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Applying Design Thinking in Systems Engineering Process as an Extended Version of DIKW Model

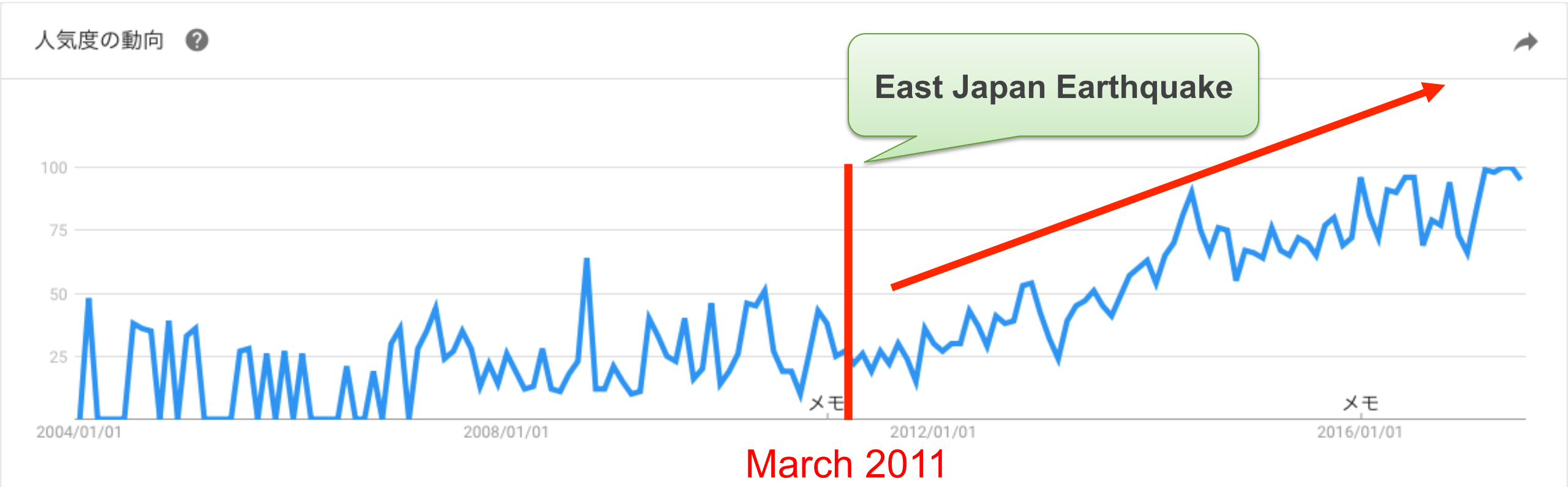

Design Thinking
デザイン思考のつくりかた
実践企業とトップクリエイタ
成功のポイントと落とし穴


NIKKEI DESIGN セミナー
新規事業や商品開発、海外戦略等の担当者必聴!
11/26(水)
緊急開催
決定!
デザイン・シンキング
実践ワークショップ
デザイン思考とシステム思考の融合で真のイノベーション創出へ


システム×
デザイン思考で
世界を変える
Innovation
前野隆司
本書には そのヒントが
きっしり詰め込まれている
茂木健一郎


デザイン思考家が
知っておくべき
39のメソッド
the d.school bootcamp bootleg


KEIO SDM x ISHINOMAKI 2.0 presents
MACHIZUKURI 2.0
イノベーションでアプローチする新しいまちのつくり方



March 2011

Japanese government has started the initiative that is to recover from disaster by using dialog with design thinking.

The Myth of Design Thinking

“It is the best methodology to generate innovation.”

“Logical thinking is a history, design thinking come up with the future.”

“Let’s conduct design thinking workshop to solve all of problem.”

and more.

Magical Lamp or Lightsaber

Issue

Definition : Design Thinking

"Design Thinking is a mindset."
by IDEO

Design Thinking for Educators Toolkit, IDEO, 2011

It's Human-Centered.

It's Collaborative.

It's Optimistic.

It's Experimental.

Which is the best quadrant?

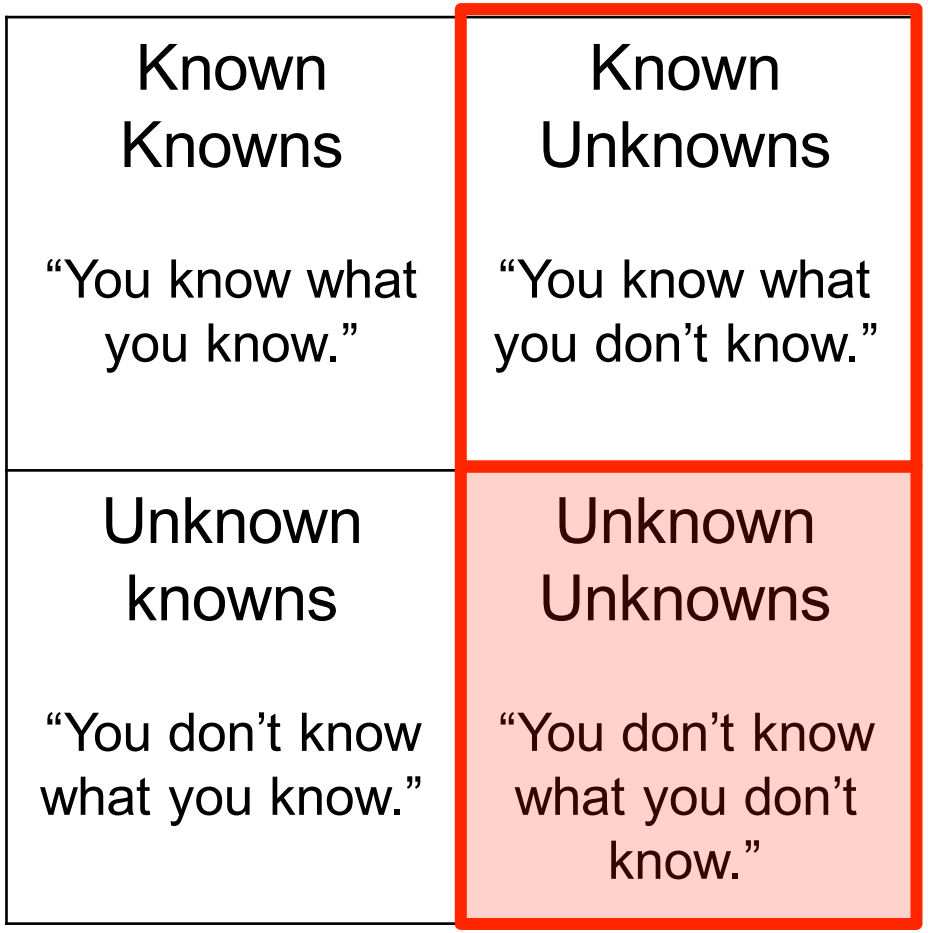
Known Knowns “You know what you know.”	Known Unknowns “You know what you don’t know.”
Unknown knowns “You don’t know what you know.”	Unknown Unknowns “You don’t know what you don’t know.”

Which is the best quadrant?

Known Knowns “You know what you know.”	Known Unknowns “You know what you don’t know.”
Unknown knowns “You don’t know what you know.”	Unknown Unknowns “You don’t know what you don’t know.”

Which is the best quadrant?

if you have identified already what you want to make, you can go the process of well known systems engineering.



if you have NOT identified already what you want to make, going to the process of design thinking is better.

Tackling to “ill-Defined Problem”

- To find "innovation" or "societal systems" solutions requires exploring outside the conventional space.
- Solving “ill-defined” problems involves more creativity (Anderson 2005)

Well-Defined Problem Problem that has a unique problem definition	**Ill-Defined Problem** Problem that DOES NOT have a unique problem definition
Well-Structured Problem Problem that can identify the problem-solving means	**Ill-Structured Problem** Problem that CANNOT identify the problem-solving means
Well-Posed Problem Problem that has a unique solution	**Ill-Posed Problem** Problem that DOES NOT have a unique solution

Two Issues

- Changes occur more dynamically, the future becomes more uncertain.
- The interconnections between multiple things bring about new value creation.
- New value creation often takes place in “unknown contexts”.

there are two issues when considering the implementation of design thinking in systems engineering methodology.

- **The low reproducibility of thinking processes.**
- **The unstructured nature of the output.**

- Purpose of Study -

- ✓ The first purpose is to develop a structured design thinking approach that allows for leveraging the power of design thinking in the conceptual design of SoS such as innovation and societal systems using the DIKW model.
- ✓ The second purpose is to develop a framework to utilize this approach effectively.

Want to be able to use design thinking without becoming ”jedi”!

Approach

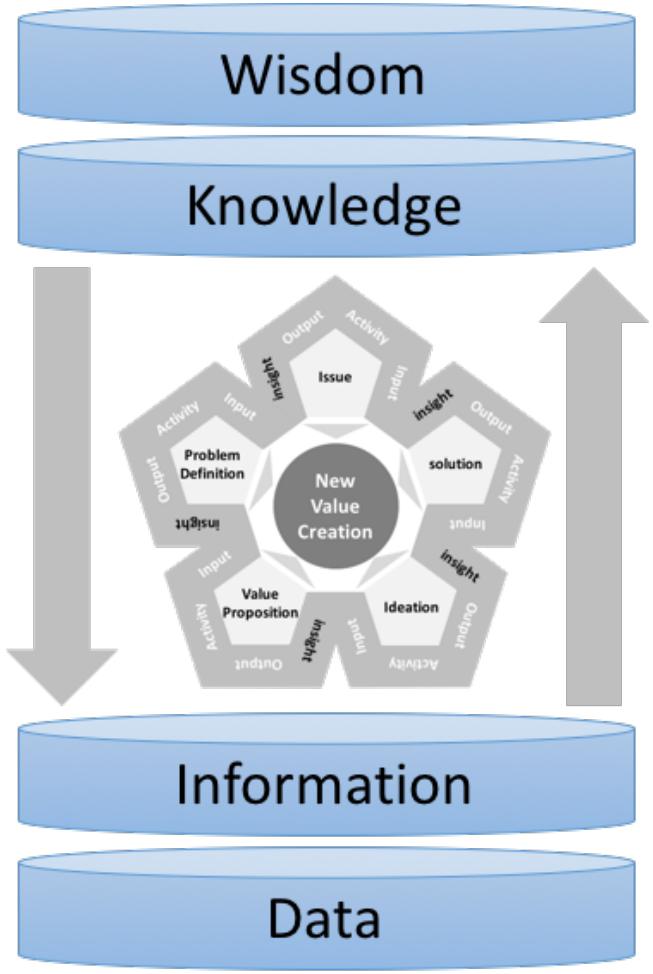
Structured design thinking approach

To eliminate the dilemma created when applying design thinking to solve “ill-defined” problems;

- “Structured design thinking approach” is a type of design thinking in which thinking processes are moderately guided.
- It is a combination of two different types of approach: the design thinking and the systems thinking through systemengineering.
- The proposed “structured design thinking approach” takes advantage of the holistic and systematic nature of systems engineering and the exploratory nature of design thinking.

The scope of structured design thinking approach

- This approach is designed as an extension of the DIKW model.
- To propose that this approach be utilized especially in the phase of converting information into knowledge.
- That is, structuring knowledge using information is a right object



Key Concept: Guide & Traceability

Guide to think

- Guides the direction and important focuses of thinking are the overall thinking processes and the format of each process's outputs.
- But not the outputs themselves. if the output contents themselves are guided, the benefits of design thinking that enable exploration beyond the conventional solution space would not be utilized at all.

Traceability to think

- To understand how the ideas were created. Making thinking processes traceable has the following benefits:
  (1) it makes discussions with diverse stakeholders easy.
  (2) it makes it possible to investigate the cause of a problem.

cf. Traceability to think

- To track the thinking process in the application of design thinking.
- To plays a role as a map indicating the current position and the destination of the discussions.

Processes: Process is an integration of multiple activities. It is a system for converting some inputs into output. The order of thoughts between each process is not fixed.

Activities: Activities are tasks that exist independently of one another. However, they are mutually linked, so their respective outputs serve as inputs for subsequent activities and form a series of thoughts.

Insights: Insights are typical outputs from each process. Insights are new perceptions and important findings that work as starting points for the next activity in a course of generating innovative solutions.

Mode: There are two thinking modes: divergent and convergent modes. A divergent mode broadly refers to searching for solutions directionally and semantically outside the conventional frames. A convergence mode refers to the structural understanding of what you are examining, and not just simply reducing the number of ideas and options.

Structured Design Thinking Framework

New Value Creation Process Framework

- The process framework of new value creation in the development of SoS conceptual design.
- Five phases can be identified.

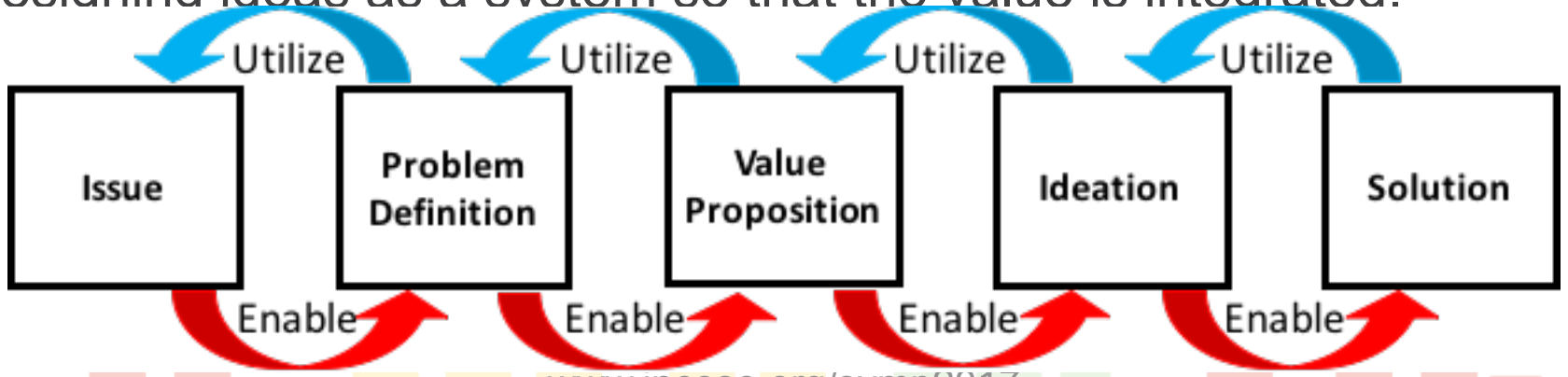
Issue: Selecting issues in an environment.

Problem Definition: Redefining selected issues as specific problems to be solved.

Value Proposition: Considering the value to be provided to stakeholders through solutions.

Ideation: Generating ideas for providing the value.

Solution: Designing ideas as a system so that the value is integrated.



Each phase consist of 4 process

Input: Each process starts with an input. The input is the known information or outputs from other processes. Since the purpose is to solve “ill-defined problems,” there is no need at this stage for the input to be comprehensively organized.

Activity: Particular activities are conducted in accordance with its purpose based on inputs to the process. A framework user may select which activity to conduct. The mode of performing the selected activity is important, not the activity itself.

Output: The form of the output differs greatly depending upon (1) what activity is selected, and (2) which mode is selected by the user of a framework. What is important is that it is visualized regardless of the type of format.

Insight: Insight may be discovered at any stage of the thinking process. In many cases, it is discovered when the output is being discussed. When a user of the framework obtains an insight, the next action is then clarified.

The Structured Design Thinking Framework

- Construct a framework using the processes defined in the "New Value Creation" framework and "4 processes".
- Adjacent processes are connected to one another with an “enabler” relationship and a “utilizer” relationship.
- The thinking process does not necessarily need to proceed in the order of the connections.
- Each phase and process are independent, and framework users may start thinking from any process.

Case

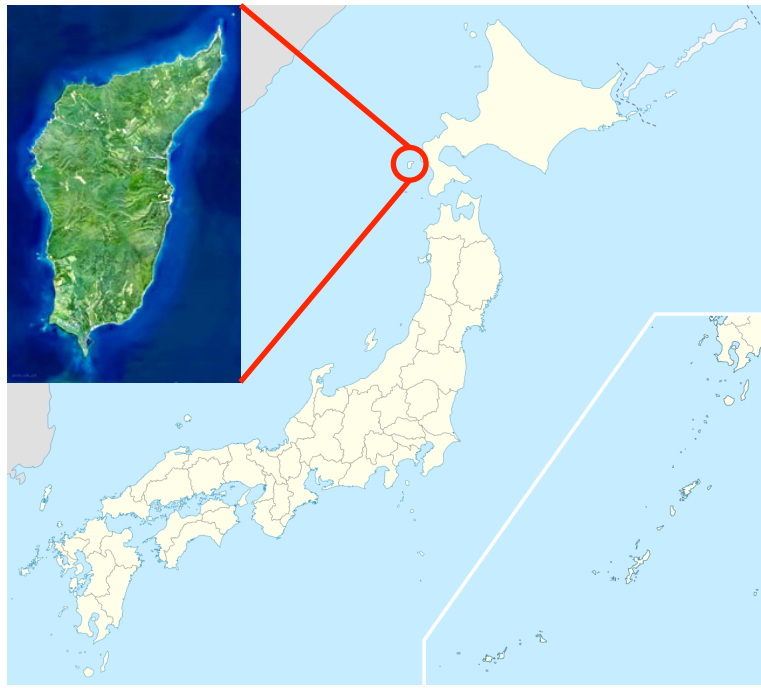
Local Community Redesign

This outlying island -one of northern islands in Hokkaido in Japan- has a population of approximately 2700 people and is facing the problems of declining population and declining tax revenue.

By identifying the hidden concerns of the people on the island with using the framework, we arrived at a conclusion:

- The island is not losing its properties and resources.
- Rather, it is gaining unused properties and resources.

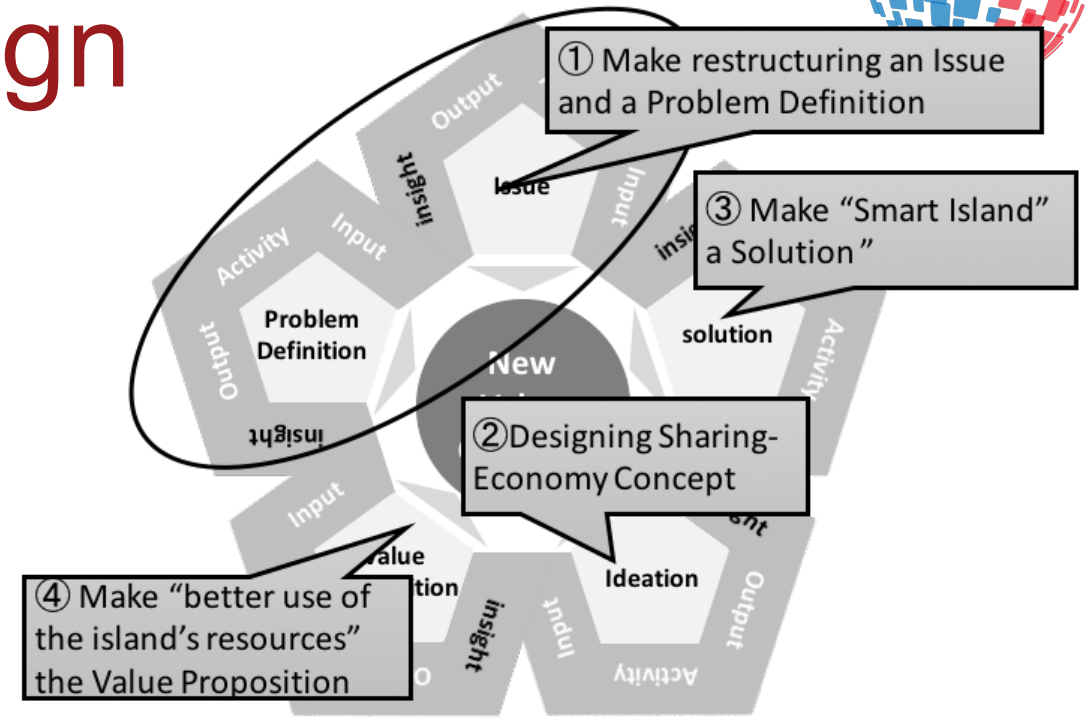
Using such tangible and intangible resources, we are working on the construction of a sharing economy type of solution. We call “Validation Island”.



Local Community Redesign

Premise:

- The government has been implementing a policy shift towards a sharing economy to promote self-reliance in municipalities.
- To involve diverse stakeholders and it is considered that an analytical approach will not be effective enough.



Thinking process:

- Usually they define the following problem: "How can we stop the decline in the population?".
- Generated "How can we improve people's feelings of well-being along with the decline in the population?"
- have discussed building a sharing economy model where people can feel less dissatisfied with the economic status and more satisfied with their well-being.
- Focused more on the new value creation sharing economy and found possibility and potentiality in building a "validation island" with the island's resources.

Conclusion

Conclusion

- Proposed a “structured design thinking approach” for maximizing the benefits of design thinking during the conceptual design of something to system design.
- This “structured design thinking approach” complements the hard and soft approaches, which are typical approaches for problem solving.
- The whole framework is structured and designed to generate iterative thinking.
- This approach and framework contribute to improving the reproducibility of thinking processes that take place when solving problems using design thinking, and the utility of the output.
- Explained the efficacy and promise of these contributions by using the cases of local community redesign.

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