Ideation Methods

ET-3153

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Outcomes

At the end of this lecture, you will be able to:

- Ideate with *6-3-5 Brainwriting Method*.
- Build on ideas of colleagues.
- Introduced to *Function Analysis*.
- Generate ideas in an Analytical and

  Systematic manner using *Morphological Method* to improve your design.
- Validate your design using *Concept Fan Method*.
- Introduced to *Mind Mapping*.
- Introduced to useful *Online Tools*.

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Module Descriptor

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Research

- A systematic inquiry, that helps make the sense of the world.

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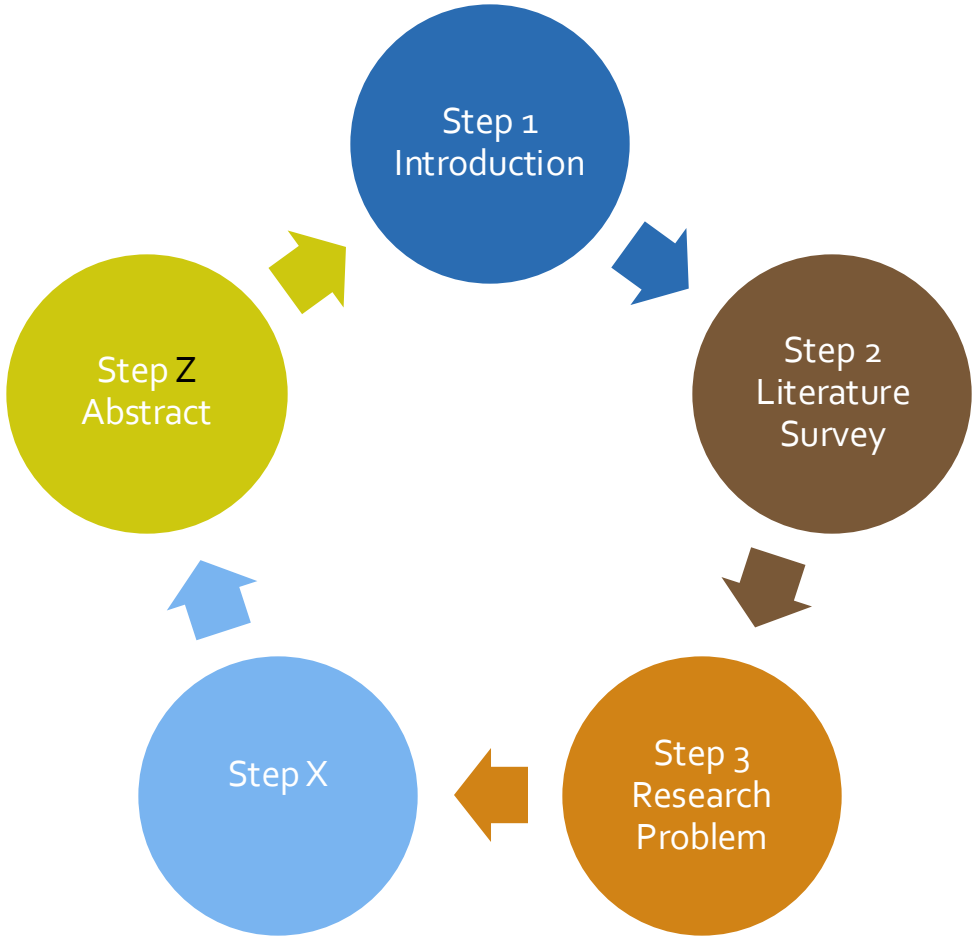
Contents



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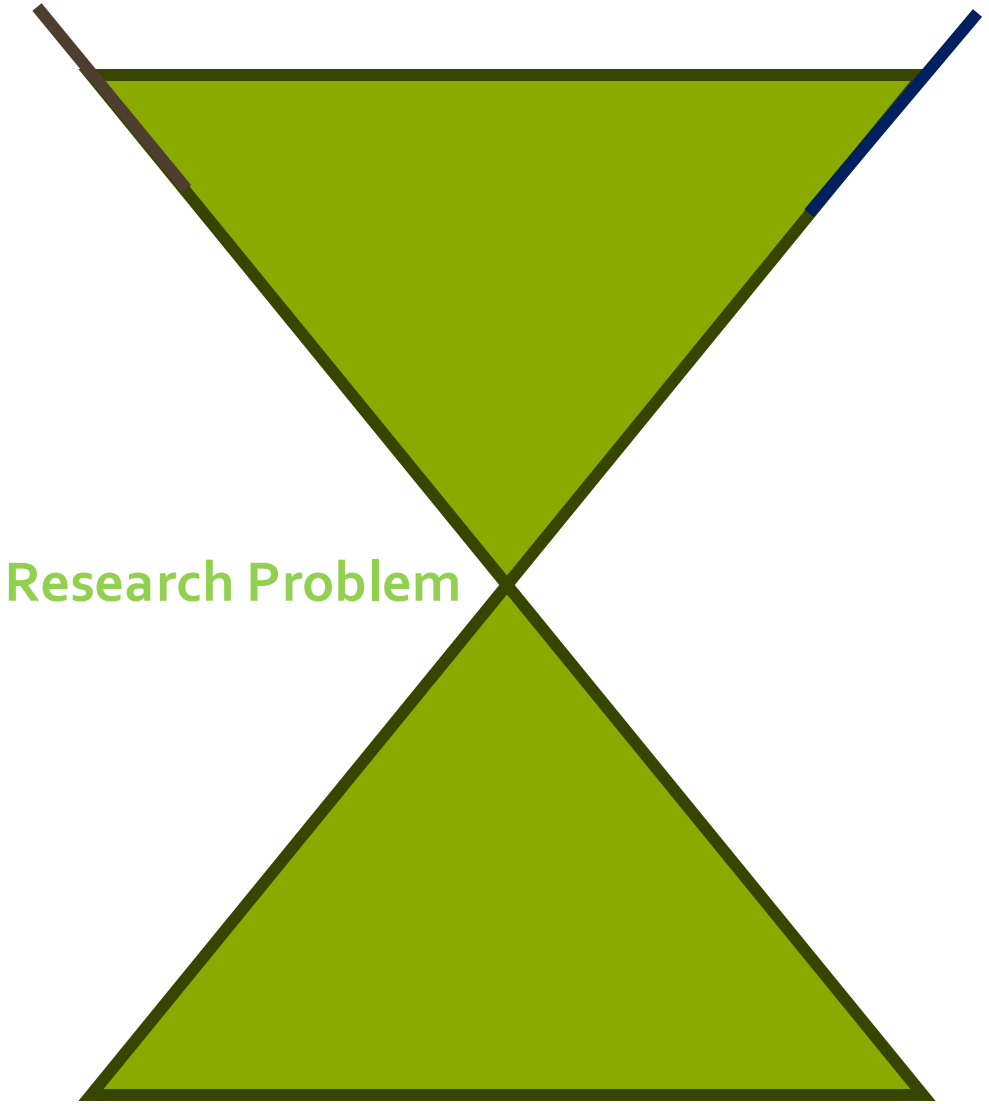
Research Process



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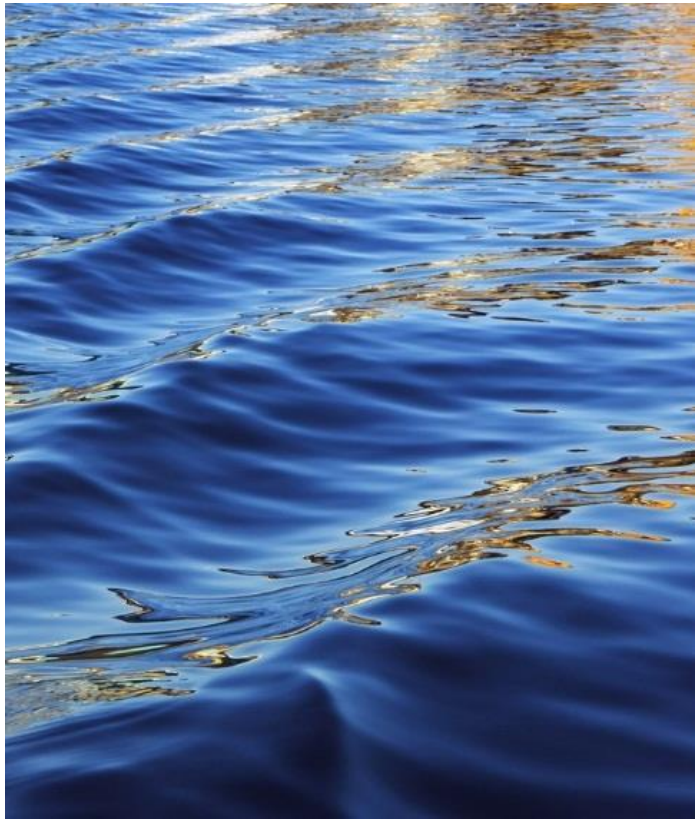
General area

Specific Area



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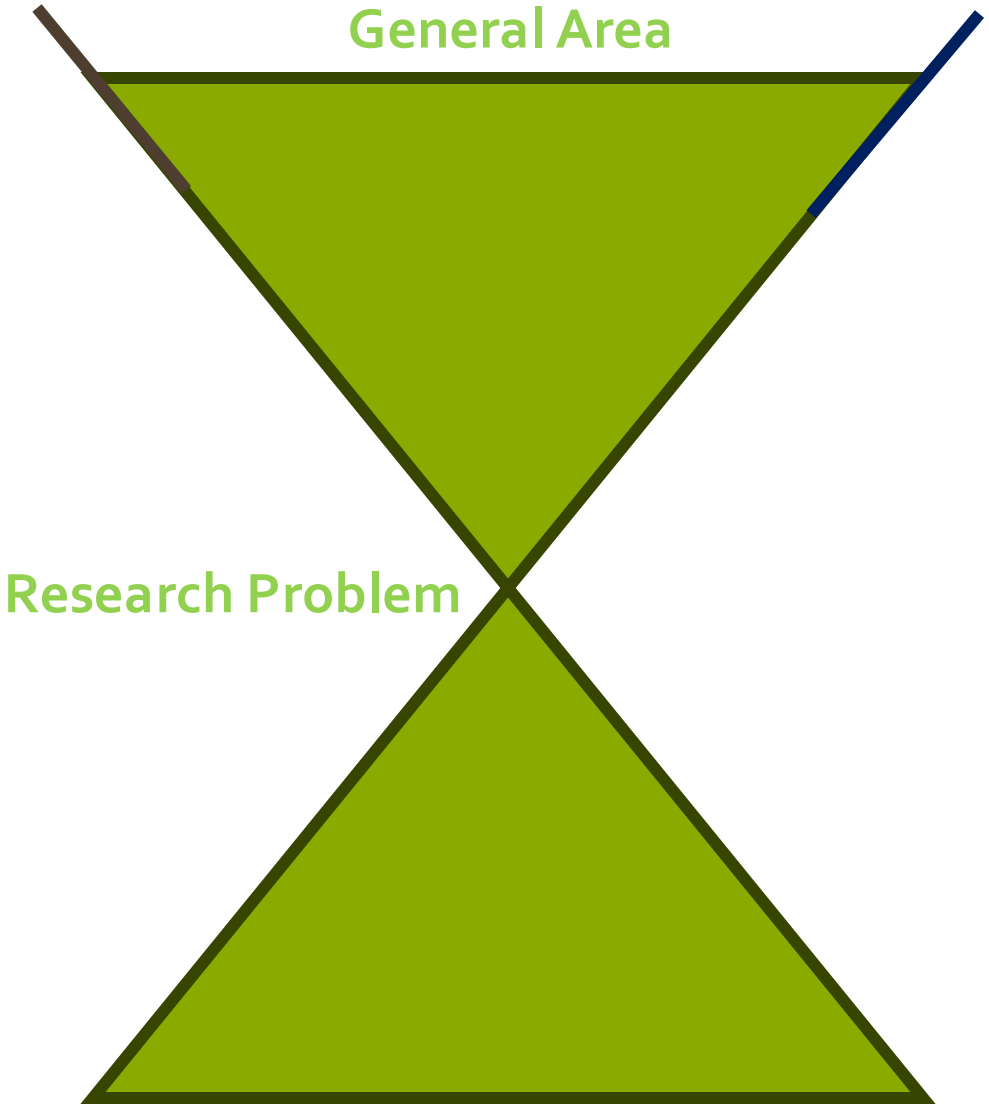
General Area

- Favorite
- Inspiring
- Intriguing
- Curious
- Burning
- National level
- Global level



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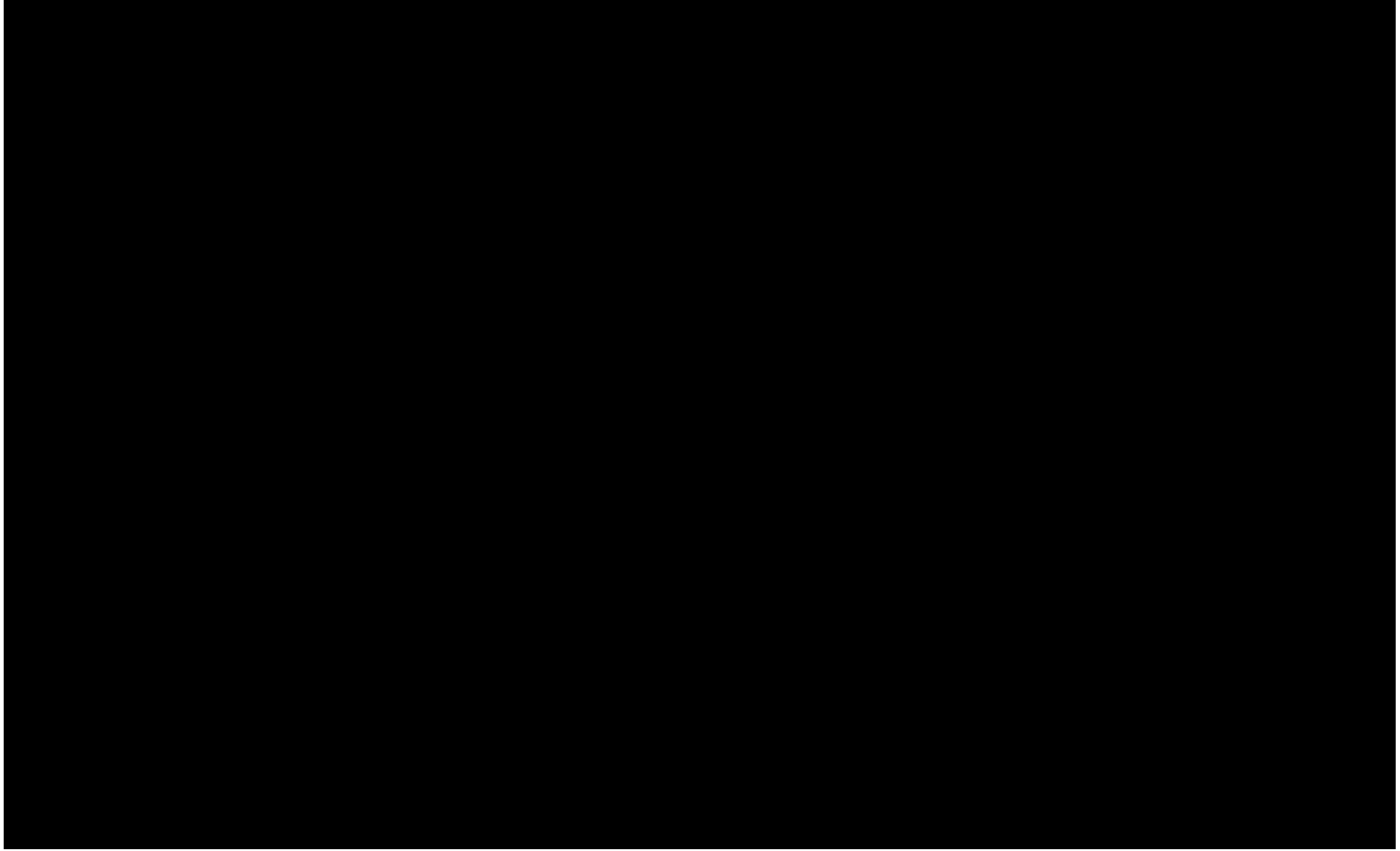

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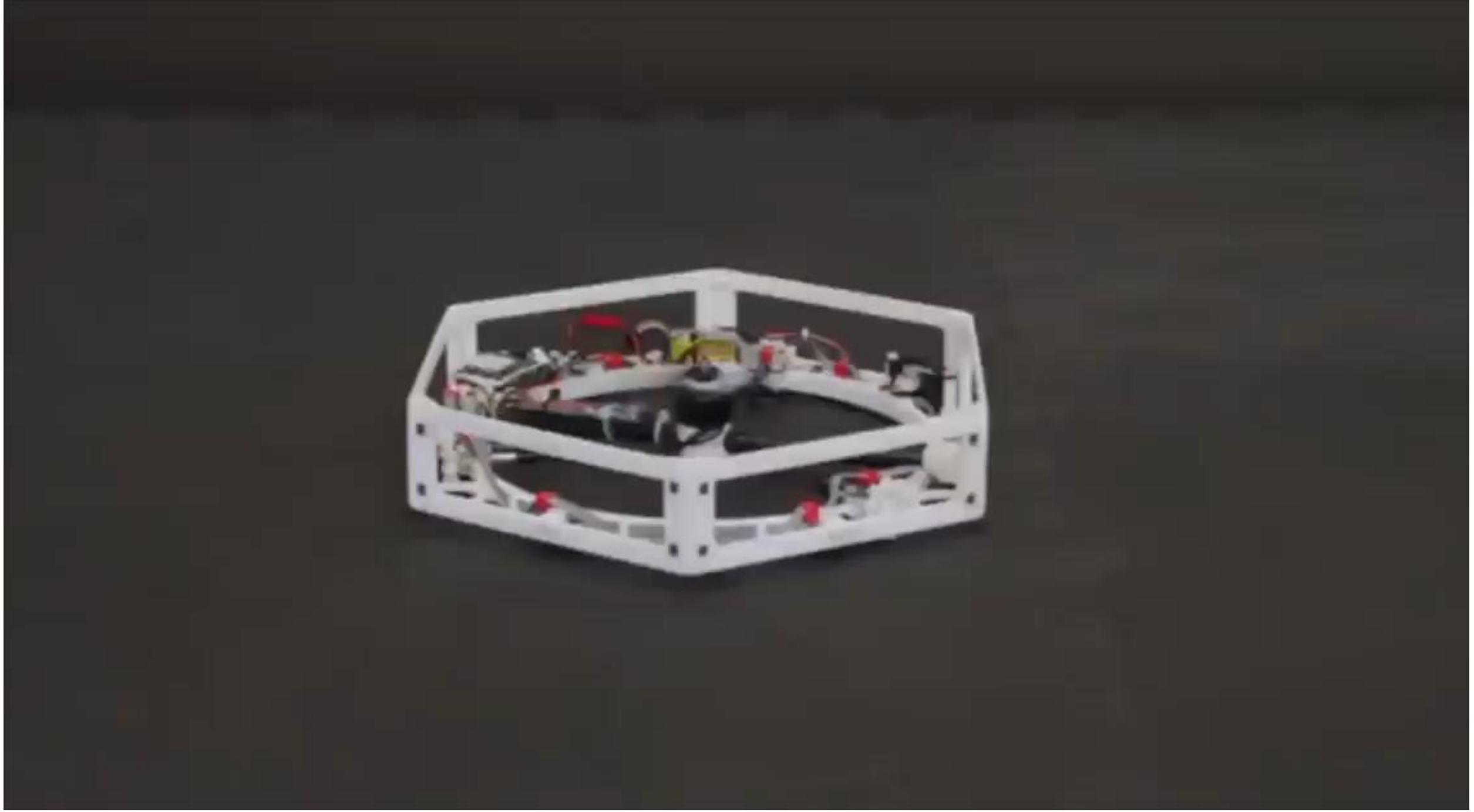

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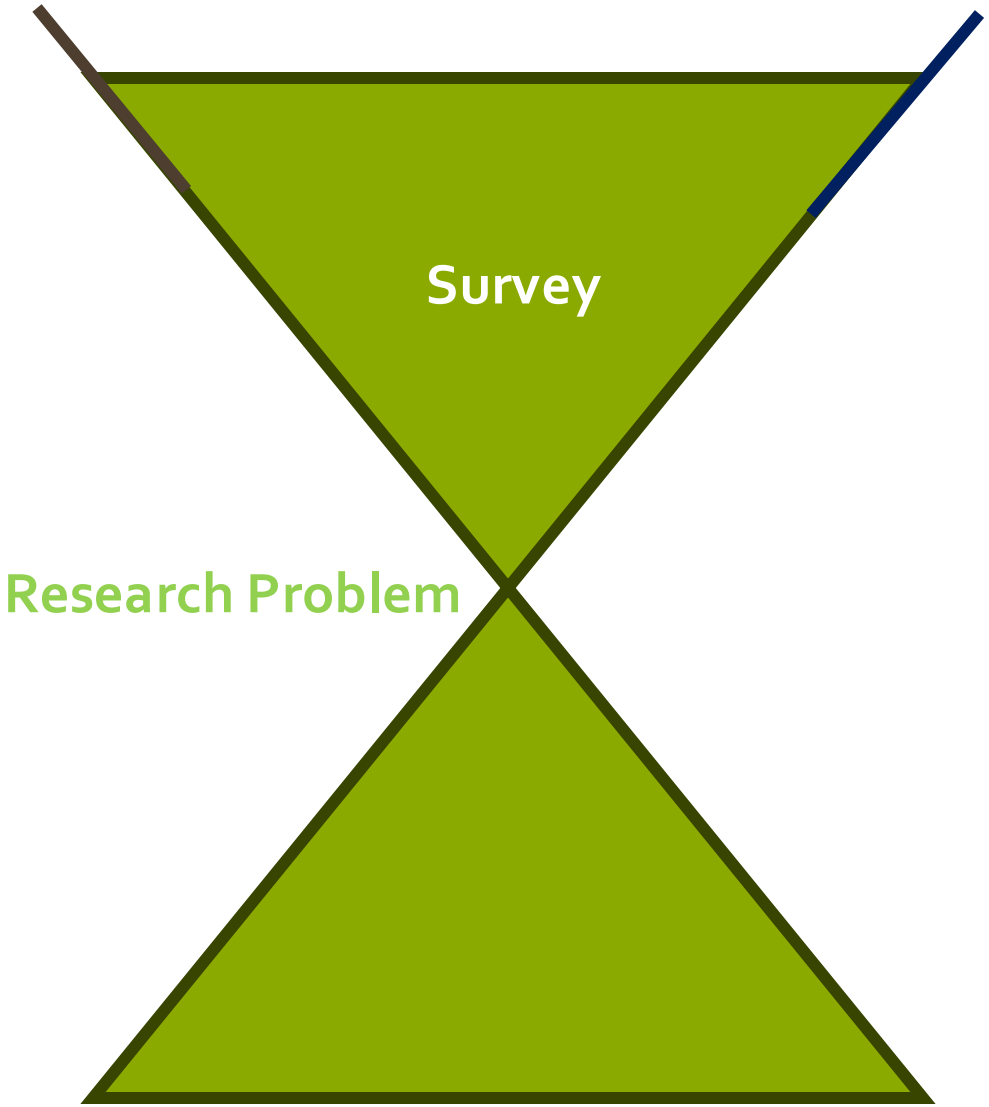
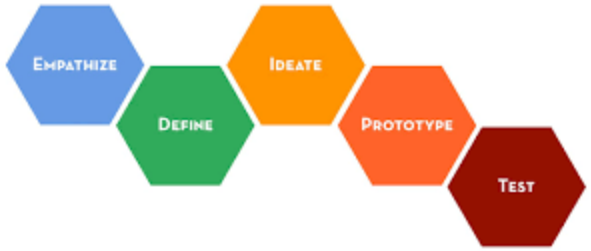
Specific Problem

- Literature Survey
- Patent Search
- Product Survey
- Professional Problem



- Design Thinking



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6-3-5-Method

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6-3-5-Method

- Six people each receive a copy of the template and write three ideas in the first row. Then the
- sheet is passed clockwise, and the next person builds on the previous person's ideas.
- This process is repeated five times. If you don't have any ideas, leave the cell blank.
- You have three minutes per round. After 15 minutes, you then have six tables with 18 ideas each = 108 ideas.
- Note: The method also works in a 4-3-3 or 3-3-2 model.

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6-3-5-Method

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6-3-5 Method Canvas

Problem:

	Solution/Idea 1	Solution/Idea 2	Solution/Idea 3
Student 1			
Student 2			
Student 3			
Student 4			
Student 5			
Student 6			

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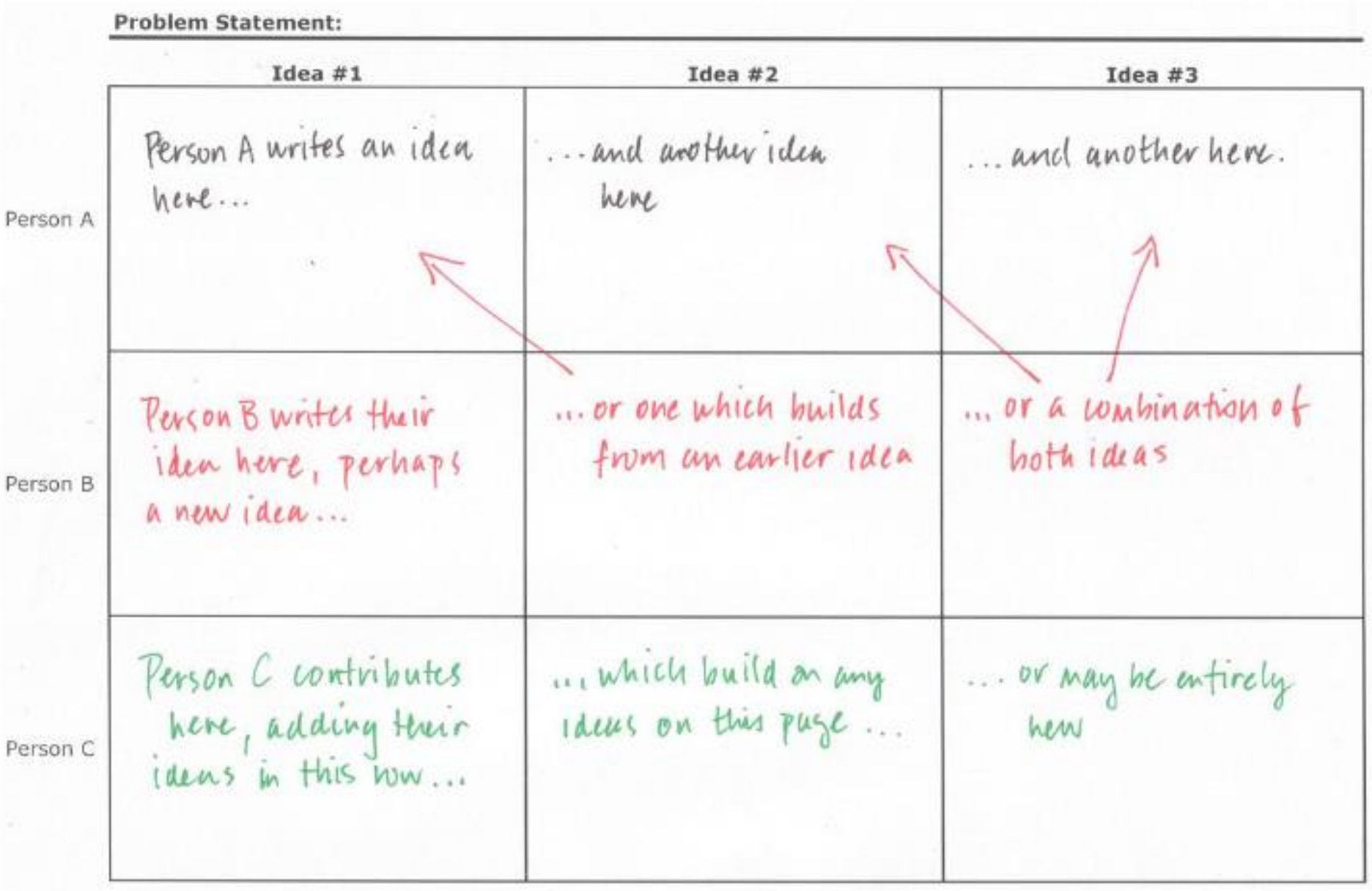
6-3-5-Method



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Functional Analysis - A Brief Introduction

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Functional Analysis

- The Functional Analysis allows:
  - identifying the physical components, the so-called building blocks, which constitute the future product, and
  - how they are interrelated to build up the functional architecture of the future product.

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Functional Analysis

- Functional Analysis as the systematic process of,
  - identifying,
  - describing, and
  - relating the functions a system has to be able to perform,
  - in order to be successful,
  - but does not consider it as a design tool to address how functions will be performed,

    i.e. to map functions to physical components.

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Functional Analysis

- In conceptual design Functional Analysis can be applied at different levels:
  - subsystem level (like the avionic subsystem of an aircraft, consisting of various pieces of equipment),
  - system (like a satellite consisting of various systems) and
  - system of systems level (like a Moon base, consisting of various systems).
- According to the considered level, the physical components or building blocks, which make up the future product, are therefore equipment, subsystems or systems.

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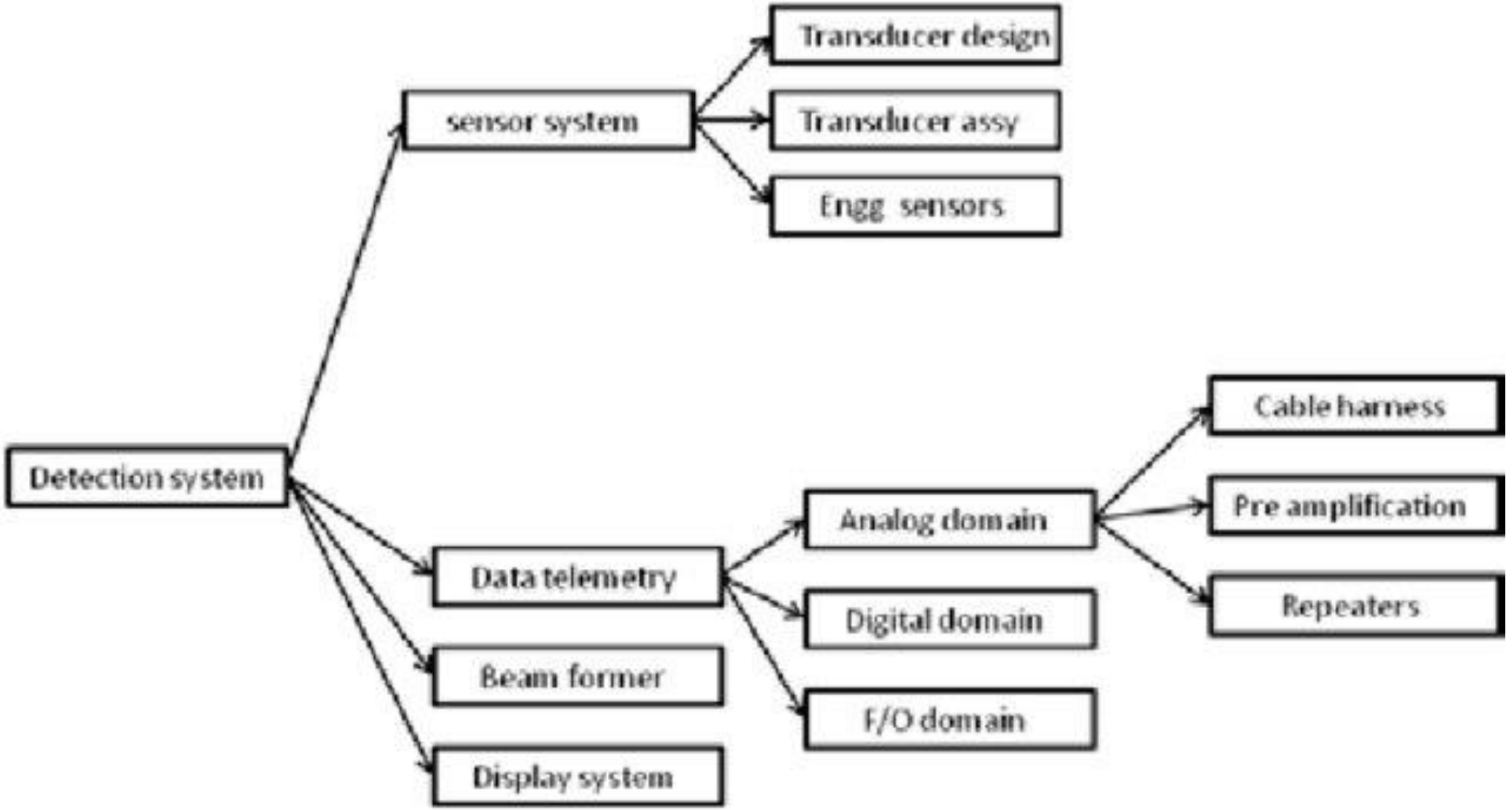
Functional Analysis - An Example



Kumar, K. & Saravanakumar, M. & Joseph, J. & Ramanathan, Hareesh. (2016). Generative Model for Conceptual Design of Defence Equipment. Defence Science Journal. 66. 81. 10.14429/dsj.66.9105.

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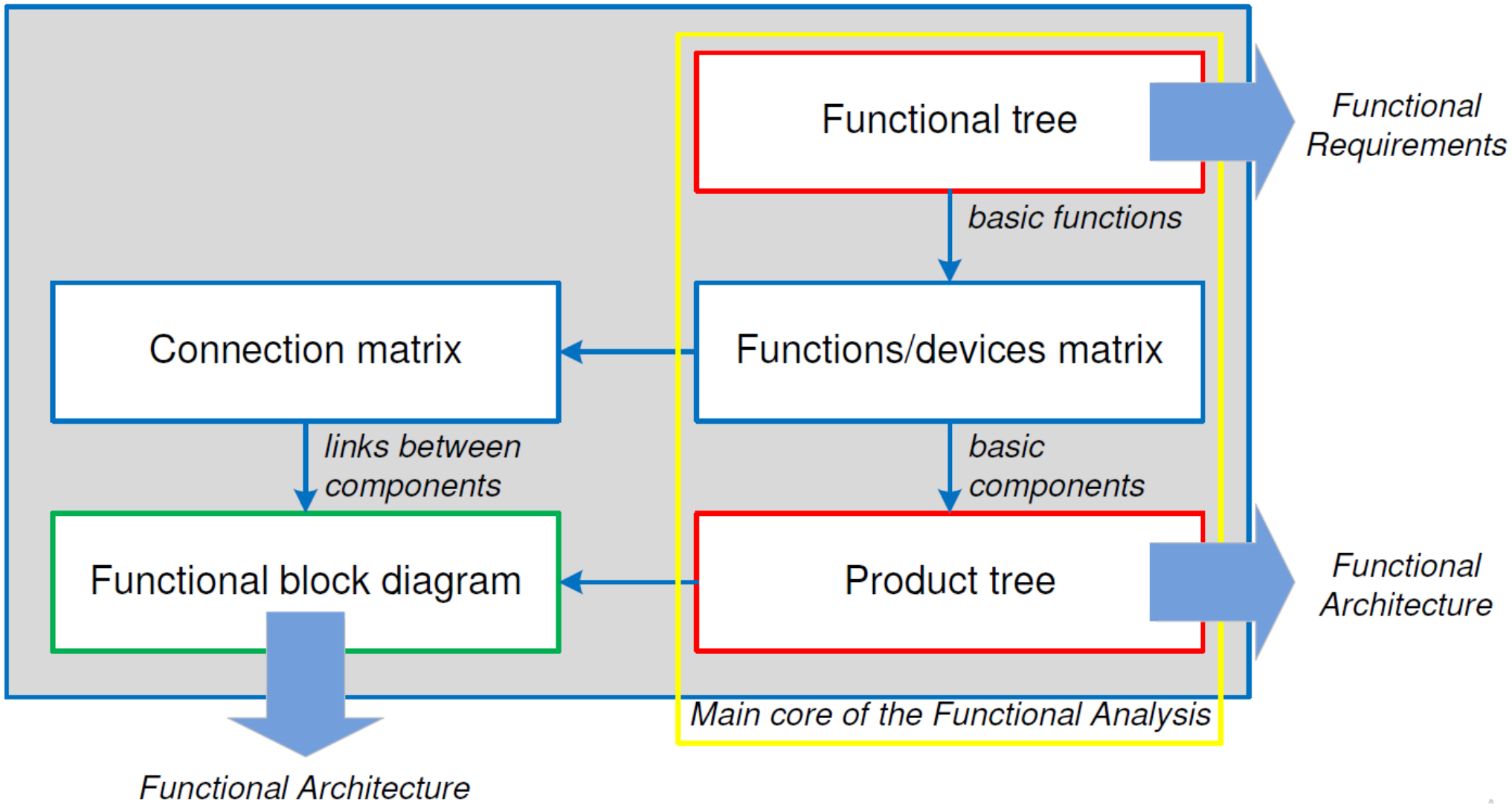
Functional Analysis - Work Flow



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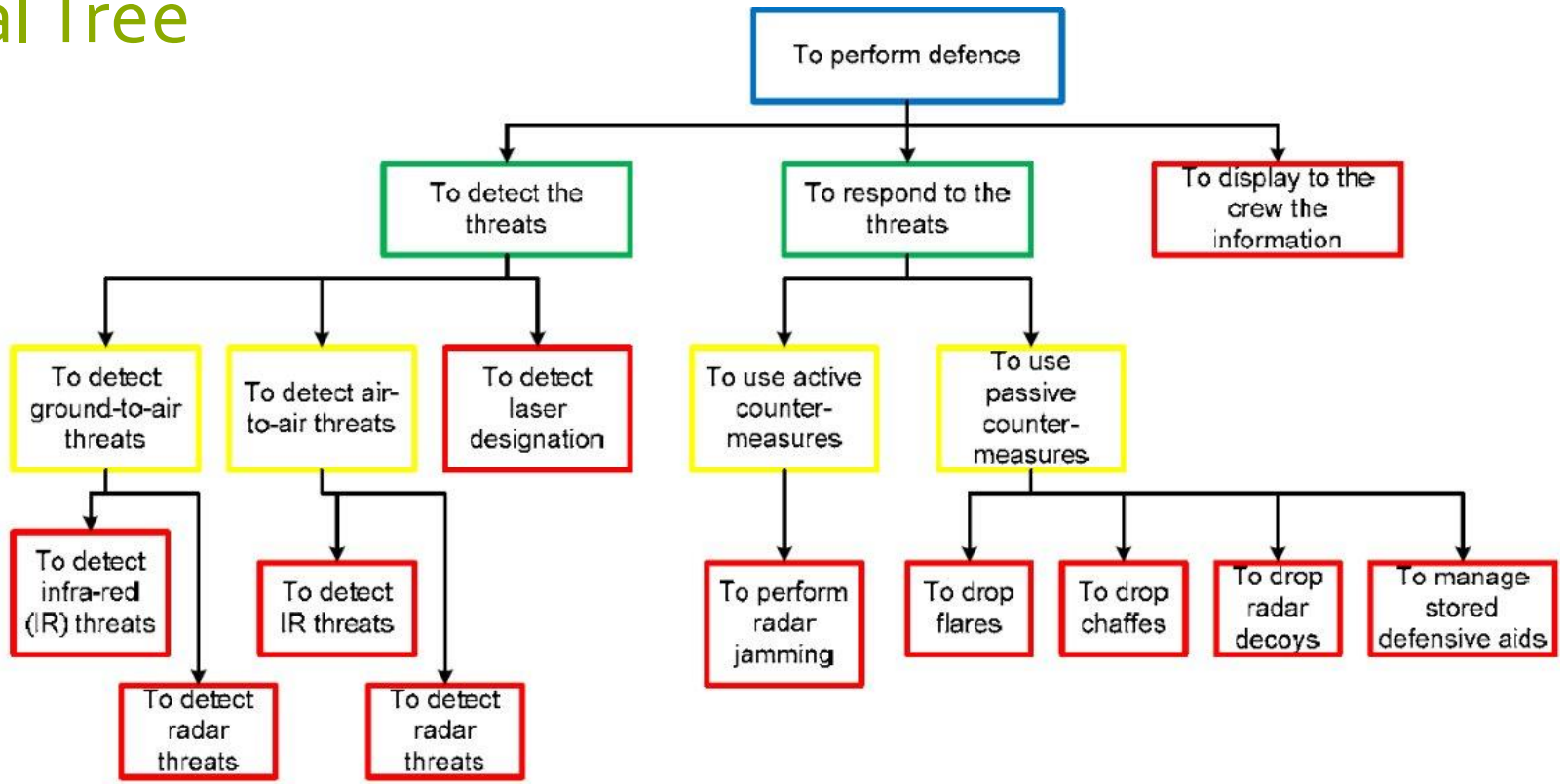
Functional Tree



- The functional tree allows splitting the higher level functions, which stem from the mission objectives/top level system requirements, into lower level functions and eventually it allows identifying the basic functions that have to be performed by the future product.
- Through the functional view we look at a new product asking ourselves "what does it do?"
- Each function shall be expressed by means of verb and noun.
- In case functions cannot be decomposed any further, they shall be reported at the bottom of the tree as basic functions.

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Functions/ Devices Matrix

- The functions components matrix is therefore used to map functions to physical components.

- Built simply by matching the bottom of the functional tree, consisting of all basic functions, with one column of components able to perform those functions.

- Starting from the column containing the first basic function under consideration, the component able to perform that function can be defined by simply answering the question: "which component is able to perform this function?"

- The same process applies to all basic functions. Starting from the analysis of the first basic function, new components progressively fill in the column of devices. Eventually all basic components are determined.

- With the functions/devices matrix we now know the basic components or building blocks, which constitute the future product.

		Basic functions								
		To detect infra-red (IR) threats	To detect radar threats	To detect laser aiming	To perform radar jamming	To drop flares	To drop chaff	To drop radar decoys	To manage stored defensive aids	To display to the crew the information
Basic devices	Missile warning receiver	X								
	Infra-red (IR) warning system	X								
	Radar warning receiver		X							
	Laser warning system			X						
	Jammer decoy dispenser				X			X	X	
	Jamming system				X					
	Chaff/flares dispenser					X	X		X	
	Store management system								X	
	Multi Function Display (MFD)									X

- By simply grouping together the basic components, the product or physical tree of the new product can be generated.

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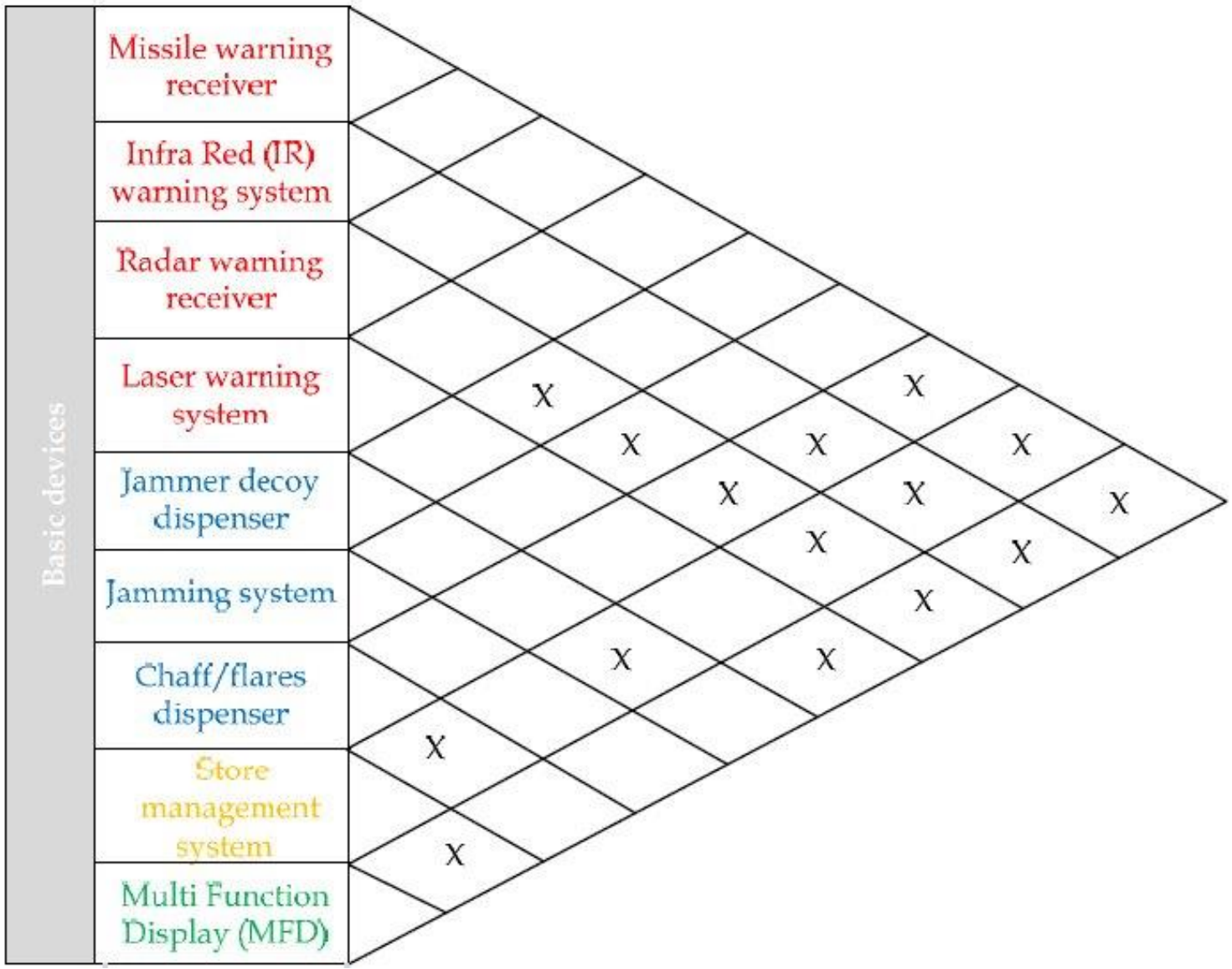
Connection Matrix

- Once the basic components have been identified, the links between the various components within the system can be determined.
- Starting from the first row and then proceeding down the column of basic devices, all components have to be analyzed, in order to understand whether or not there are connections between them.
- In case two components have a connection because, for instance, they are requested to exchange information, then the box where the two components intersects must be ticked.



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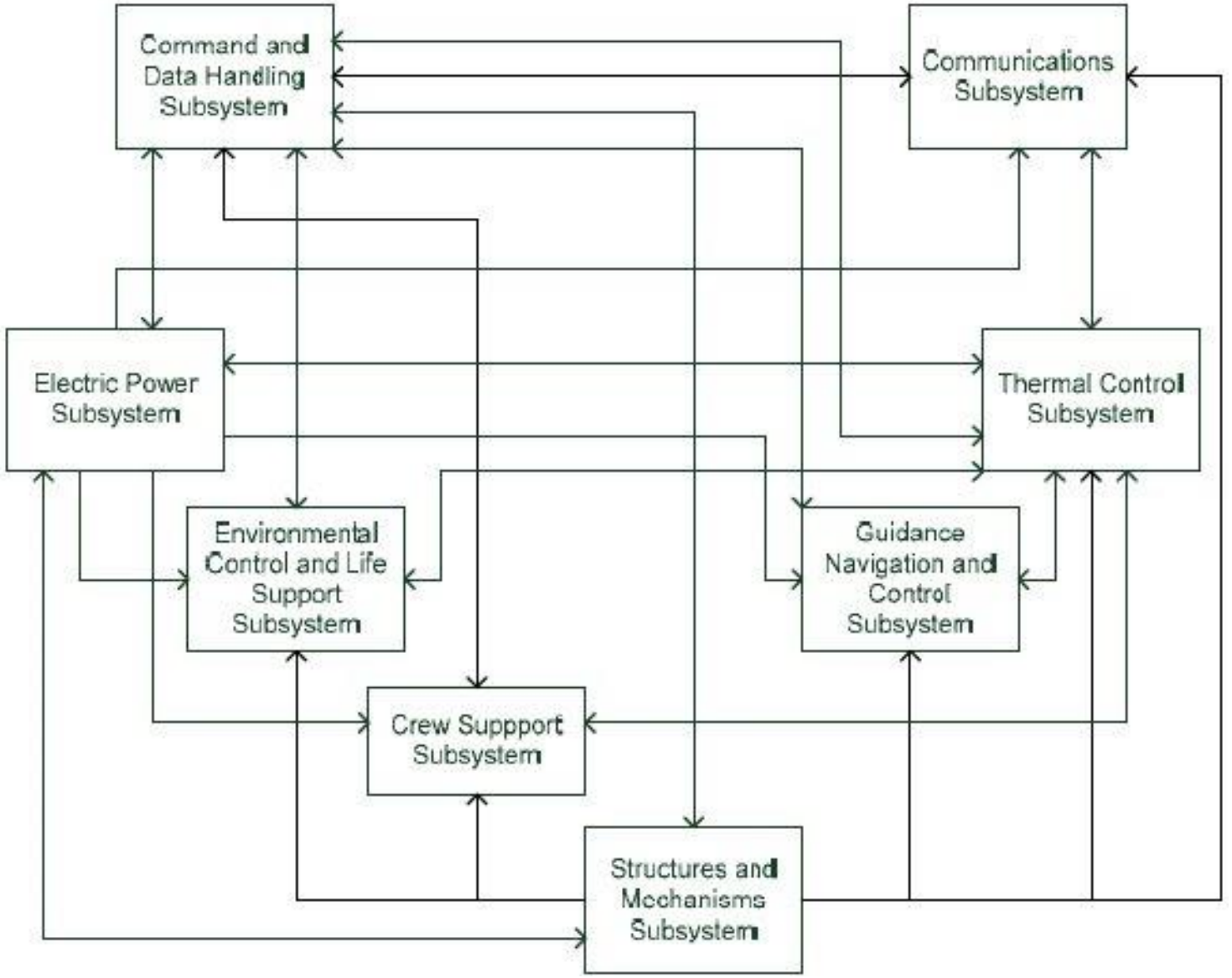
Functional Block Diagram

- In the functional block diagram, where building blocks, that need to be connected, are linked through point-to-point connections.

- These connections are arrows and not just simple lines, the functional block diagram provides the reader with additional information, if compared to the connection matrix, as it highlights not merely connections but where these connections are pointing to, i.e. if they are half duplex or full duplex connections.

- Referring to a functional block diagram, it is therefore possible to understand that, for instance, sensors are transmitting information to displays and not viceversa.



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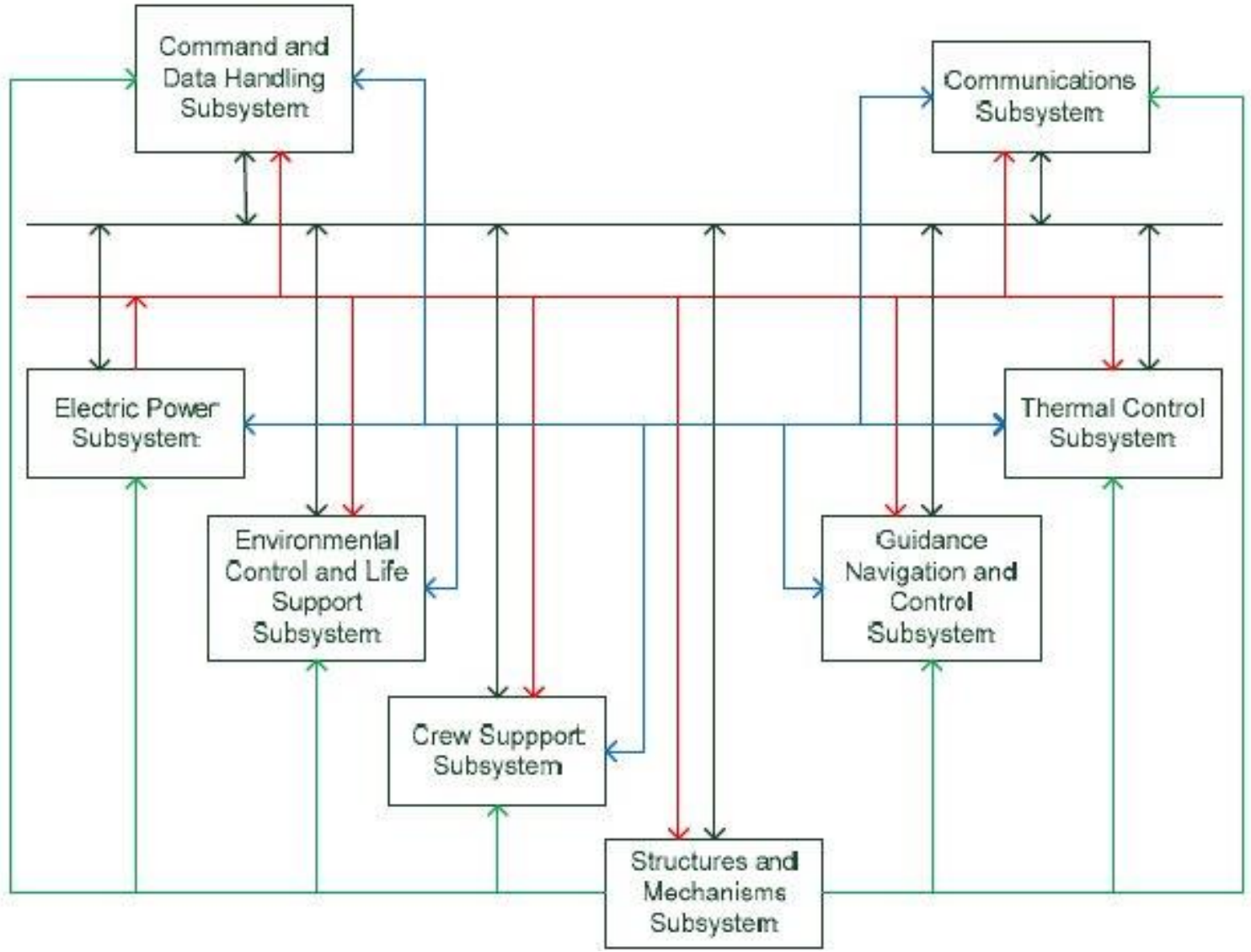
Physical Block Diagram

- Neither the connection matrix, nor the functional block diagram is said about the nature of the connections, which may be, for instance, power, signal or fluid lines.

- This information is instead provided by the physical block diagram, which may be considered as complementary to the functional block diagram.

- Power line supplies the various building blocks with the necessary power.

- The signal lines, unlike the functional block diagram where there are point-to-point connections, in the physical block diagram there is a main bus to transmit commands and receive feedbacks to/from the various subsystems.



- The building blocks that need an active cooling interface to dissipate heat are connected by a ducting fluid line with the Thermal Control Subsystem.

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Morphological Matrix

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Morphological Matrix

- Functions of the product are taken as a starting point.
- The various functions and subfunctions of a product can be established through a function analysis.
- These solutions will form the components in the morphological chart.
- The morphological method thus yields a matrix of functions and components.
- Possible components are listed on the basis of their functions.
- The components are concrete and specific, specifying the elements that belong to a category (i.e. parameter).

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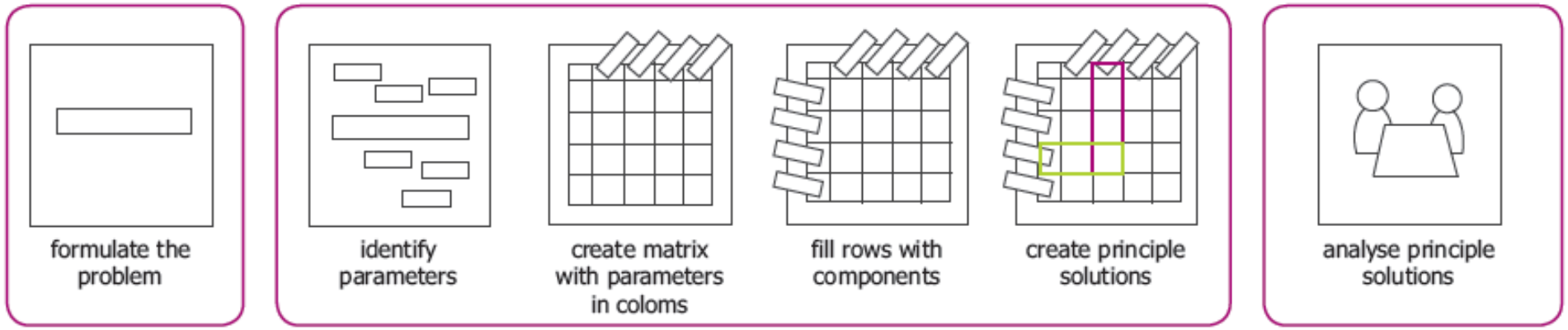
Building a Morphological Matrix

- How to Morphological Chart
- formulate the problem
- identify parameters
- create matrix with parameters in columns
- fill rows with components
- create principle solutions
- analyse principle solutions



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Morphological Matrix

ET3153 Individual Design Project

Morphological Method Canvas

Equipment:

Function/Attribute	Solution/Method 1	Solution/Method 2	Solution/Method 3

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Morphological Matrix

Eyes	off	look downwards	flash	animation	turn of
Screen	text "follow me!"	route to next stop	direction of next stop	picture of next stop	
Pointer	Staight up	towards visitors	in rest	to next location	backwards
Body movement	none	little to attract attention	back and forth	sideways back and forth	

Daphne E. Karreman,Geke D. S. Ludden,Vanessa Evers,"Beyond R2D2: Designing Multimodal Interaction Behavior for Robot-specific Morphology," ACM Transactions on Human-Robot Interaction, Vol. 8, Issue.3, Article No.: 18, pp 1–32, https://doi.org/10.1145/3331144.

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Concept Solution - An Example

Morphological Table		Multiple solutions			
		1	2	3	4
Functions / Tasks	Auto detection & Alert 1	Use Dunking sonar [7]	Towed array & hull sonar [9]	Use towed array sonar & manoeuvre [8]	Non acoustic methods [6]
	Auto classification 2	Use magnetic signature [7]	Use Spectral data for classification [9]	Use satellite data to process movement underwater. [6]	Use Target parameters [8]
	Counter measure 3	Acoustic countermeasure [9]	Silence Own machinery [6]	Use acoustic False target [7]	Use noise makers [8]
	Escape measures 4	Move at flank speeds [8]	Escape geometry to be worked out [9]	Use a second platform to confuse [6]	Silence own ship completely.[5]

Concept solution 2
S1,2-S2,2-S3,1-S4,2

Kumar, K. & Saravanakumar, M. & Joseph, J. & Ramanathan, Hareesh. (2016). Generative Model for Conceptual Design of Defence Equipment. Defence Science Journal. 66. 81. 10.14429/dsj.66.9105.

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SCAMPER Method

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SCAMPER

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SCAMPER Method Canvas

Equipment/Problem:

Substitute	Combine	Adapt	Modify	Put to Another Use	Eliminate	Reverse
Replace whole/part or concept with something else.	Unite. What? Who? Ideas? Materials?	Adjust to a new purpose? reshape? tune up?	Change the color, sound, motion, form, size. Make it larger, stronger, thicker, higher, longer. Make it smaller, slower.	Change when, where, location, time, or how to use it.	Omit, get rid of, cut out, simplify, weed out.	Change the order, sequence, pattern, layout, plan, scheme, regroup, redistribute.

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SCAMPER

S	Introduce a range of plant-based protein options, catering to the growing demand for vegetarian and vegan alternatives.
C	Introduce the concept of "All-Day Breakfast," providing customers with a flexible dining experience.
A	Implement mobile ordering and payment systems.
M	Make significant modifications to their Happy Meal offerings by reducing portion sizes and incorporating healthier sides like apple slices and milk.
P	Repurpose its drive-thru lanes to serve as designated mobile order pickup points.
E	Phase out less popular menu items.
R	Introduce self-service kiosks at McDonald's locations that allow customers to customize their orders.

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SCAMPER

S	Introduce dairy alternatives like almond milk and oat milk, catering to the growing demand for non-dairy options.
C	Combine the concept of loyalty programs with mobile ordering through the Starbucks Rewards program.
A	Enhance its mobile ordering capabilities, allowing customers to place orders in advance, reducing wait times and catering to the evolving work habits of their clientele.
M	Modifiy its menu offerings to introduce seasonal and limited-time beverages, creating a sense of urgency and excitement among customers.
P	Repurpose its physical space to create a welcoming environment for remote work and meetings, transforming its locations into versatile spaces for both work and leisure.
E	Discontinue the use of plastic straws in favor of more sustainable alternatives.
R	Rearrange its store layout to facilitate mobile order pickup stations, improving order fulfillment times and enhanced the overall customer experience.

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SCAMPER

S	Explore sustainable materials like recycled polyester and sustainable cotton as a substitute for traditional synthetic fabrics.
C	Combine fashion and technology with their collaboration with Parley for the Oceans, resulting in a range of footwear and apparel made from recycled ocean plastic.
A	Expand their casual footwear lines, allowing them to tap into the broader trend of comfortable, versatile fashion for everyday wear.
M	Modify their shoe designs to incorporate advanced cushioning and support technologies, addressing the evolving needs of athletes and fitness enthusiasts.
P	Repurpose their manufacturing waste by incorporating it into the production of new products, reducing waste and demonstrating a commitment to circular economy principles.
E	Eliminate hazardous chemicals from their production processes, contributing to safer and more sustainable manufacturing practices.
R	Rearrange their supply chain to prioritize local production and reduce carbon emissions associated with transportation.

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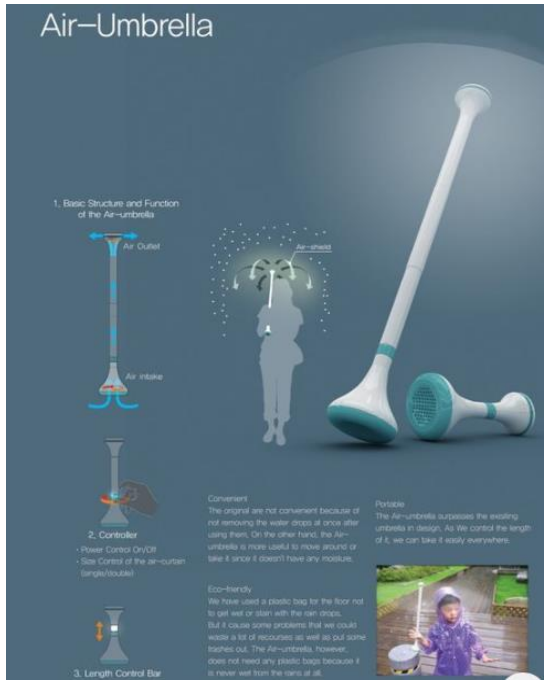
Substitute

FJÄLLBERGET chair by The IKEA design



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Combine

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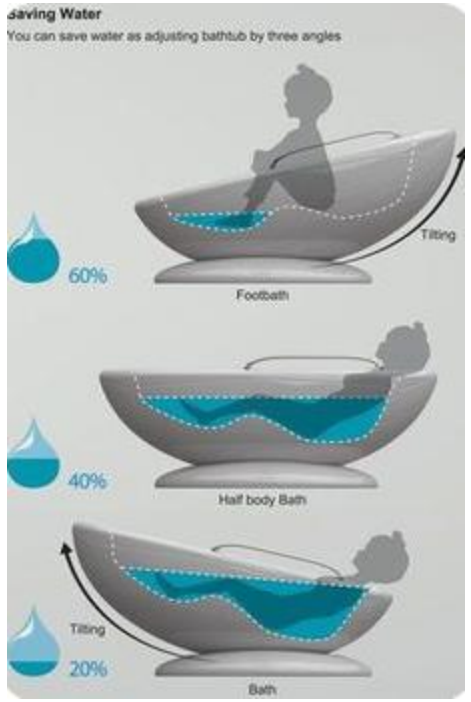
Adapt



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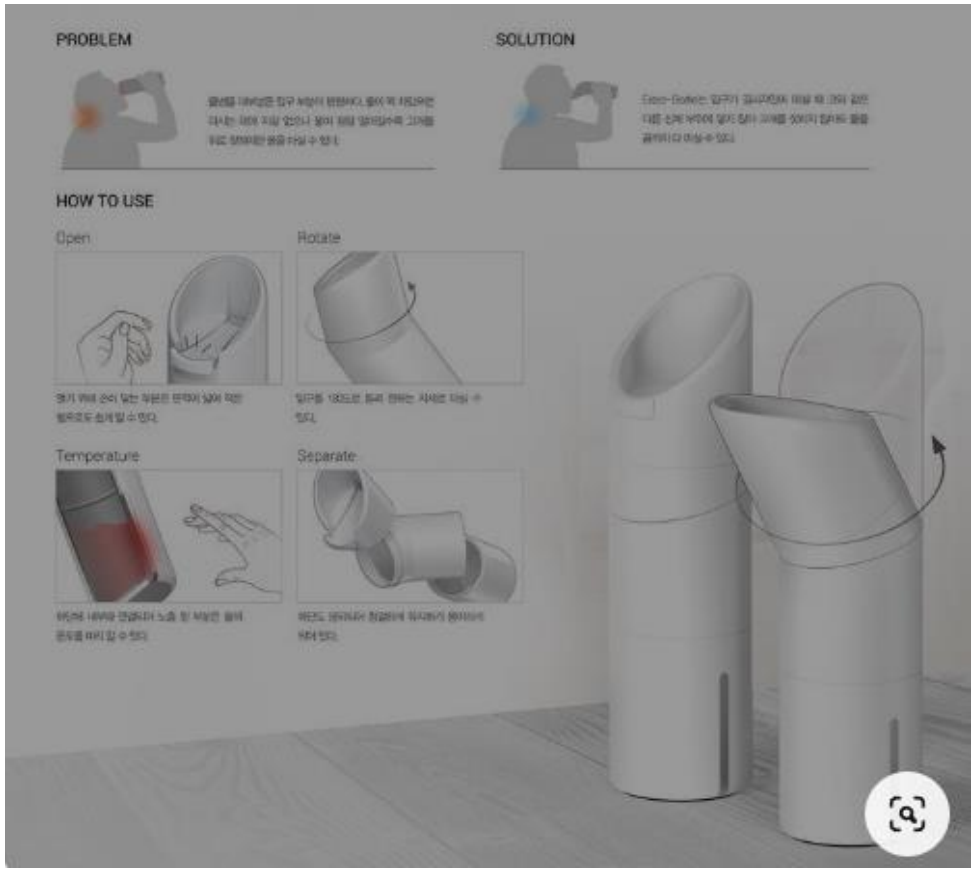
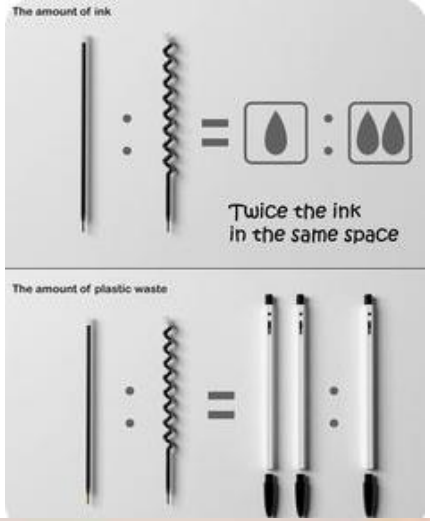
Modify





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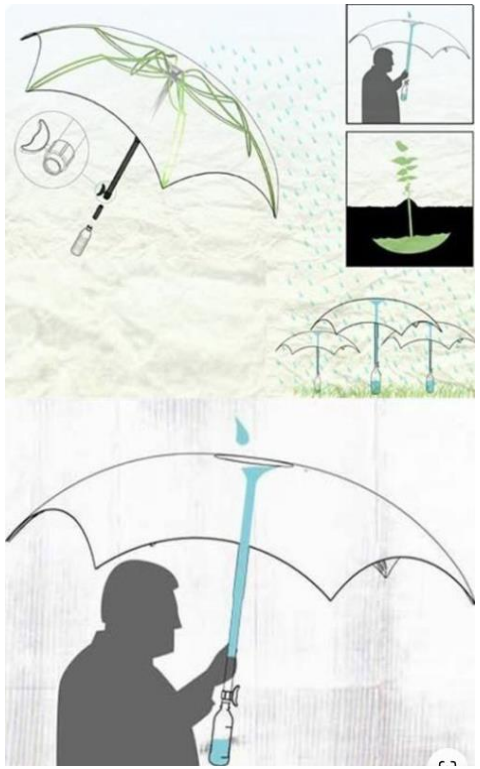
Put to Another Use



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Eliminate

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Concept Fan Method

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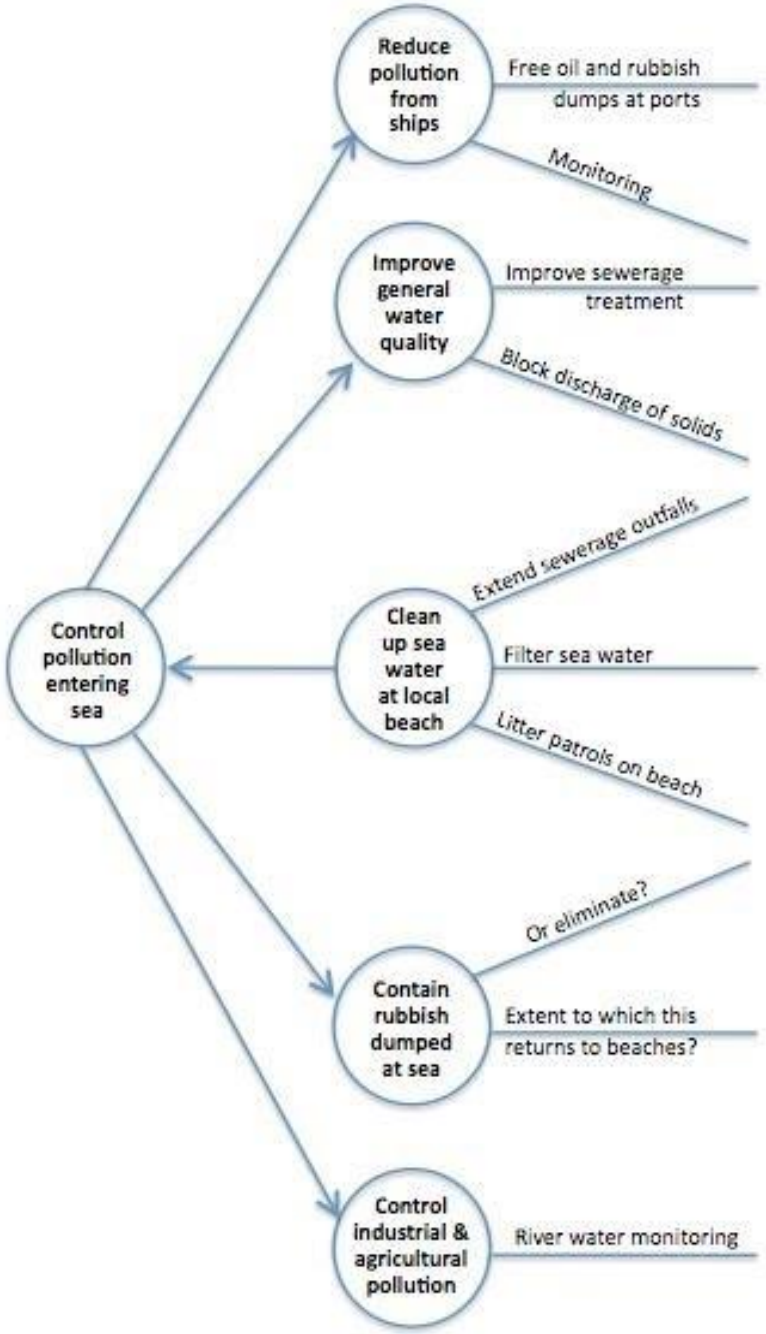
Concept Fan



Generating ideas from a broader definition of the problem

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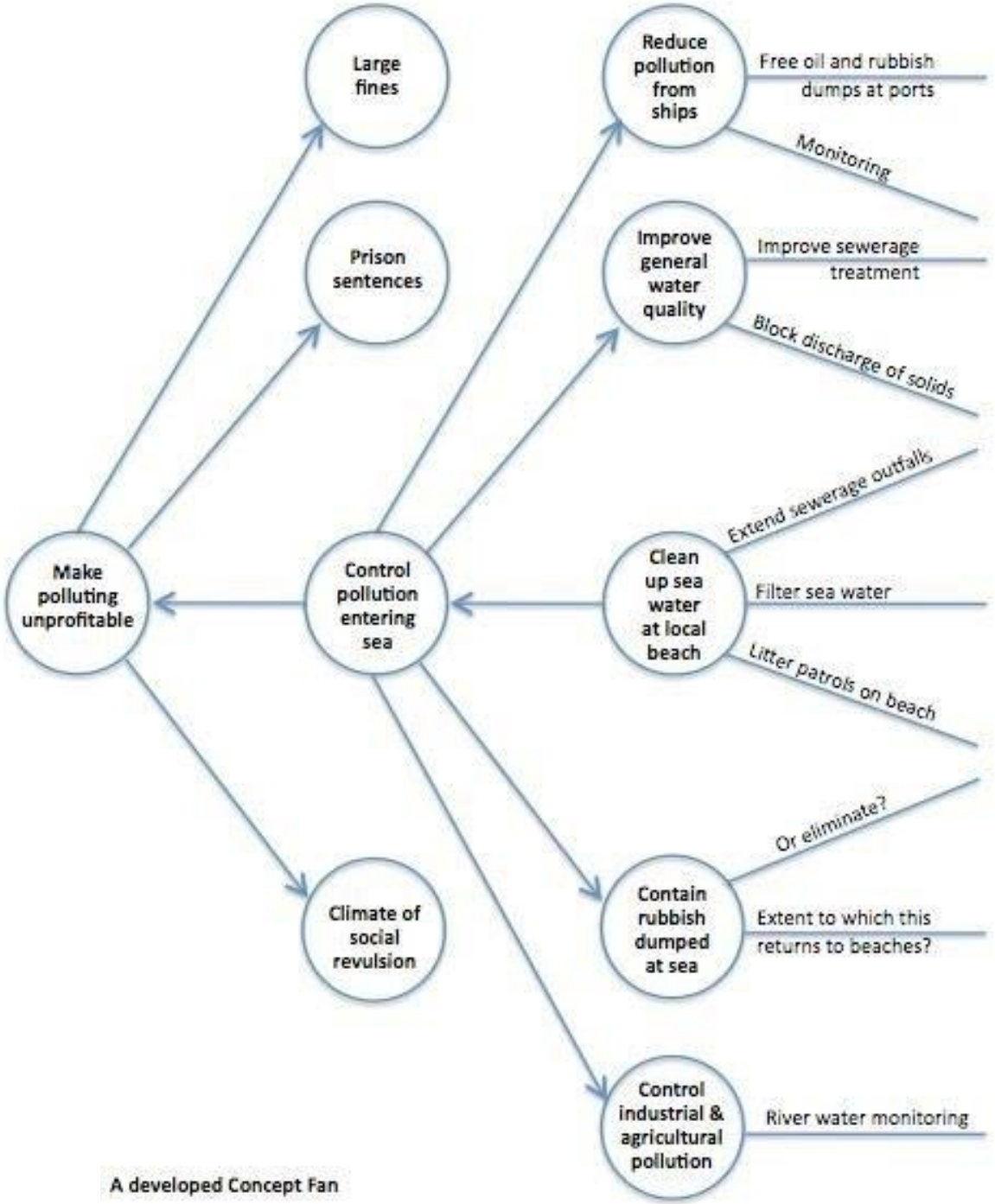
Concept Fan



A developed Concept Fan

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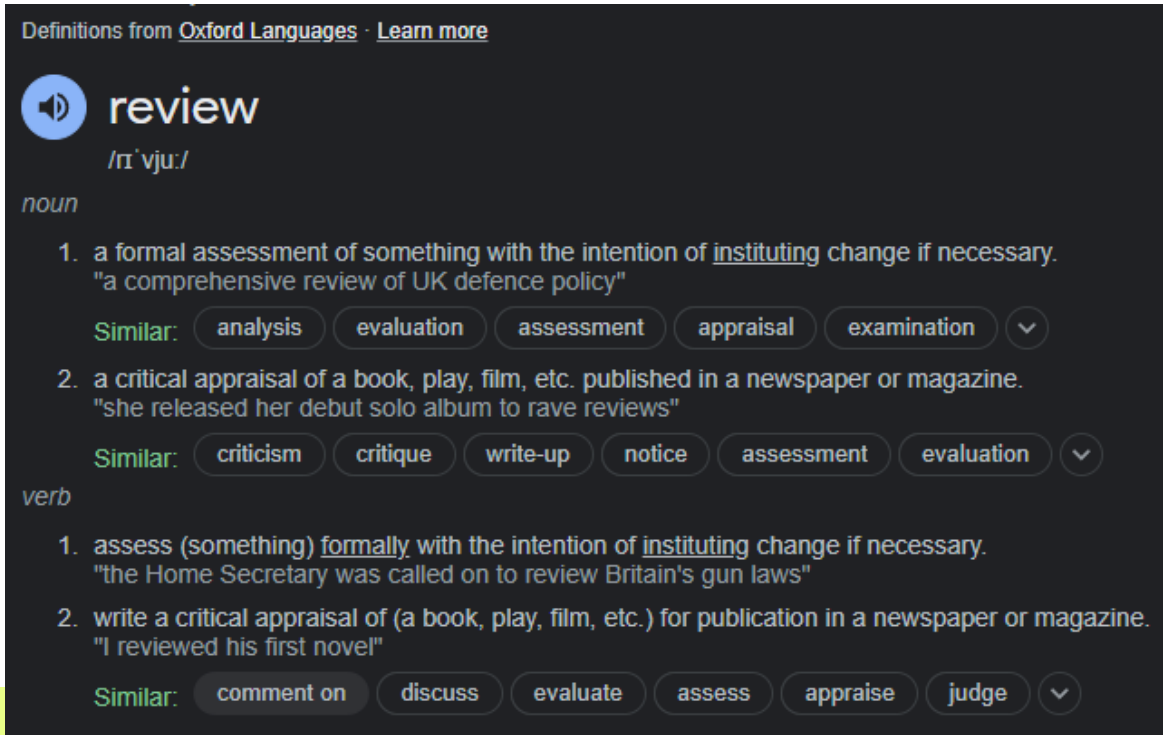
Literature Survey/ Review

- Pull a chair up to a round-table, and Engage with those notable scholars, researchers and writers, who have addressed your question.
- Where am I in relation to what have already done on the subject.
- The term may sometime be misleading at undergraduate level as we hardly review the literature but situating your work with the literature and identifying gaps and problems with that literature.
- Highlight the Strengths and Weaknesses, some areas need strengthening or elaborating.
- Driven by Research Question



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Research Question

- Adress a question that hasn't be answered
- Must address something of significance
- Researchable ?

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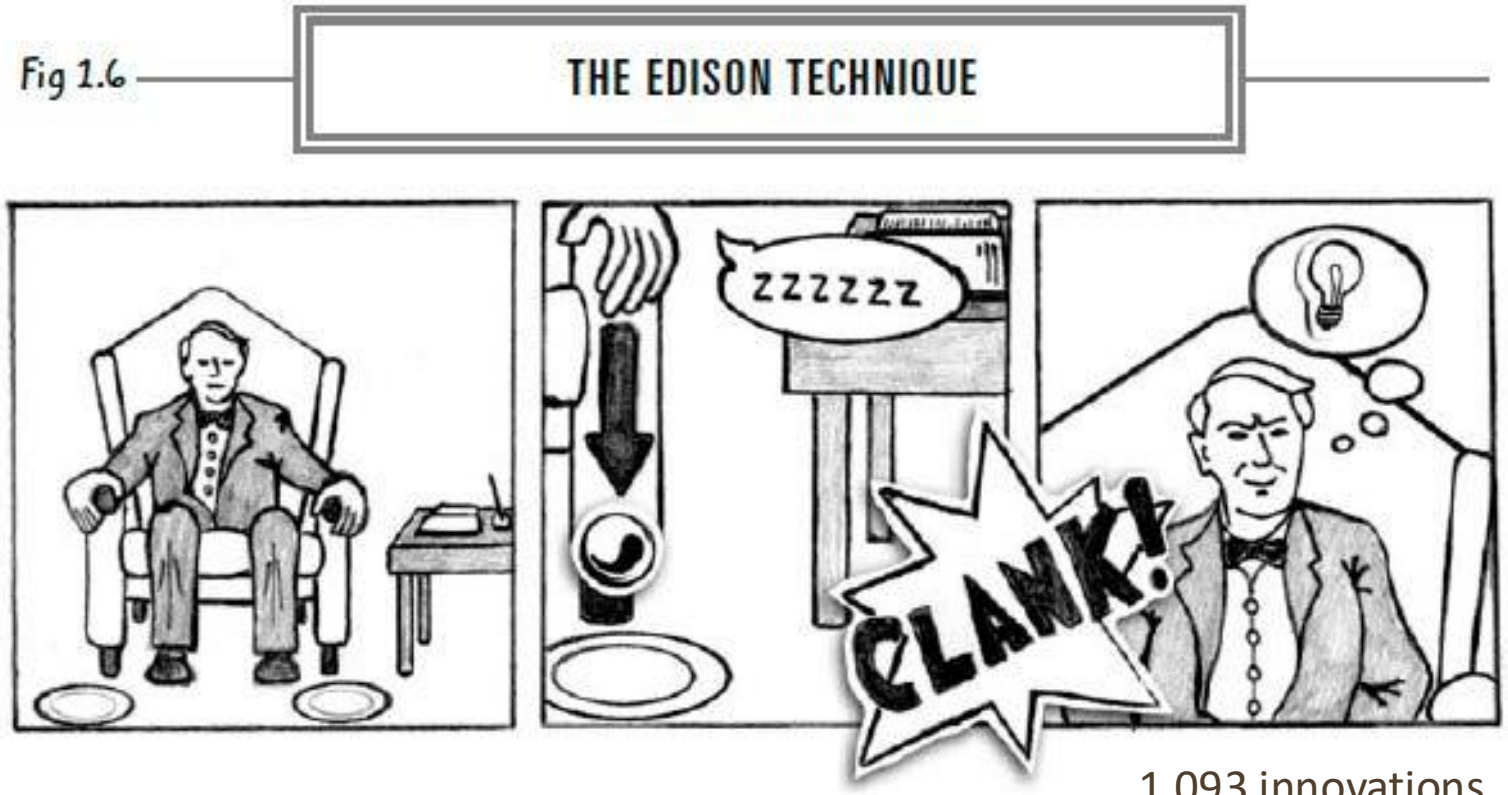
Ideation and personas

- 'Aha' moment



1,093 innovations

https://uxdesign.cc/why-do-creative-people-need-time-to-sit-around-and-do-nothing-307f3d8d7b16

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Example: Mind Mapping 'Strategies for Climate Change' Essay Topic

http://www.greendealsolutions.net/wp-content/uploads/2013/03/strategies-for-change.jpg [Accessed: 10 July 2014]

The British Dyslexia Association states, "Dyslexics struggle with their spoken and/or written language, following instructions, poor concentration and carrying out analytical or logical tasks. Strategies such as mind mapping are recognized as valuable learning tools."

The British Dyslexia Association, www.bdadyslexia.org.uk.

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Motivation

- Justification
- Impact
- Value of outcomes
- Validity of outcomes
- Implementation
- Economic feasibility

- Upliftment of Quality of Life
- Serving the humanity

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Writing and Keeping Notes

- Do never wait for the last moment
- Write while you work – may be even daily basis
  - Adding gradually to the main argument
  - Remove the not relevant
  - So, ideas evolve in writing
  - Also building up the strength and quality.

- Always keep references with relevant facts
- Paraphrasing
- Plagiarism

- Online tools

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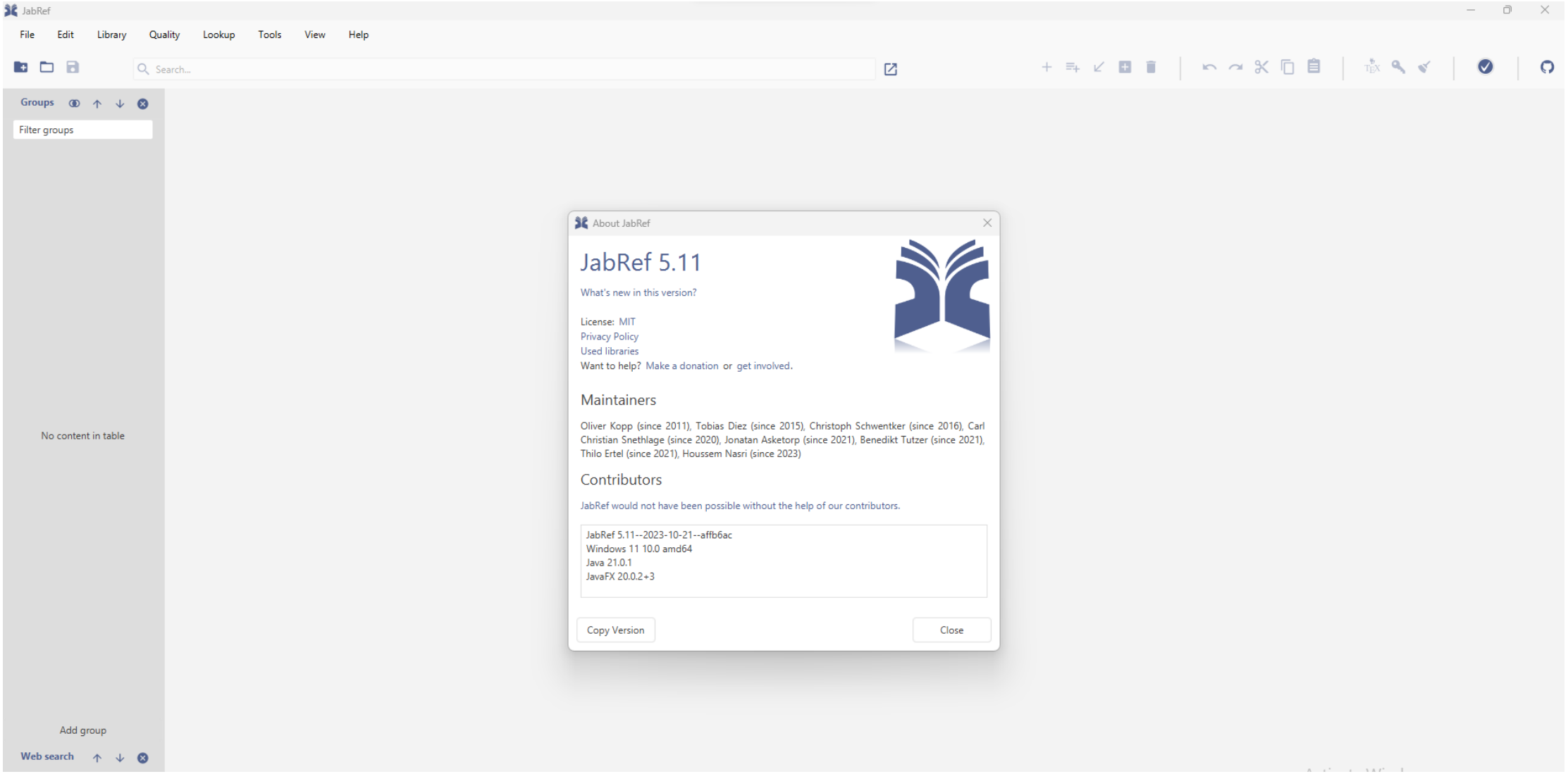
Referencing Tools



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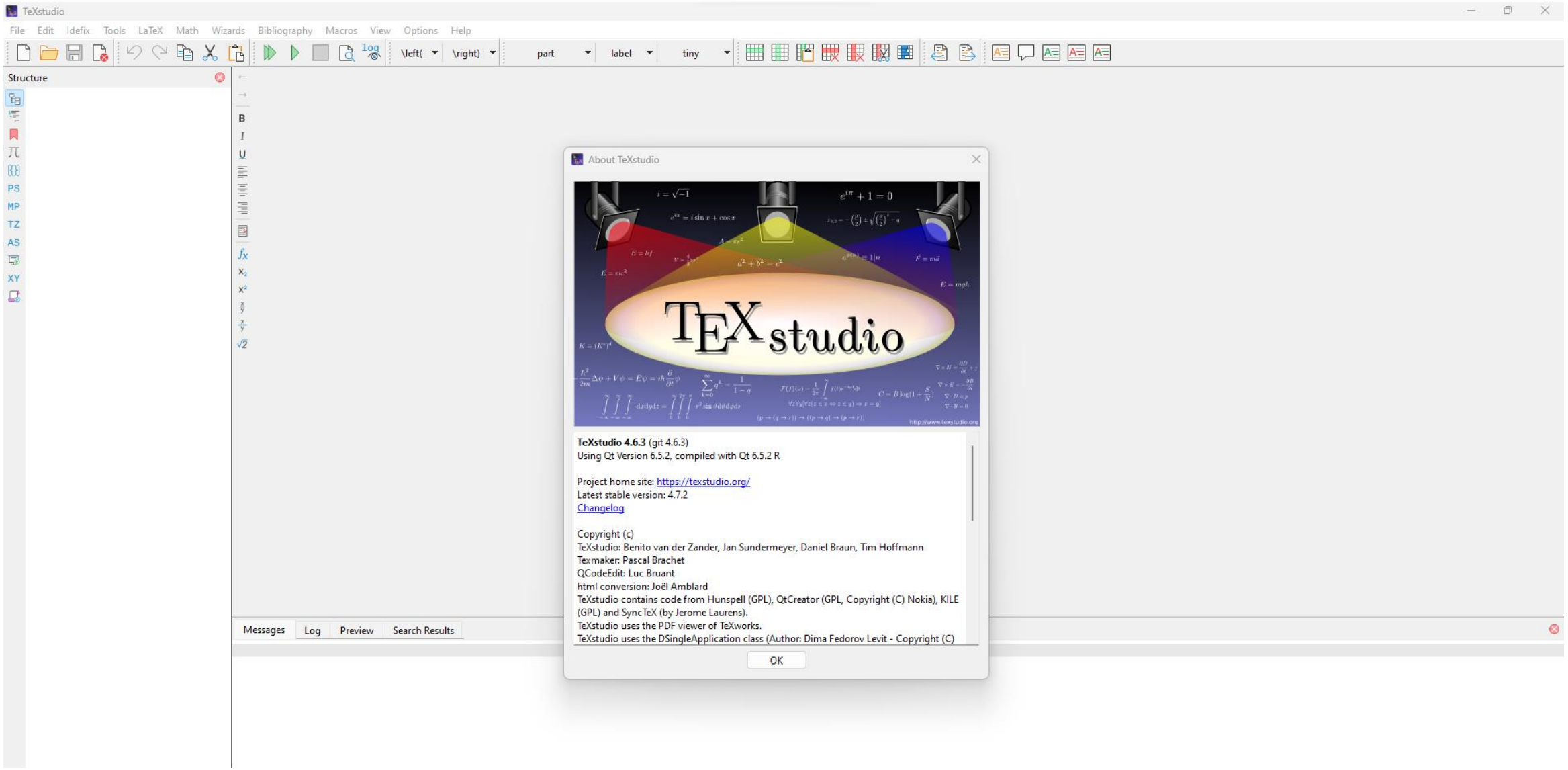
Typesetting Tools



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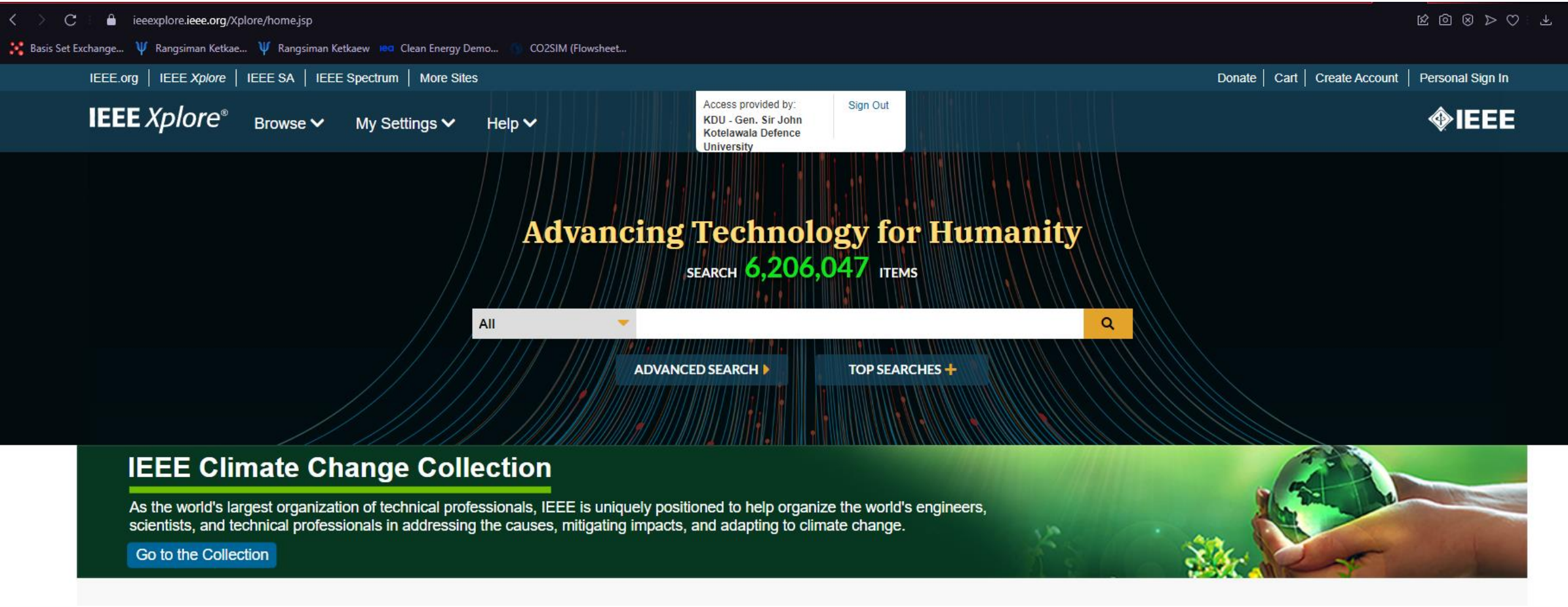
Online Tools



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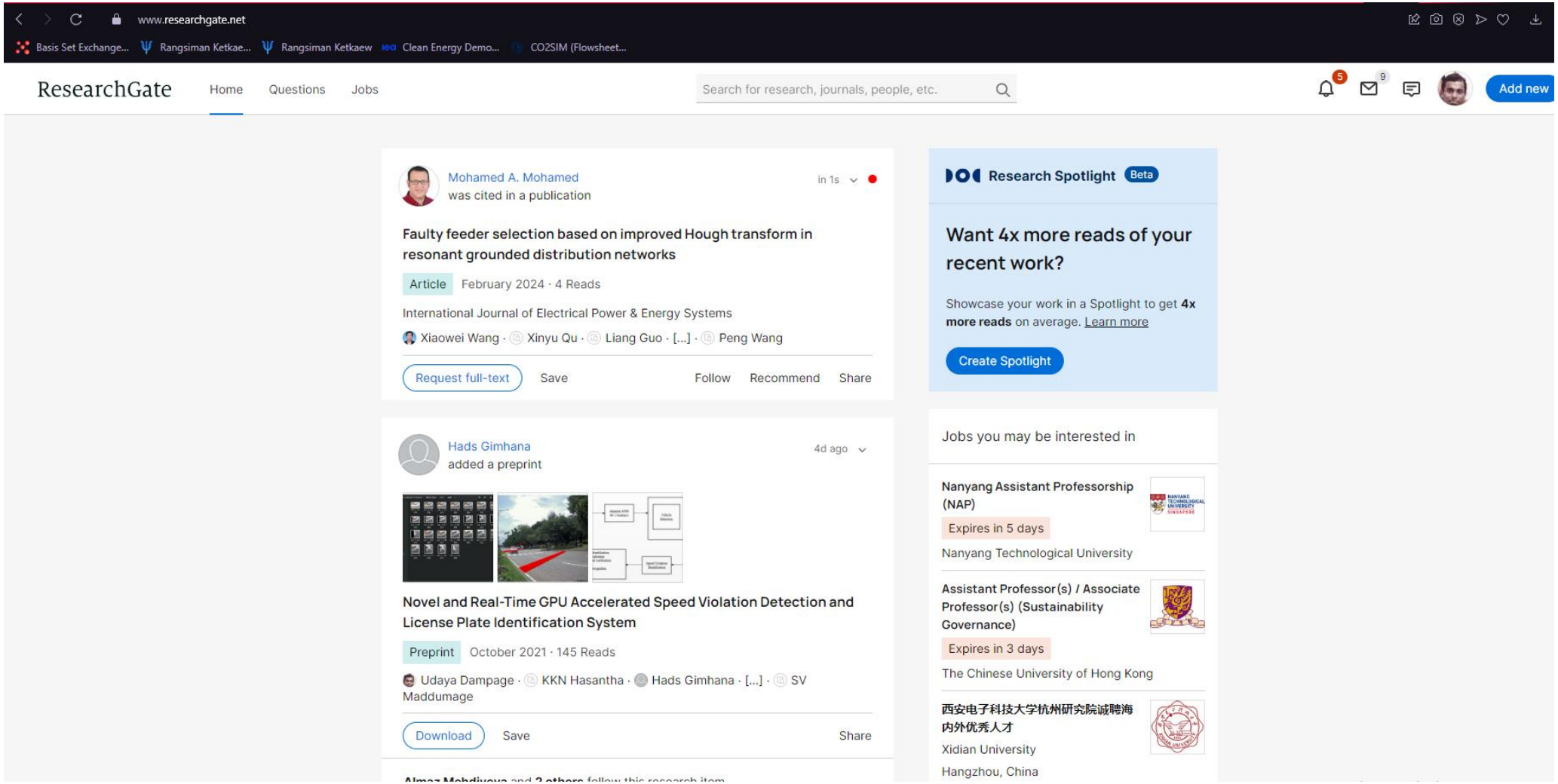

160+ million publication pages, 25+ million researchers

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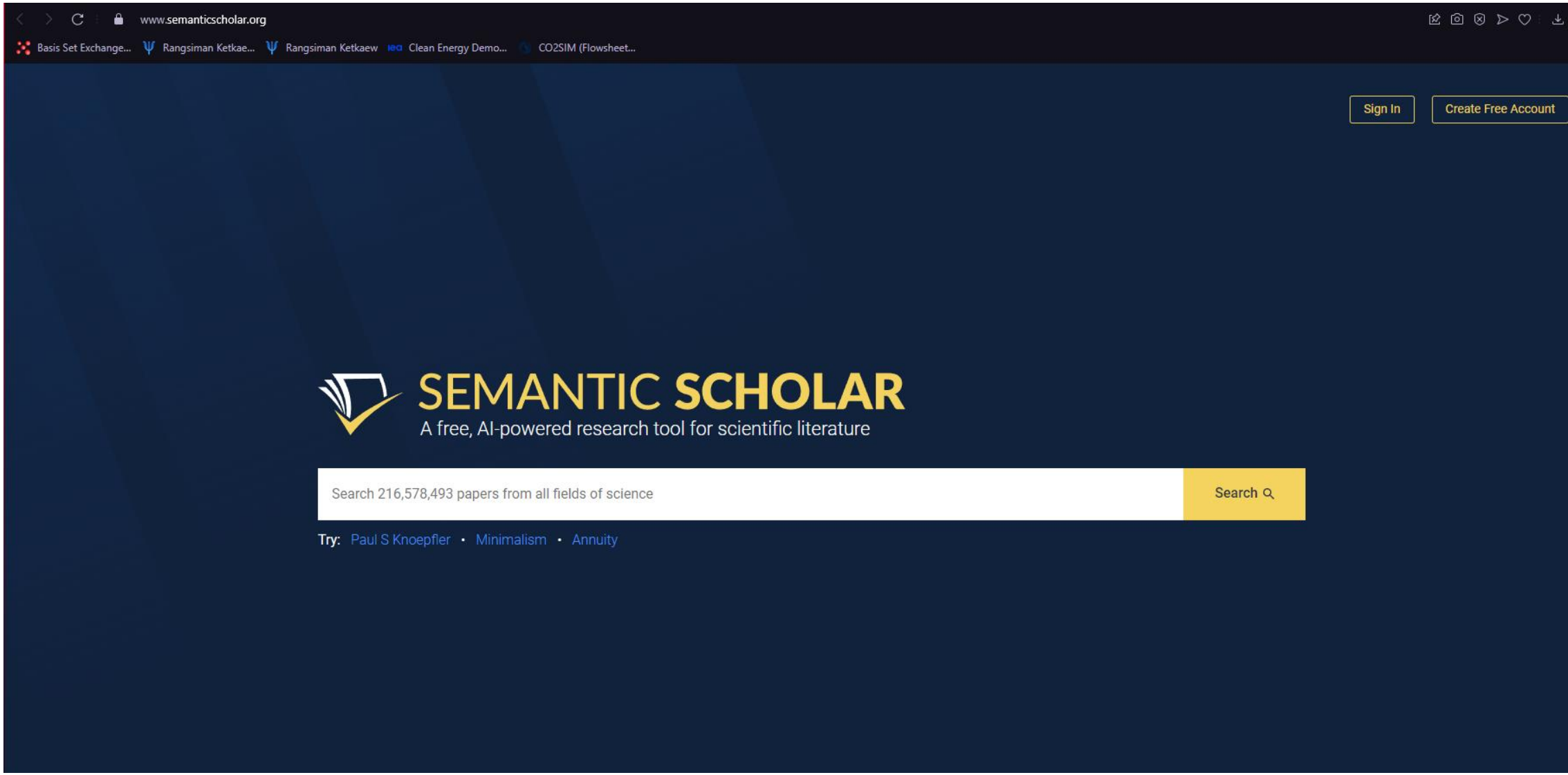

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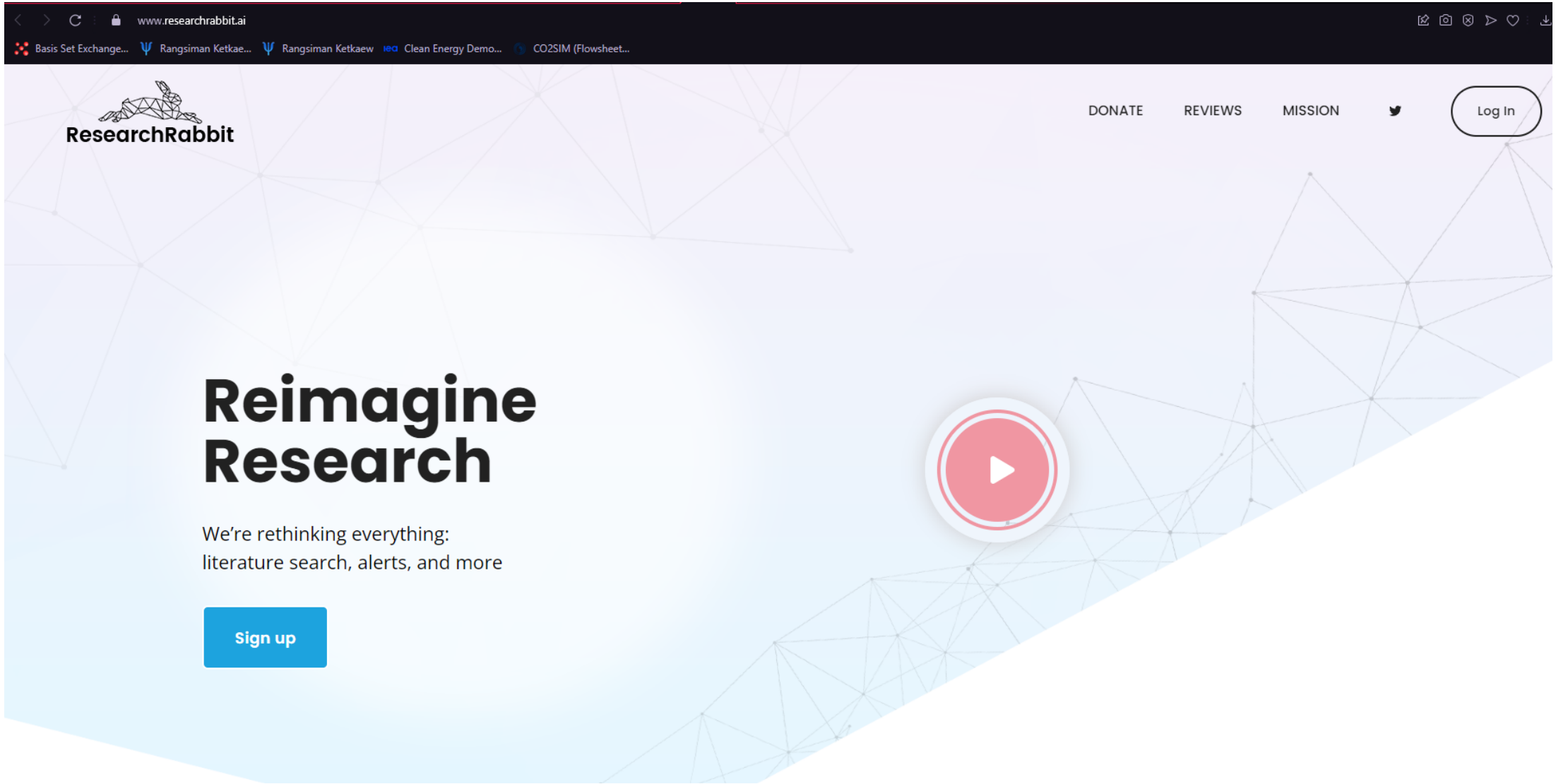

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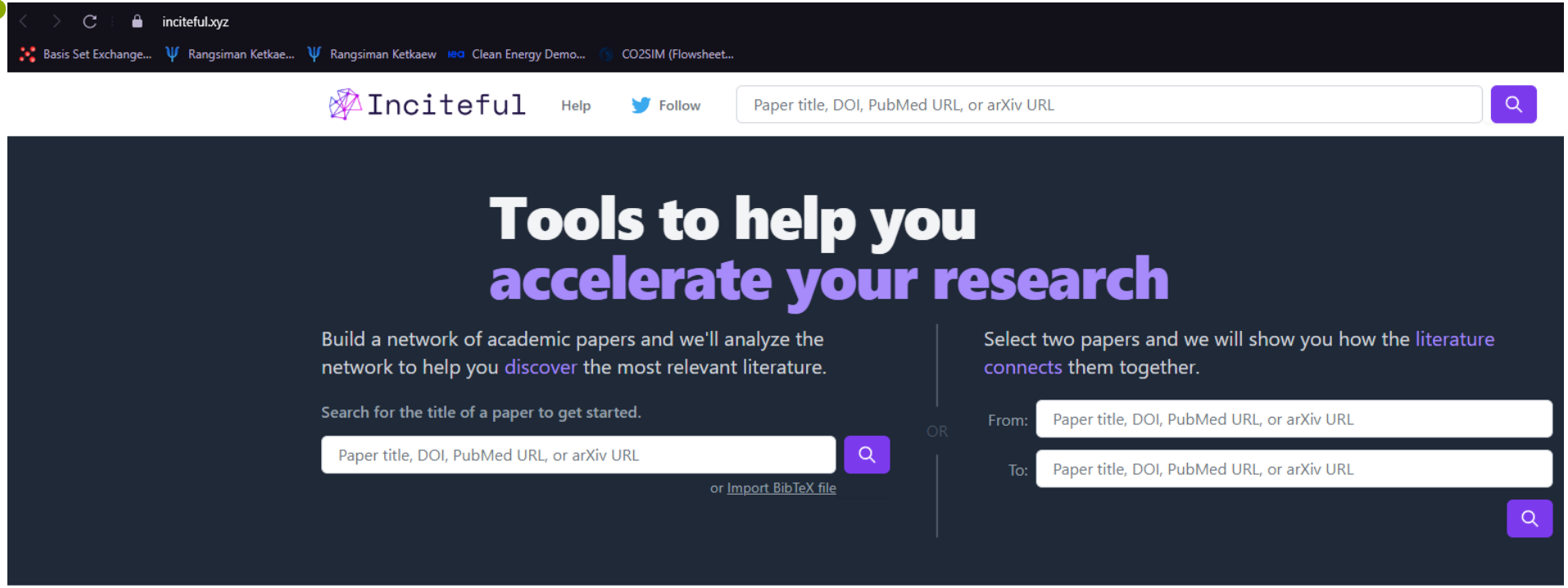

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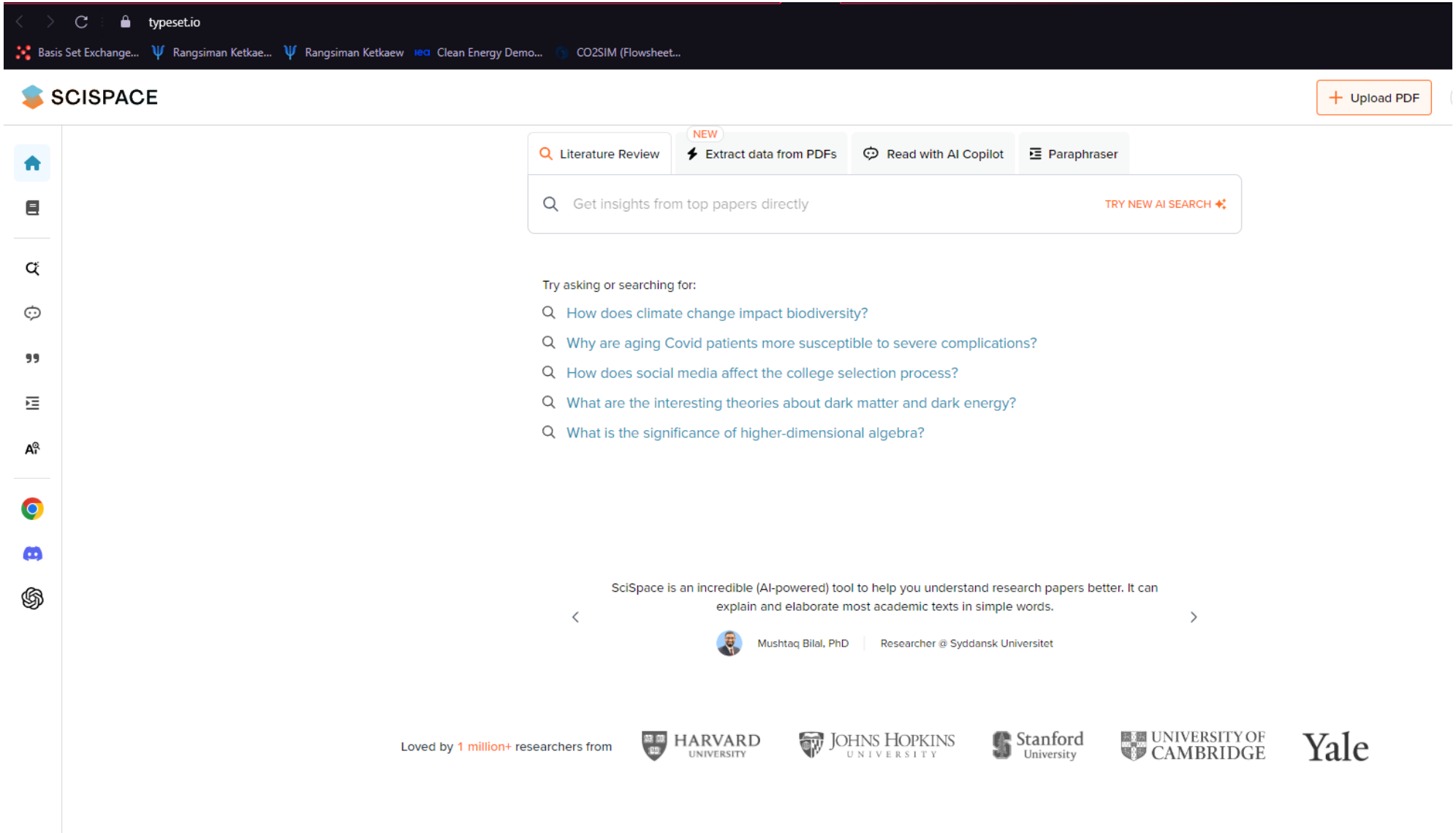

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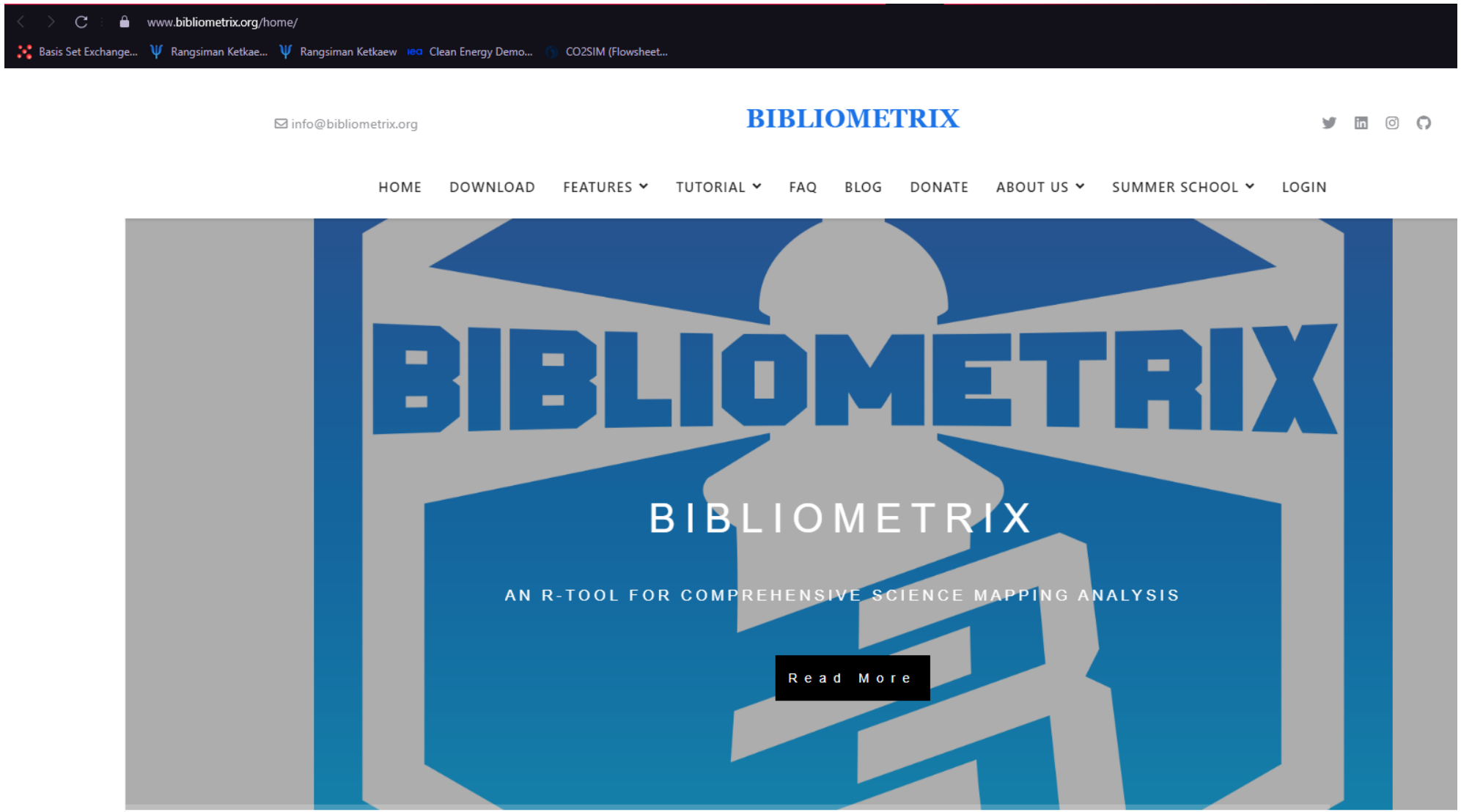

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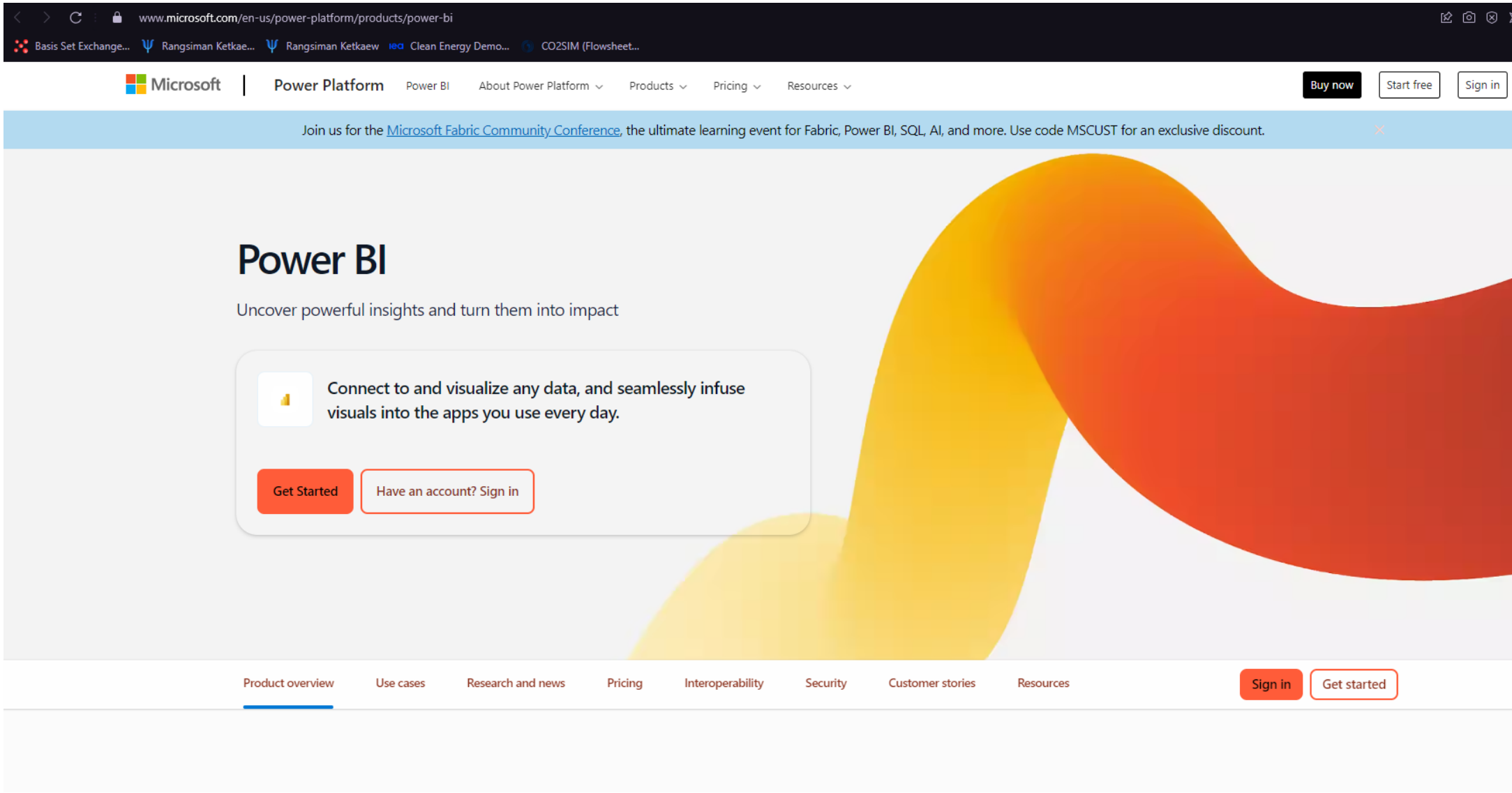

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Mind Mapping is a powerful note-taking method, great when you need to think creatively. To use effectively, use different colors.

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"I have not failed. I have just found 10,000 ways that won't work"

Thomas Edison

Thank You..

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