extractor. The Juicero Press was Wi-Fi enabled and used exclusive single-serve packs of pre-chopped fruit and vegetables, delivered to the customer exclusively by the company on a subscription basis. The company attracted negative media attention when consumers and journalists discovered that its juice pouches could be squeezed just as easily by hand as with the company's expensive machine.
  - **SFR Box 8:** At the time of its launch, SFR's Box 8 was criticized for its superfluous functions and high price, failing to meet French consumers' expectations of simplicity and efficiency when it came to Internet boxes.
2. Innovation is useful and performative, but **not mature enough**
  - **Apple Newton:** One of the first personal digital assistants (PDAs), launched by Apple. Although a notable innovation for its time, the Newton suffered from a number of problems, including high price, imposing size, and problems with handwriting recognition. These limitations made the product less attractive to the consumer market, and it was eventually replaced by more powerful and user-friendly devices.
3. The **product-market fit is not right**, or innovation has broken down
  - **Segway:** Despite initial media hype, this personal electric vehicle, billed as revolutionary, has failed to establish itself in a clear market segment, struggling to find a broad consumer base due to its high price and regulatory restrictions in many places.

- **Google Glass:** While technologically advanced, it did not align with consumer expectations for wearables regarding privacy and everyday utility.
  - **Moulinex:** A French company known for its small household appliances which went bankrupt in 2001. This was attributed to a combination of problematic internal management, increased competition, and perhaps a lack of innovation adapted to market developments and consumer needs.
4. Needs are changing, and **some technologies are no longer adapted** to these new needs
- **Nokia:** Once the world's leading mobile phone manufacturers, Nokia did not adopt the Android operating system and was quickly overtaken by competitors who did.
  - **BlackBerry:** Once a leader in the smartphone market, BlackBerry failed to adapt to the touch-screen trend and competition from Apple and Android.
  - **Kodak:** Despite its pioneering role in photography, Kodak was unable to make the transition to digital quickly enough to maintain its leading position.
  - **Minitel:** Although Minitel enjoyed some success in France, its international expansion failed, mainly because of the growing popularity of the more open and versatile Internet.
5. Needs are changing, and **some business models are no longer adapted** to these new needs
- **Copains d'Avant:** A popular French social network in the 2000s, enabling users to find old school friends, Copains d'Avant has struggled to adapt to the rapidly changing social networking market, particularly in the face of international competitors such as Facebook.
  - **La Camif:** This French mail-order cooperative for teachers went into receivership in 2008, unable to compete with new online consumer habits.

# BMC-RID, an adapted BMC to RID methodology

**BMC-RID** [1, 2] is the name of the method used in the **business design** sub-process. The **Business Model Canvas**, by Osterwalder and Pigneur, is made more robust thanks to two RID advantages:

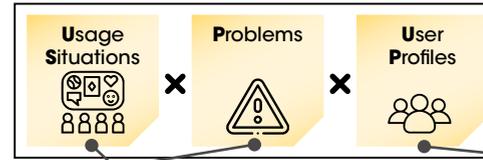
- 1. The canvas is initiated with the ambition perimeter** as early as the ambition perimeter is decided. The (usage situations, problems) pairs of the selected macro value buckets are injected into the value proposition block. The user profiles part of the macro value buckets are injected into the customer segment block, and the links with the value proposition elements kept. In doing so, BMC-RID naturally guarantees that the value proposition is well-founded and that the product-market fit is not arbitrary as well.
- 2. A set of UNPC innovation indicators is assigned to each of the nine BMC-RID blocks.** In this way, each block can be seen as an ideation space, with numerous competing ideas under instruction, for which the impact and certainty of innovation is monitored, before leading to the choice of a mature and optimal solution for each block. In this way, the business model innovation process is fragmented, parallelized as far as possible, and secured.



We believe that with **BMC-RID**, the weakest points of the traditional BMC have been addressed.

## BMC-RID example of the Accesseat RID study

The numbering of blocks indicates the order of block filling in general.



Ambition perimeter

<p><b>Strategic partners</b></p> <ul style="list-style-type: none"> <li>▪ RIDers</li> <li>▪ Silver Valley</li> <li>▪ Insurance company</li> <li>▪ Health organizations</li> </ul> <p><b>8</b> </p>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>▪ Conceiving an efficient solution responding to the elderly's "pain" point</li> </ul> <p><b>6</b> </p> <p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>▪ RIDers</li> <li>▪ Faurecia</li> <li>▪ Seating division</li> <li>▪ Patterns of the Accesseat concept</li> </ul> <p><b>7</b> </p>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>▪ Facilitating movements without disturbing habits and without being intrusive</li> <li>▪ Helping the elderly to enter and leave a vehicle</li> <li>▪ Discrete/invisible product</li> <li>▪ Not stigmatizing</li> </ul> <p><b>1</b> </p>	<p><b>Customer relationship</b></p> <ul style="list-style-type: none"> <li>▪ Personal assistance in showrooms that allow people to test the product</li> <li>▪ Create a community with SilverValley in order to create a word-of-mouth effect</li> <li>▪ Suggestions from peers (family or other elderly people)</li> </ul> <p><b>4</b> </p> <p><b>Distribution channel</b></p> <ul style="list-style-type: none"> <li>▪ Retailer</li> <li>▪ Special showrooms</li> <li>▪ OEM</li> </ul>	<p><b>Customer segment</b></p> <ul style="list-style-type: none"> <li>▪ Elderly person (62+) on the car as driver or passenger</li> <li>▪ Relatives of elderly people</li> <li>▪ Possible segment:</li> <li>▪ People with movement restrictions</li> <li>▪ Pregnant women</li> </ul> <p><b>2</b> </p>
<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>▪ Cost of development</li> <li>▪ Economy of scale due to the growing size of the aging population</li> </ul> <p><b>9</b> </p>		<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>▪ Asset sale</li> <li>▪ Brand loyalty by elderly people who feel understood</li> </ul> <p><b>5</b> </p>		

### SOURCE

- [1] Bekhradi A, Yannou B, Cluzel F, Chabbert F., 2016. Importance of problem-setting before developing a business model canvas, In Int. Design Conf., May 16-19, Dubrovnik, Croatia.  
 [2] Bekhradi A., 2018. Planning technology maturation by exploration of useful problems in markets: The case of innovative startups. PhD thesis. Université Paris-Saclay.



## In brief, how can **Radical Innovation Design** be defined?

**Radical Innovation Design** is a novel, complete and well-structured innovative design methodology that prioritizes the improvement of the **user experience** within a **context of activity**. RID considers innovative design as the improvement of the activity-support-system to augment the performances of a future activity. Indeed, in Engeström's Activity System Diagram theory, the designed solution that serves for supporting an activity is called a mediating artefact which corresponds to a **Product-Service-Organisation** in RID.

RID guides innovators who want to systematically explore users' problems and unstated needs, evaluating which ones are most pressing in terms of innovation, and taking into account the **effectiveness of existing solutions** in contributing to an augmented activity. RID renews the way to define innovation targets along with a prioritized set of **value buckets** in coherence with company strategy. Value buckets, which are frequent **usage situations** where major problems are experienced and for which the **existing solutions** provide little or no relief, are **qualified questions** to usefully start ideation sessions with the guarantee that, if value buckets are cracked, then unaddressed usefulness value is created for users. With its emphasis on **problem exploration**, RID differs from methods based on early prototyping. The RID methodology has been validated in various industrial and business sectors.

**Radical Innovation Design® is a trademark.  
This trademark and RID Intellectual Property belong to CentraleSupélec.**

**RID has been invented by Professor Bernard Yannou.**

**CentraleSupélec lets commercial exploitation rights to HyB'RID startup company.  
HyB'RID has been co-founded by Bernard Yannou and François Cluzel.**



## RID as a production process

With RID, innovation becomes an observed, controlled and optimized **production process**; it is a systematic and informed process where a clear question is asked and answered at each stage.

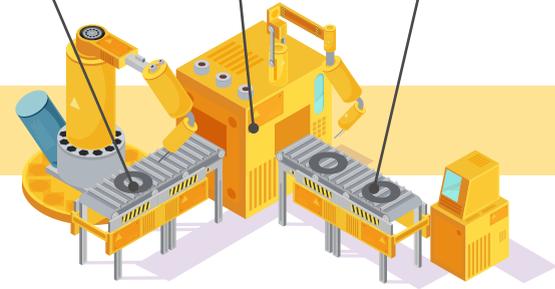
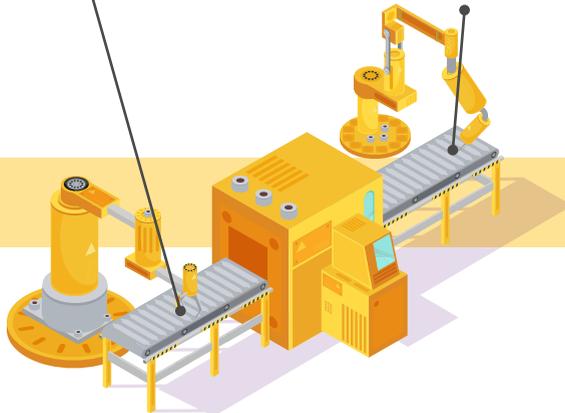
Which activity to innovate?  
(activity field, ideal goal)

What is wrong in this activity? What  
can the best-in-class solutions do?  
(quantities of pain)

Where should we innovate?  
(value buckets)

What knowledge is needed?  
(deep knowledge)

Where could we innovate?  
(effectiveness indicators)



Two important milestones exist (i) when the problem is validated, and (ii) when the solution is validated. In between, a kind of digital intelligence, mainly made of RID comparator and RID compass, monitors the stage and gate of this production process. Note that when no satisfactory solution comes, the problem must be revisited. **In short, the RID process consists of the optimization of the (problem, solution) pair.**

**Digital cockpit**



**Problem validated**

**Solution validated**

What is targeted by the company?  
**(ambition perimeter)**

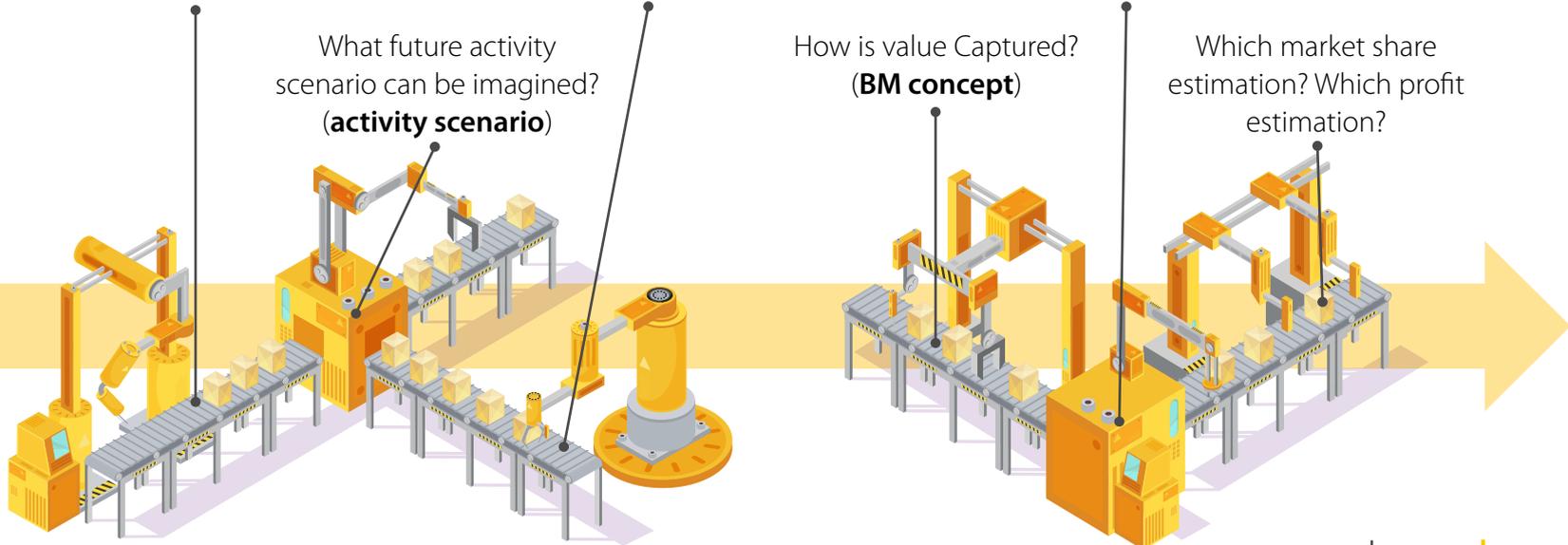
What PSO value proposition can be realized?  
**(PSO concept)**

What is effectively augmented?

What future activity scenario can be imagined?  
**(activity scenario)**

How is value Captured?  
**(BM concept)**

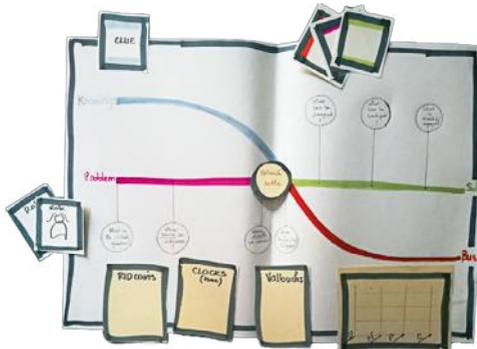
Which market share estimation? Which profit estimation?



**You can put into practice the basics in only 3 hours.**

## Narrative

Set the scene for mobility users in the Ile-de-France region, their daily usages and the dissatisfactions they experience depending on the means of transport used or available. The game script immerses learners in the complexity of contextualizing usage, which is a prerequisite for producing usefulness.



## Roles

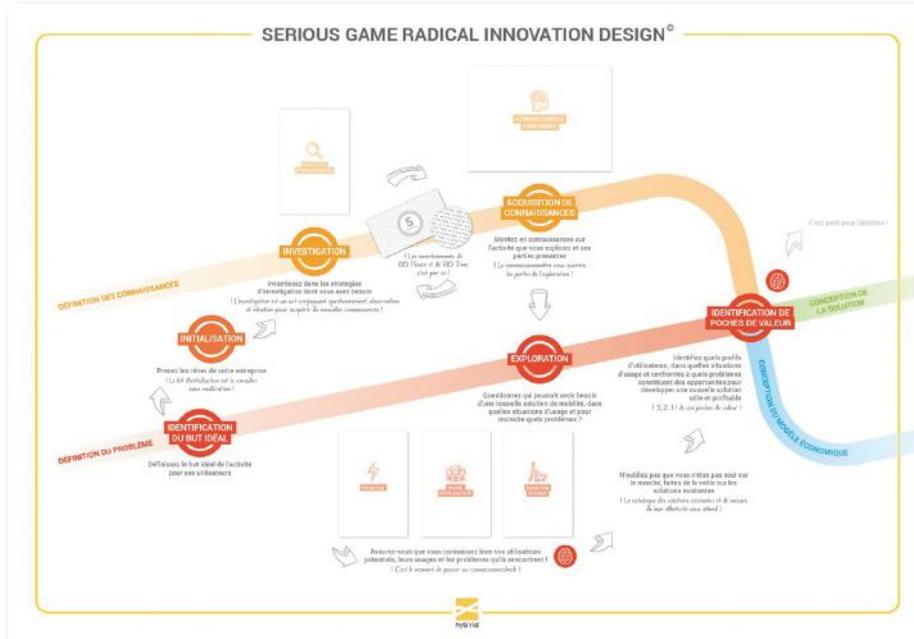


## Objectives

You have two contradictory objectives of **usefulness for users** and **profitability for your start-up.**



## Game board



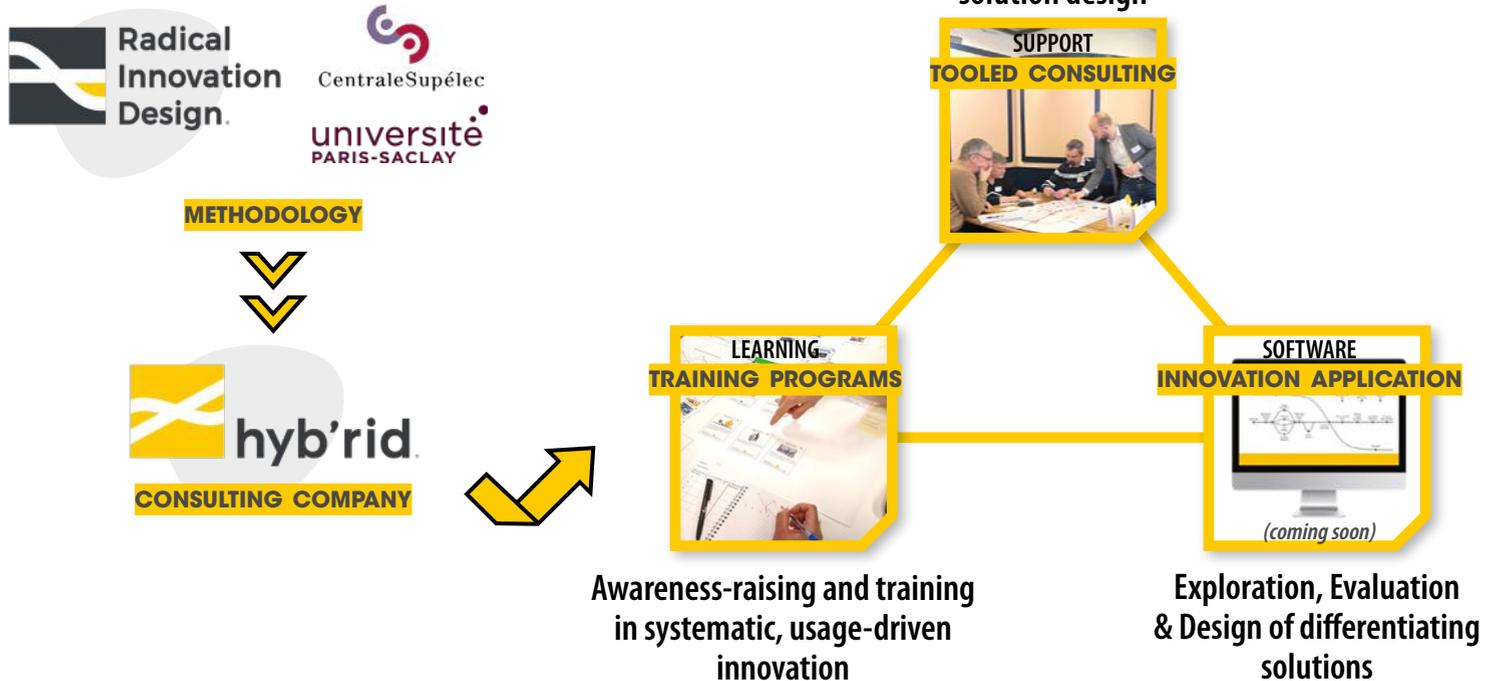
**Just play, have fun,  
experience and  
debrief!**



### SOURCE

Ma, Y., Yannou, B., Cluzel, F., & Vallet, F. (2023). Tools to help teachers and designers complete individual tasks when co-designing industrial engineering games - Application to the design of an innovation management game. *European Journal of Engineering Education*.

Yannou, B., Vallet, F., & Cluzel, F. (2023, 5-7 juillet). Innover par les usages sur un périmètre d'activité: la méthodologie Radical Innovation Design illustrée par son jeu sérieux sur l'innovation de la mobilité sur le Grand Paris. Paper presented at the 12<sup>ème</sup> Colloque EPIQUE, Paris.



## HyB'RID offers three types of services to companies

You need to strengthen the development of your technology or PSO\* solution...

You wish to target customers, usages, activities or pains and expectations with an innovative solution ...



**Assess the maturity level** of your technology/solution  
**Identify the activities** that your technology/solution could **impact**  
**Measure the potential** of your technology/solution in relation to the **targeted markets**  
**Build your technology-market roadmap**

**Understand the stakes** of the customers, the uses, the activities or the targeted pains/expectations  
**Identify the value buckets to target** pains and expectations not met by existing solutions in a potential market

**Build the specifications of your new product/service/organization**

**Design the architecture** of your innovative product/service/organization and **its business model**

**Assess and validate** the augmented activity and the corresponding competitive advantage

**Build the disruptive offer solution and assess the differentiating value created**

\*Product, Service and/or Organization



# Radical Innovation Design

A systematic and usage-driven innovation methodology to ensure usefulness for users and profitability for companies

Bernard Yannou  
François Cluzel



TEASER

Would you like to revisit some preconceived ideas on how to lead innovation processes?

In a data-rich world, data analytics should reveal essential challenges to innovation and model the effectiveness of potential solutions. A robust innovation methodology should refer to leading market solutions, constructing its innovation brief upon a comprehensive user experience analysis. To determine how well solutions satisfy a range of user needs, more sophisticated methods are required to qualify user experience and quantify its expected benefits and notable shortcomings. Once we have pinpointed the pertinent problems, assistance in organizing ideation processes would be beneficial, fostering the development of promising concepts and business models, as well as swiftly appraising the practical efficacy of innovative solutions. There should ultimately be an openness to automating, to some degree, the articulation of pertinent issues and the curation of the most useful and profitable solutions.

Whether you share these convictions or are simply intrigued about innovation, this eBook is for you, as it shows how to innovate in an organized, modern way using the Radical Innovation Design® (RID) methodology. RID, a revolutionary computerized approach to knowledge- and usage-driven innovation, excels at the in-depth exploration and exploitation of problems and solutions and has proven its effectiveness in a wide range of industries. Aimed at professionals new to innovation, students and innovation experts alike, it offers three customized journeys to explore original concepts using practical illustrations and real-life projects.

The authors, Bernard Yannou and François Cluzel, are both design and innovation engineering faculties at CentraleSupélec, Université Paris-Saclay, and have extensive teaching experience. With a long list of industrial design and innovation books to their credit, they have supervised numerous doctoral theses in industrial environments. This eBook and related downloadable material are open-access to disseminate RID-based practices.

This document is a teaser of the full open-access eBook that will be available soon. It provides the whole introductory chapter, including an introduction to Radical Innovation Design methodology, as well as the “instructions for use” to browse the full eBook. It also presents extracts from the 360 pages, with two fact sheets per chapter, chosen to be representative of the full eBook (concepts, methodological contributions, examples, practical tools...).

ISBN: 978-2-7598-3066-4

