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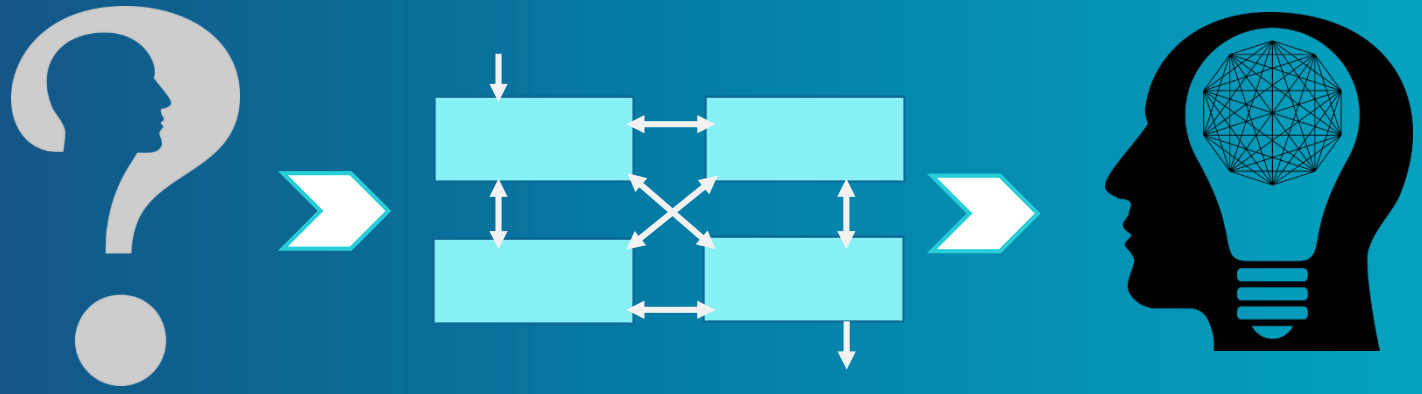
Problem Solving Toolkit



Dr Osnat Dagan

What is a problem?

- A problem exists when there is a **gap or a conflict** between an existing state and a desired state (Duncker, 1945)
- A problem is an **assignment** that someone
  - Wants or **needs** to solve
  - Does not have a **procedure** for solving
  - Has to choose the appropriate **way** to find a solution (Newell & Simon, 1972; Charles & Lester, 1984; Mayer, 1983)

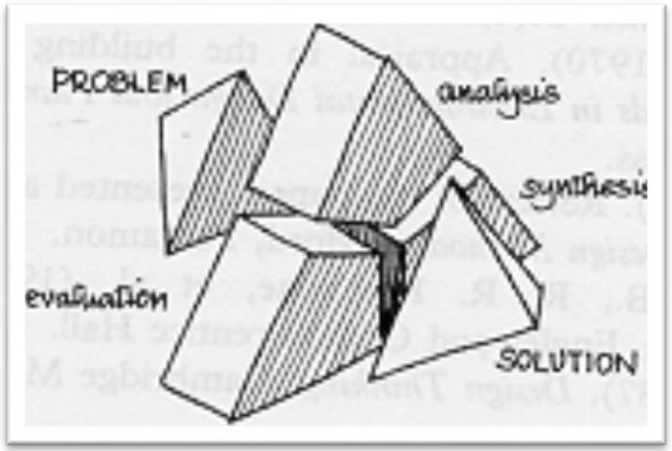
Problem solving approaches

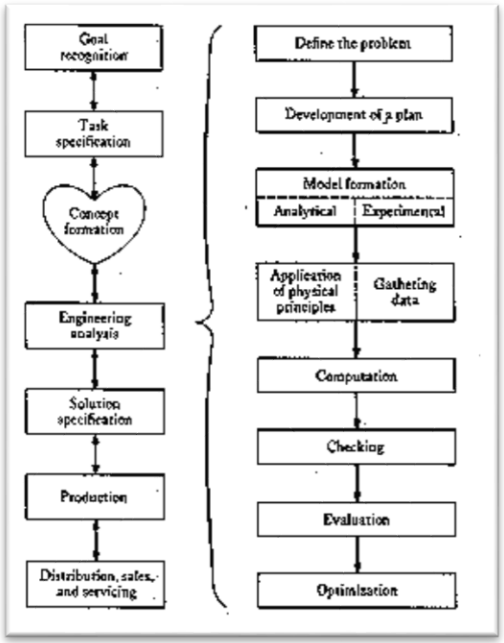
Problem solving is a behavior, activity, or process that **decreases the gap** between the **existing** state and the **desired** one

Heuristics Approach	Algorithmic Approach
Identify the ability to improvise solutions to a stimulus "Artistic" ability to create ideas (Shon, 1983; Newell & Simon, 1972; Hegaty, 1991)	Identify logical paths that bring us to possible solutions (Polia, 1957; Charles & Lester, 1984)

Problem solving (design process) models

Lawson 1997

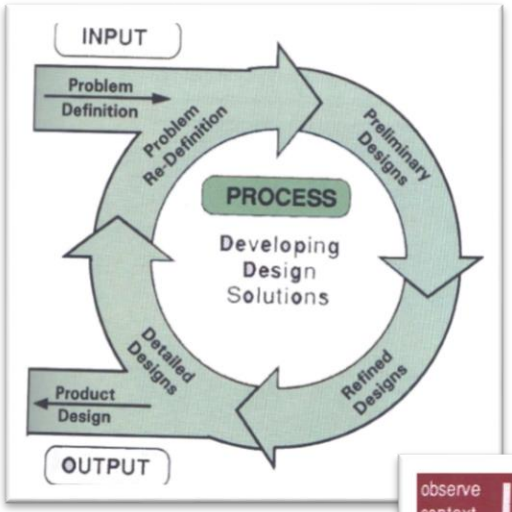


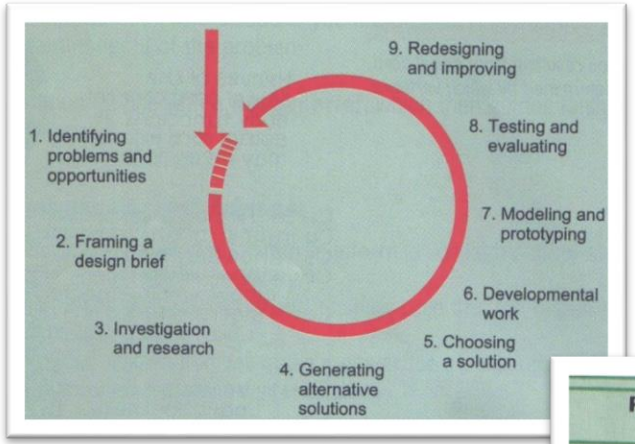


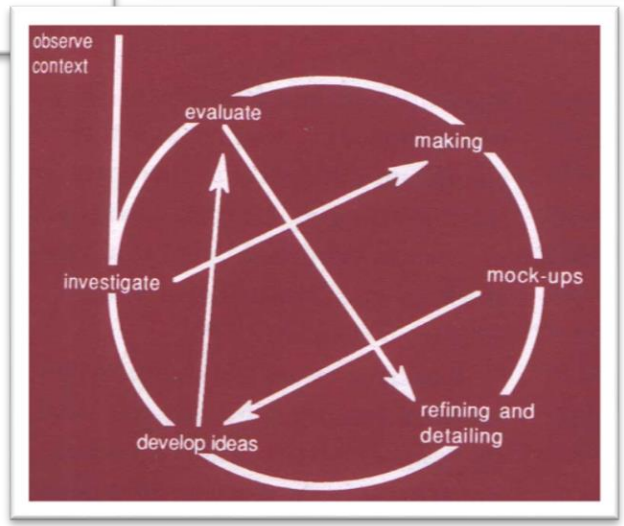
Frye,1997

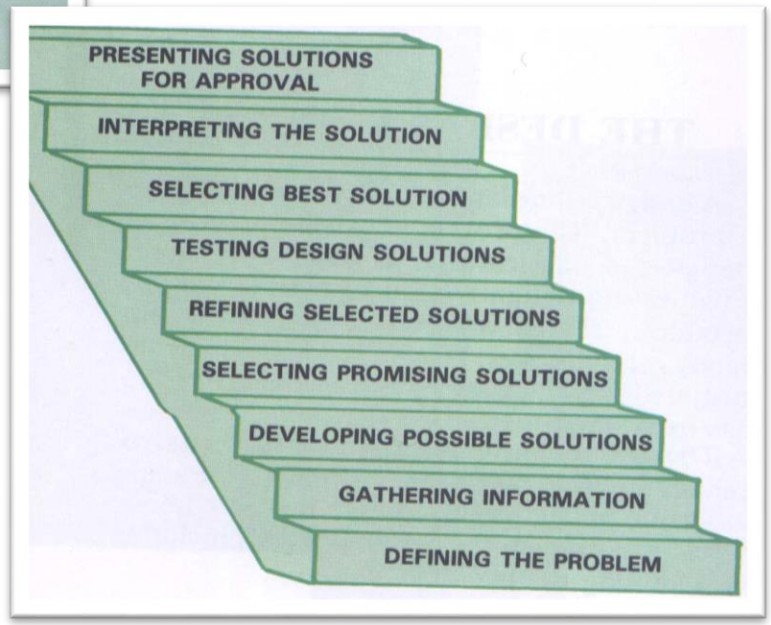
Bucciarelli, 1994

Problem solving (design process) models









Problem solving (design process) models

Most of these models describe

a linear and step-by-step

method of problem solving

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Problem solving step-by-step model: critique

- Problem solving **experts** do not perform a linear process (Glaser, 1982)
- Method does not take **alternative mental models** into account (Driver, 1989)
- There is no one way to solve a problem. There are **different paths** for different problems and states (De Vries, 1996)
- We need to present a **variety** of strategies and processes that the solver could suit to various contexts and problems (Johnsey, 1995)

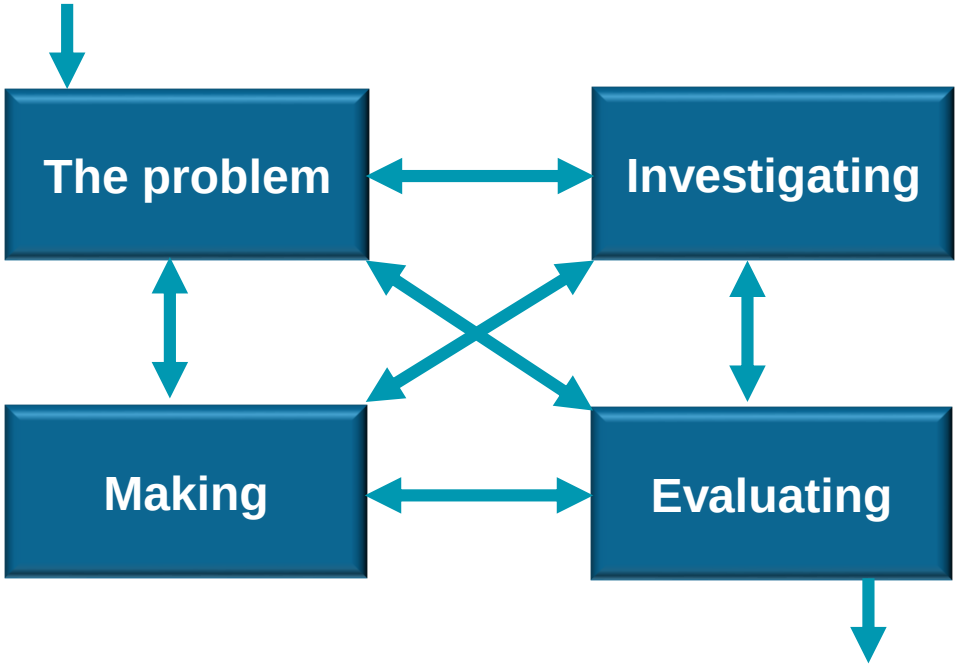
How to work with the problem solving toolkit?

You can use each tool more than once

- The problem
- Investigating
- Making
- Evaluating

How to work with the problem solving toolkit?

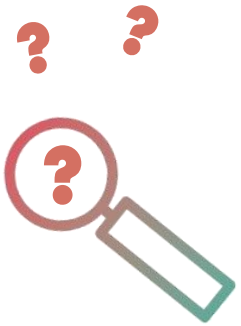
You can use each tool more than once

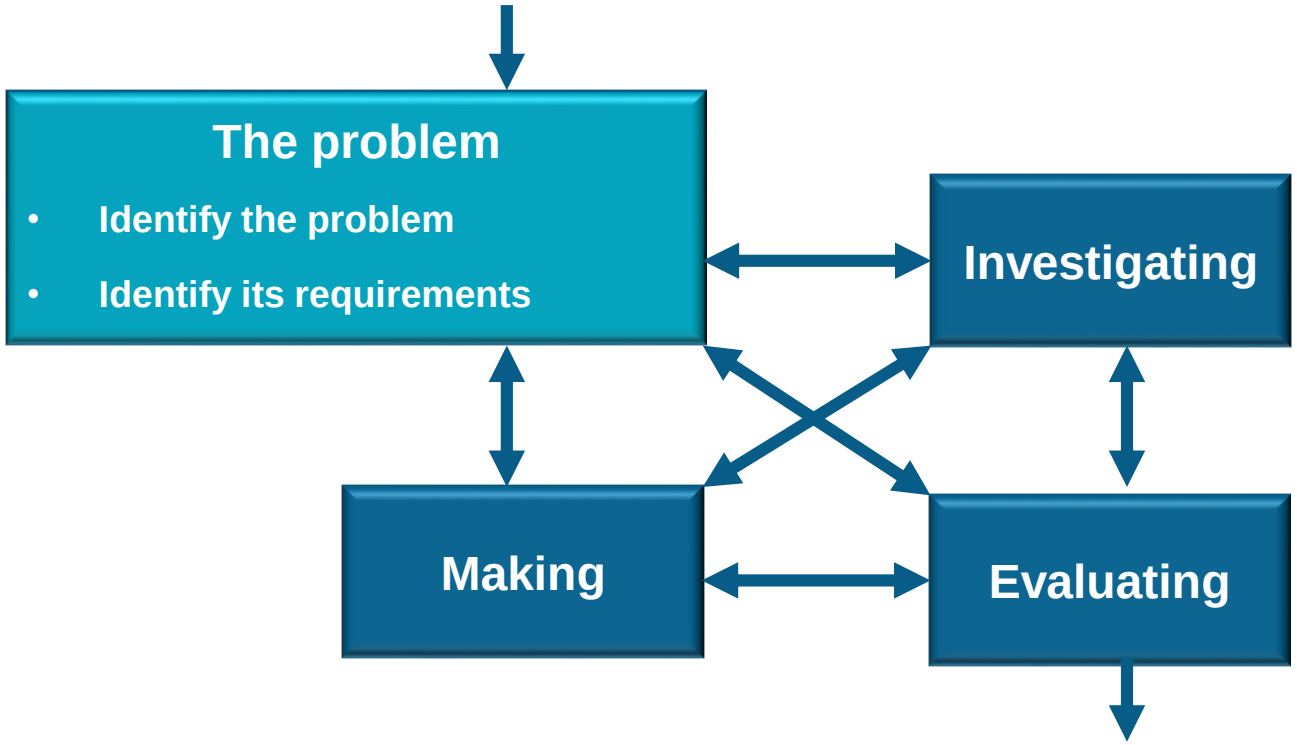


How to work with the problem solving toolkit?

Begin the process using the problem toolkit

- Identify the **problem**
- Identify its **requirements**





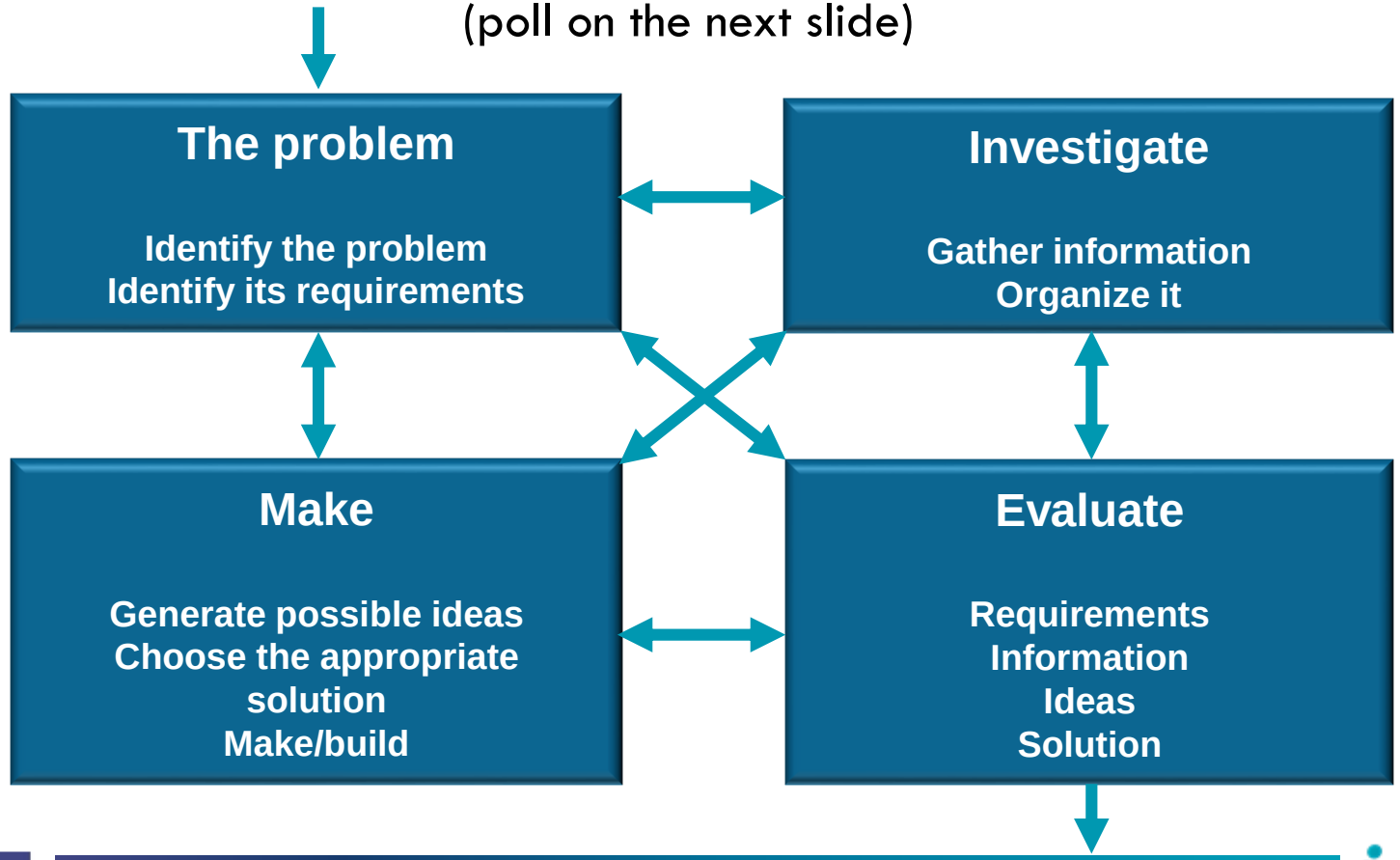
The problem: An example

- **Sample problematic situation**
  - In many cities all over the world, people build skyscrapers
  - More than 150 families could live in such a building
  - Each building produces a lot of garbage (1 person produces 1.5 kg per day)
- **Identify the problem**
  - **The question we ask to solve the problem begins with HOW?**
  - How to design and build a system to collect the garbage from these skyscrapers?
- **Identify the requirements from the solution**
  - Easy to use, looks clean, aesthetic, inexpensive, etc.

What next?

You identified the problem and its requirements. What next?

(poll on the next slide)



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The problem -reply what next?

◉ Allow Single Choice Only ○ Allow Multiple Choices

A. The problem

B. Investigation

C. Making

D. Evaluation

+ Add another answer

Preview

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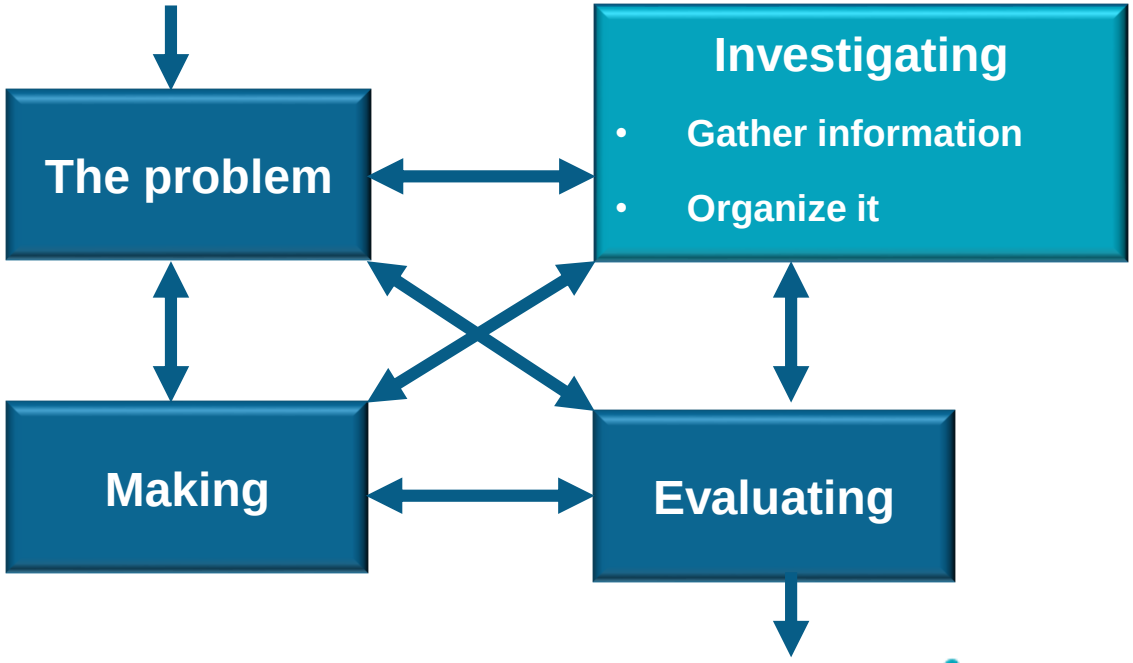
How to work with the problem solving toolkit?

Investigation includes:

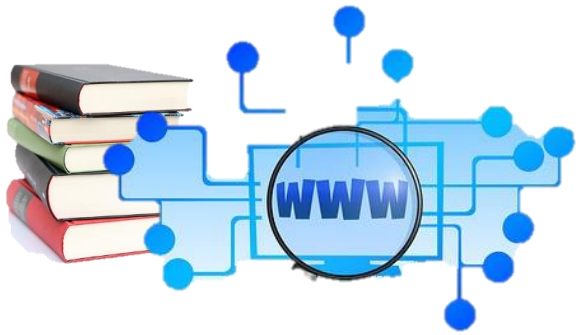
Investigating

- **Gathering information** via internet, books, shop, experts, etc.
- **Organizing** the information



Investigation: An example

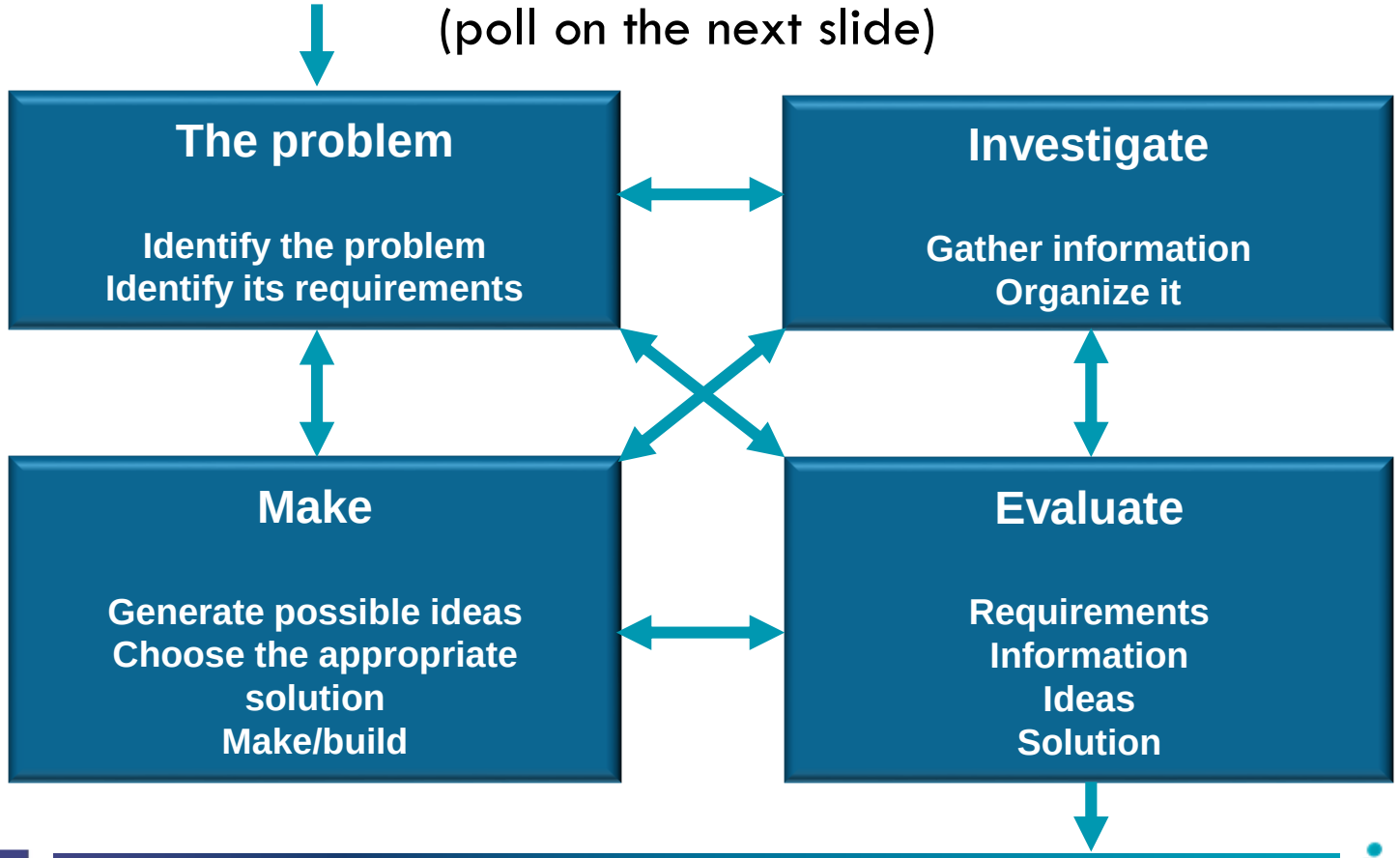
- Could each of you, as an international group, **discover** how to solve this problem? (How to design and build a system that collects the garbage from these skyscrapers?)
- **Search for information** via the internet or books
- **Organize the information** that could help you to solve the problem



What next?

You gathered information. What next?

(poll on the next slide)



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Gathering information -reply what next?

◉ Allow Single Choice Only ○ Allow Multiple Choices

A. The problem

B. Investigation

C. Making

D. Evaluation

Insert option here

+ Add another answer

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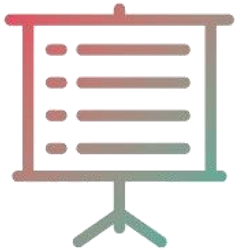
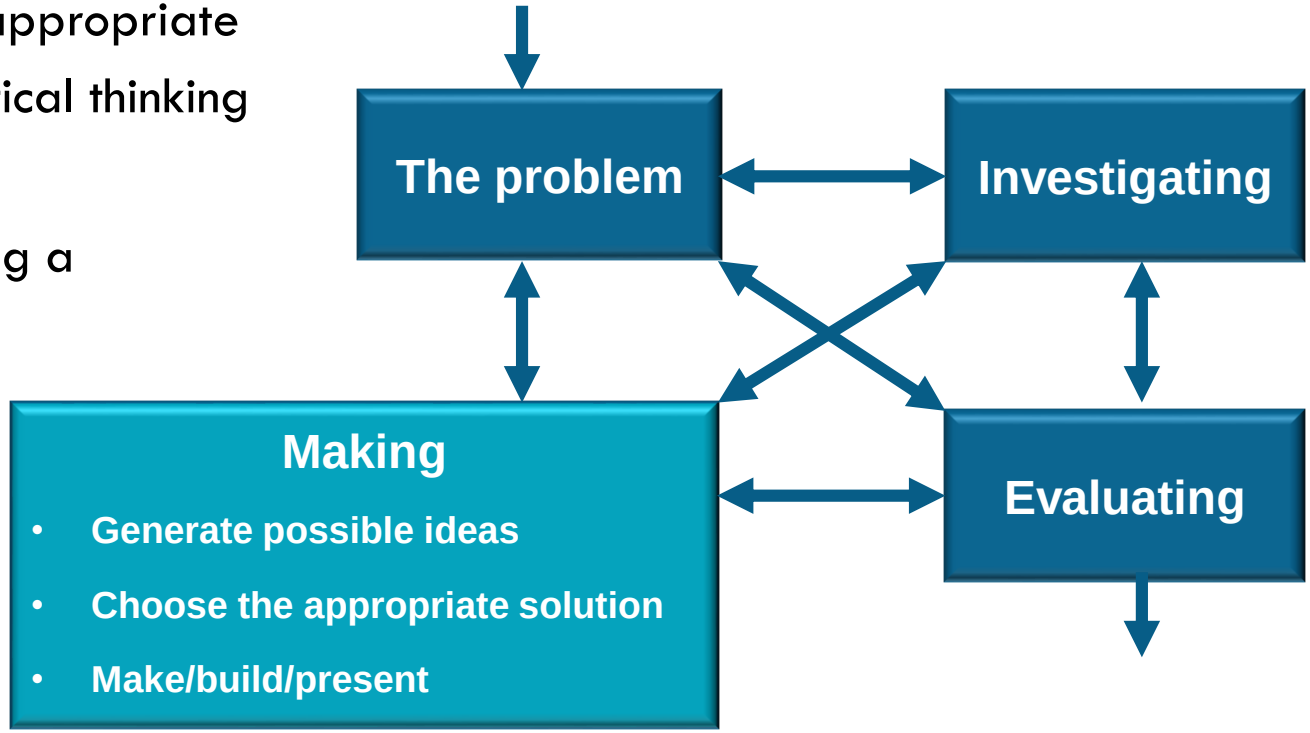
How to work with the problem solving toolkit?

While 'making' you can use these toolkits

Making

- **Generating** possible creative ideas (using creative thinking methods)
- **Choosing** the appropriate solution (using critical thinking methods)
- **Making**, building a prototype, and presenting it





Making: An example

- **Generating possible creative ideas such as these**
  - A garbage collector in each apartment who moves it to the main container
  - A compost container in each floor that feeds a small garden
  - A robot that collects all the garbage to a specific location
  - A main container on the roof or in the basement of the building with central municipal conveyers
- **Choosing the appropriate solution** that answers the most requirements
- **Making, building a prototype,** and presenting it to your colleagues via a PowerPoint presentation, a short movie, or a poster

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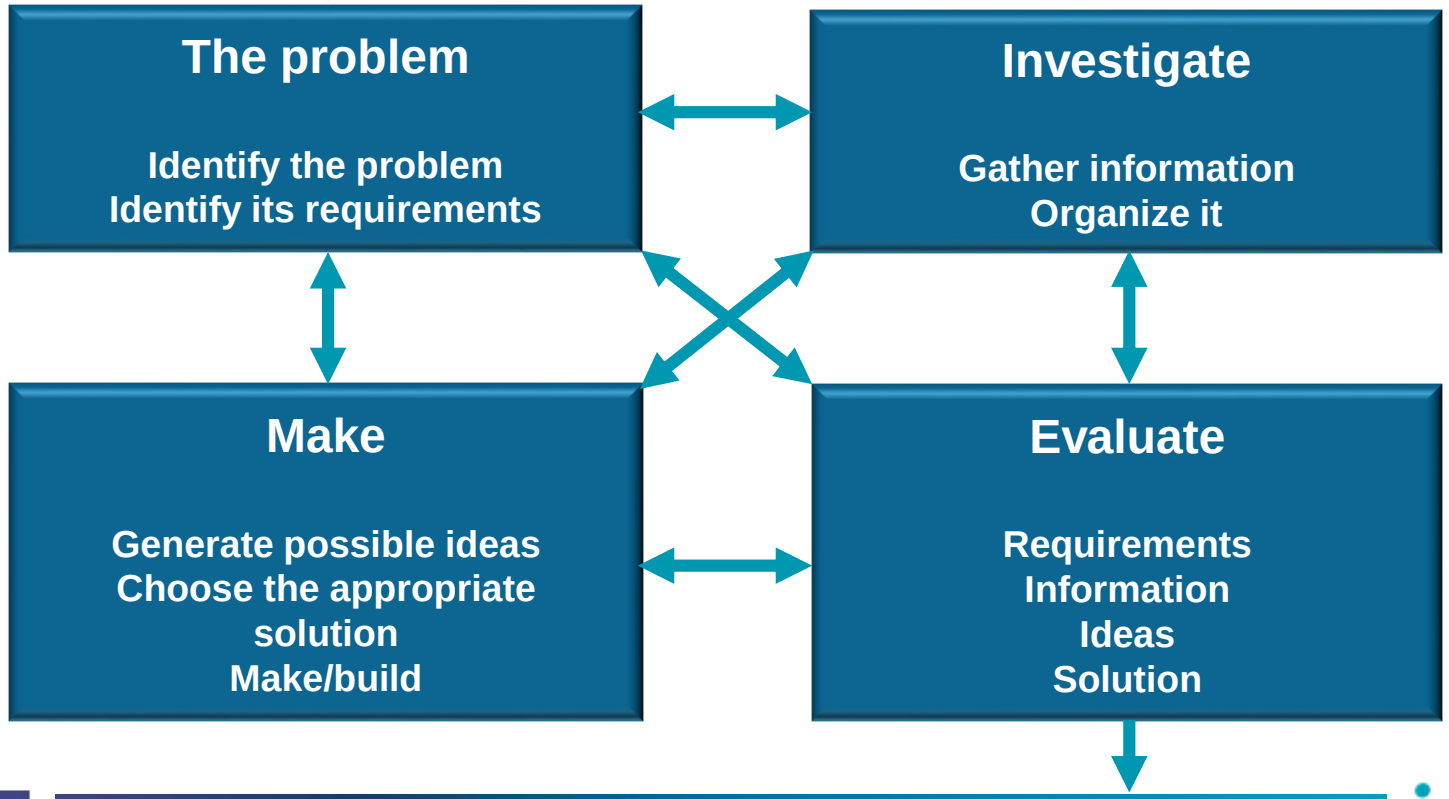
What next?

You generated an idea? Chose the appropriate solution?

Made it? What next? (poll on the next slide)



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Making (generating idea, chosing the appropriate solution, making? - reply what next?

◉ Allow Single Choice Only ○ Allow Multiple Choices

A. The problem

B. Investigation

C. Making

D. Evaluation

+ Add another answer

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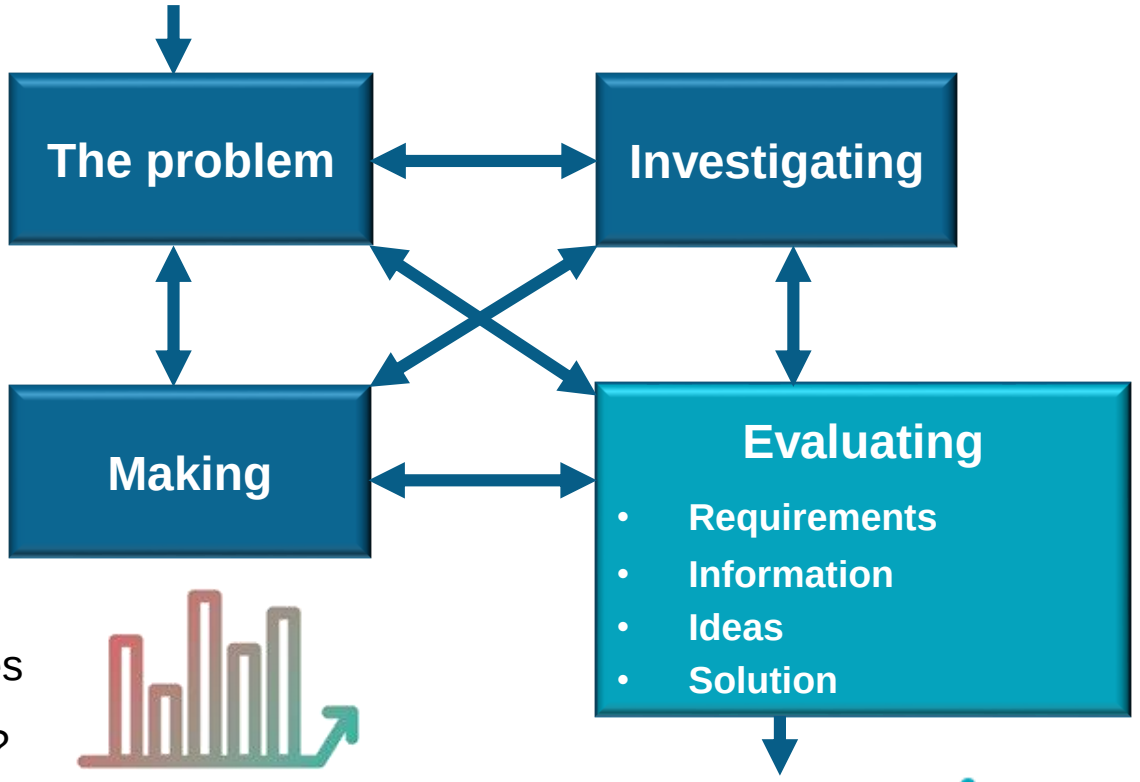
How to work with the problem solving toolkit?

The evaluating toolkit could be used to evaluate:

Evaluation

- **Requirements:** Are these the most important requirements?
- **Information:** Do we have all the information to solve the problem?
- **Ideas:** Do these ideas solve the problem and its requirements?
- **Solution:** Is this the most appropriate solution, and does it suit the most requirements?



Evaluating: An example

We have to ask ourselves these questions at each evaluation point

- **Requirements:** Have we identified all the necessary requirements? Are there more? Should we delete some of them?
- **Information:** Does the information solve the problem? Do we need more? What specific information is needed? Where to find it?
- **Ideas:** Do these ideas solve the problem? Do they answer our requirements? Do we need to generate more ideas?
- **Solution:** Is this the most appropriate solution? Does it suit the most requirements?

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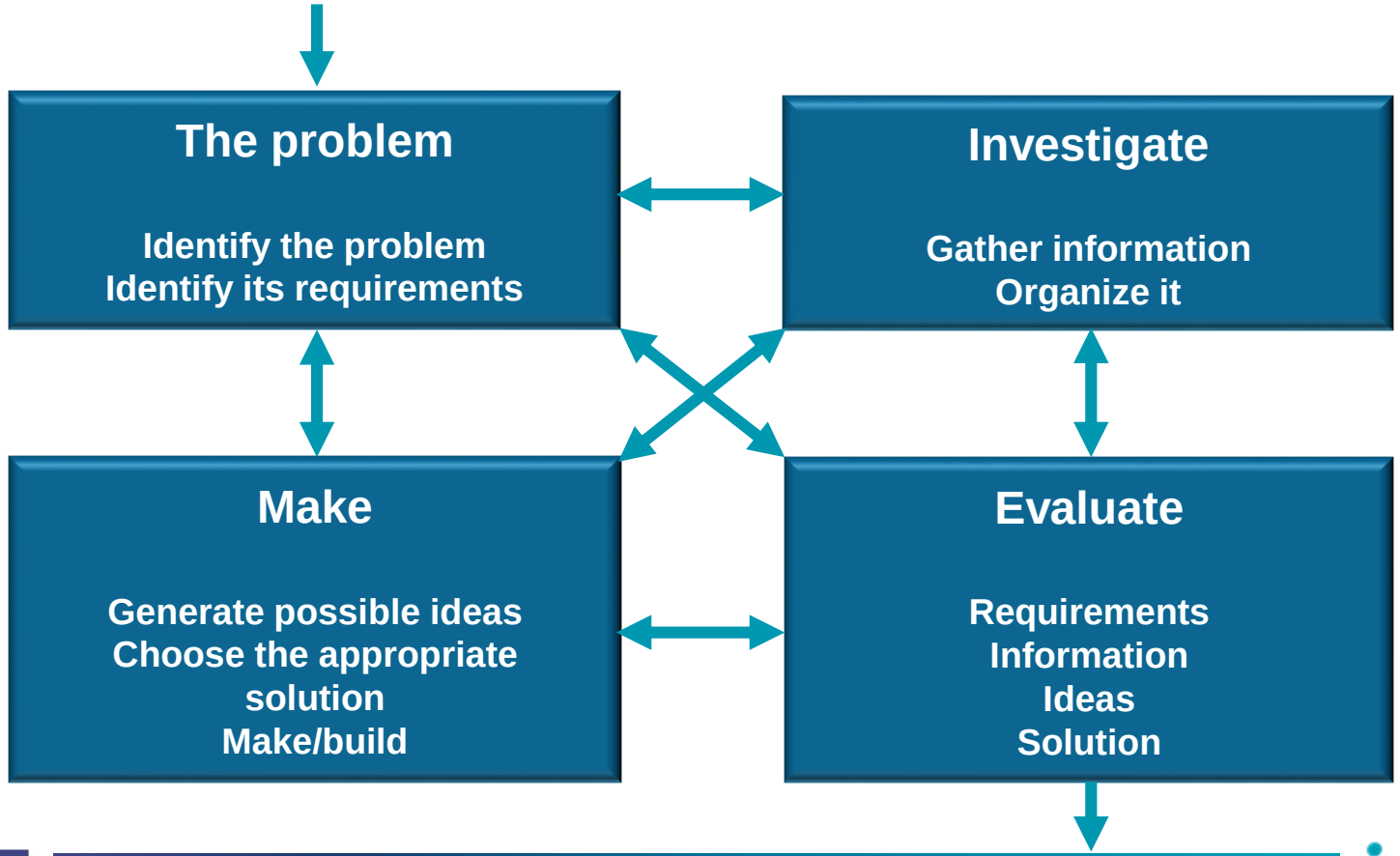
What next?

You evaluated… What next? (poll on the next slide)



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Evaluation (the information, the ideas, the requirements or the solution - replly what next?

◉ Allow Single Choice Only ○ Allow Multiple Choices

A. The problem

B. Investigation

C. Making

D. Evaluation

+ Add another answer

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Examples of possible paths

Possible Path A

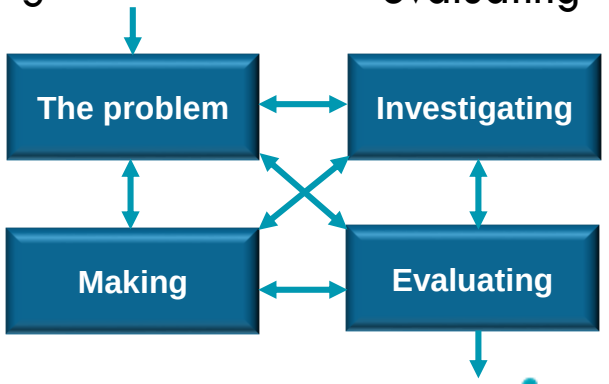
- The problem
- Investigating
- making-generating ideas
- Evaluating
- Investigating
- Evaluating
- choosing a solution
- Evaluating
- Making/building
- evaluating the product

Possible Path B

- The problem
- Making-generating ideas
- Evaluating
- Investigating
- Evaluating
- Making-choosing a solution
- Making/building
- evaluating

Possible Path C

- The problem
- Making/building
- Evaluating
- Investigating
- Evaluating
- choosing a solution
- Evaluating
- Making/building
- evaluating



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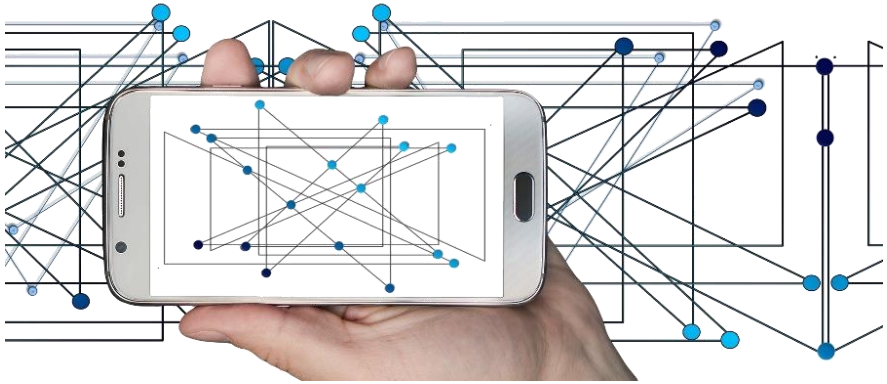
Your problem - solving path

- On paper or on your computer, **sketch** how you will use the toolkit to solve a new problem. What will be the **order** of the tools when you face a problem that you need to solve?
- **Photograph** the sketch
- Add your sketch and your name to the Padlet **collaborative wall**: https://padlet.com/osnat_dagan/jk0tu7vm8bau
- At the end of the process, **re-examine** the sketch to compare your initial ideas with the end result



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