The New Challenge of Delphi Survey at NISTEP

The Data Science into the Foresight

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Science and Technology Foresight Center

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Summary

- **Implementing Digitization of Delphi Survey**
  - Transition from paper based to web based questionnaires
    - It enables to collect mass data in a short time.
  - Embarking on data science efforts
    - It enables to overview data from various perspectives.

Developed online Delphi System called "Delphin" which enables data analysis from various perspectives while sequentially verifying the condition of respondents and responses

Requirements

Readiness

- Necessary to output analysis in a short time to follow rapid technological and societal diversification and situation changes

Scalability

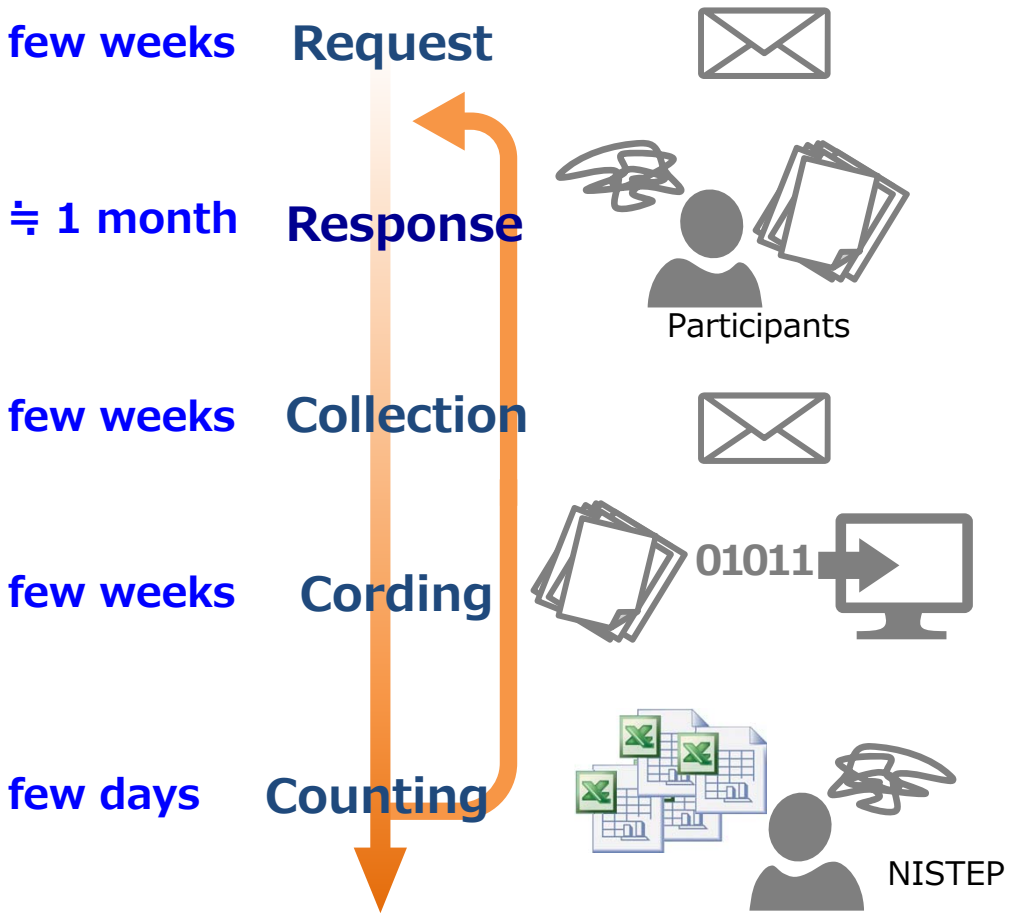
- Enable only to collect mass date in a short time by data collection on ICT and reduced management cost
- Necessary to develop a system for NISTEP staff who is not expert at mass data processing to analyze the collected data

Making Delphi Survey to be web based and developing analyzing system

Transition to Web based Delphi Method

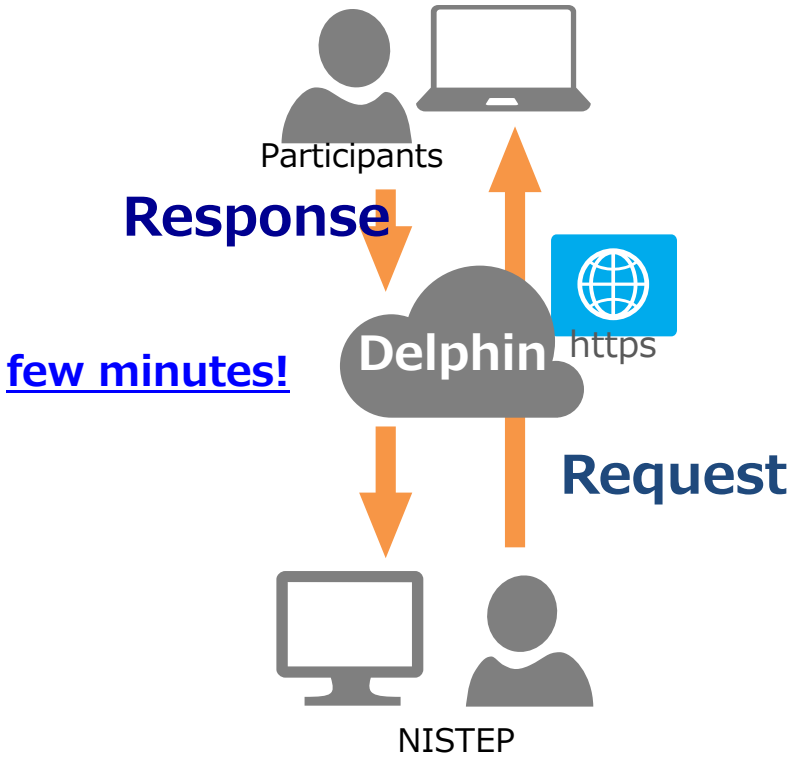
- Delphi survey was conducted by mail in the past
- It is now switched to the new way. (i.e. Web based Delphi)

Past (Mail Base)



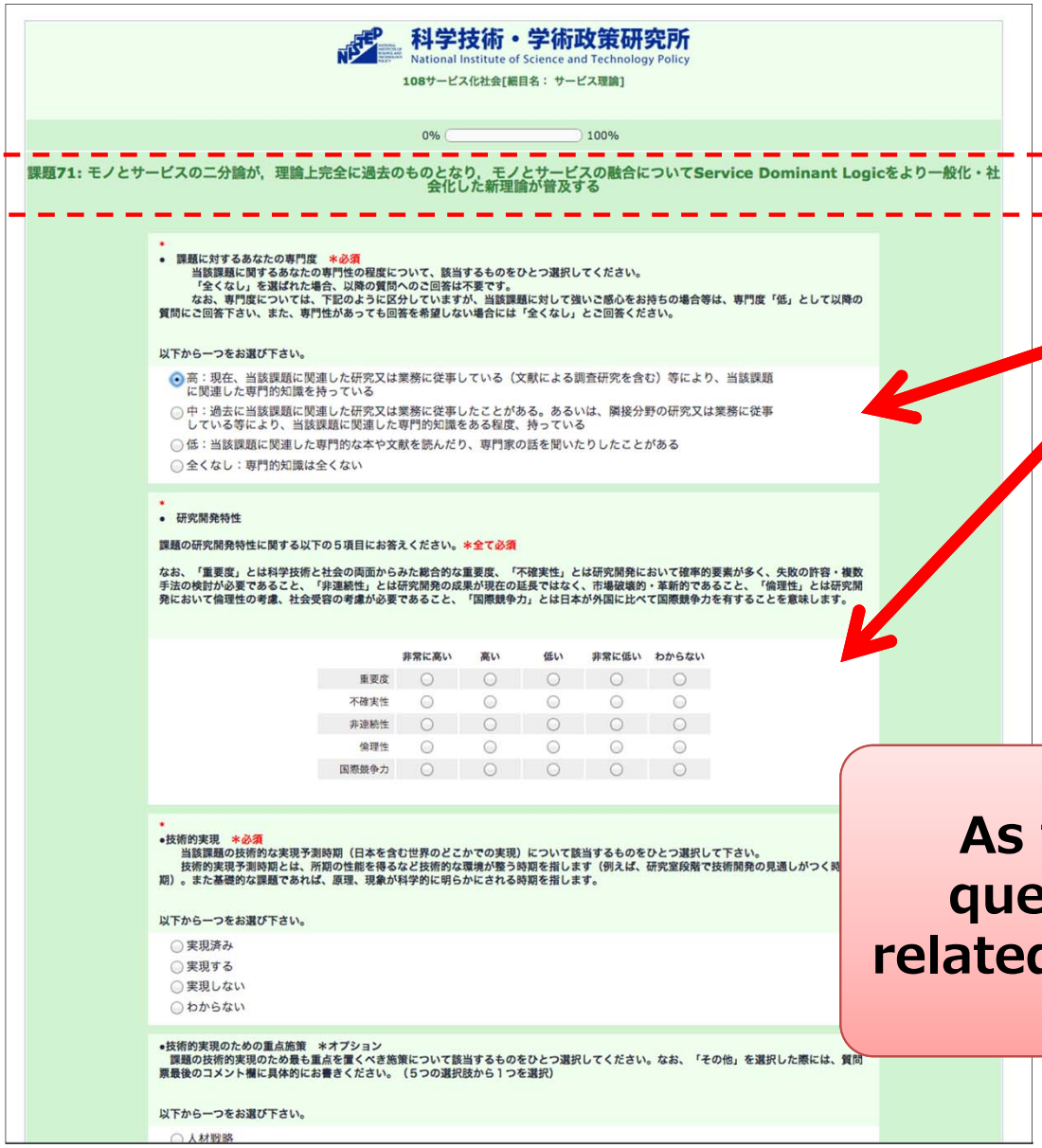
It took months excluding response period With struggling with Excel for counting.

Present (Web Base)



It requires only a few seconds excluding responding time and progress can be tracked anytime.

Screenshot of Survey System



LimeSurvey®
the open source survey application,
...refreshingly easy and free

Topics

Question items

As this is a system for general questionnaire, there are issues related to operability such as UI/ UX

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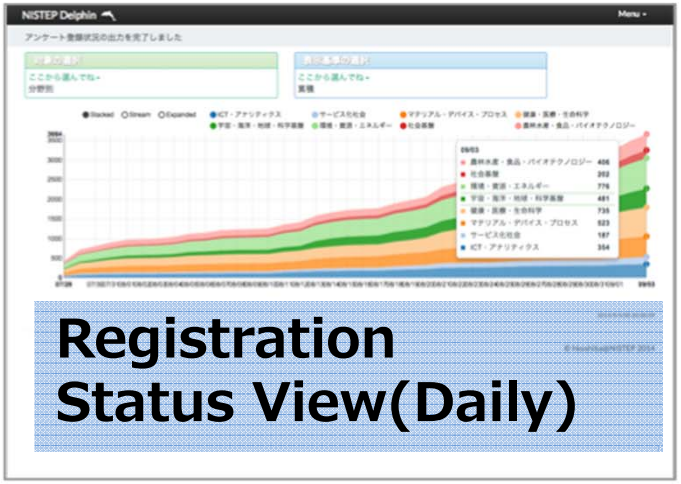
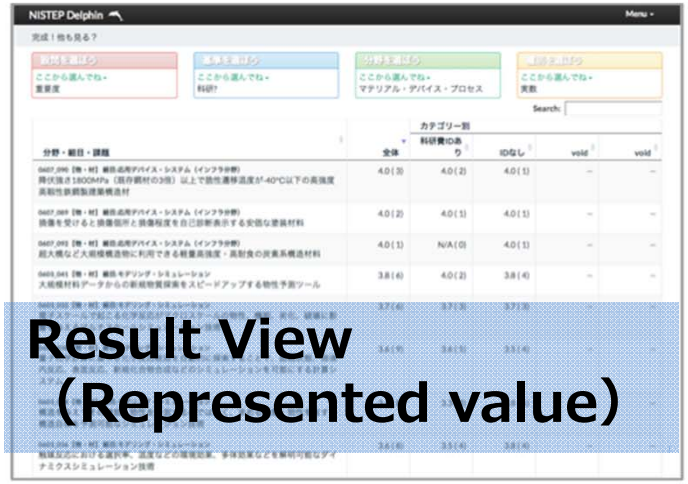
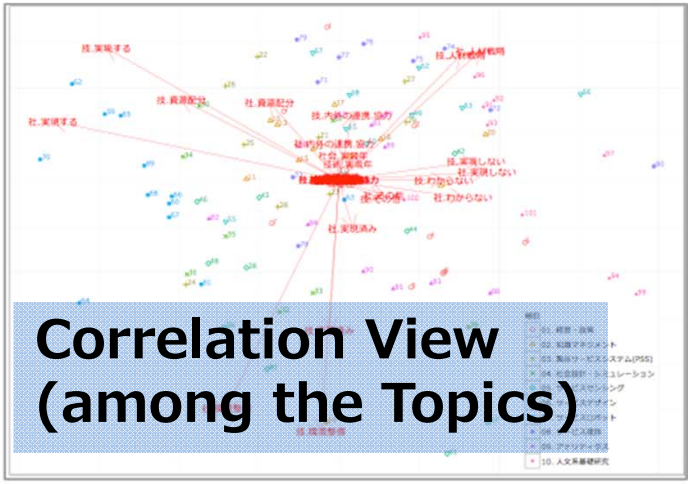
Making Delphi Survey to be web based and developing analyzing system

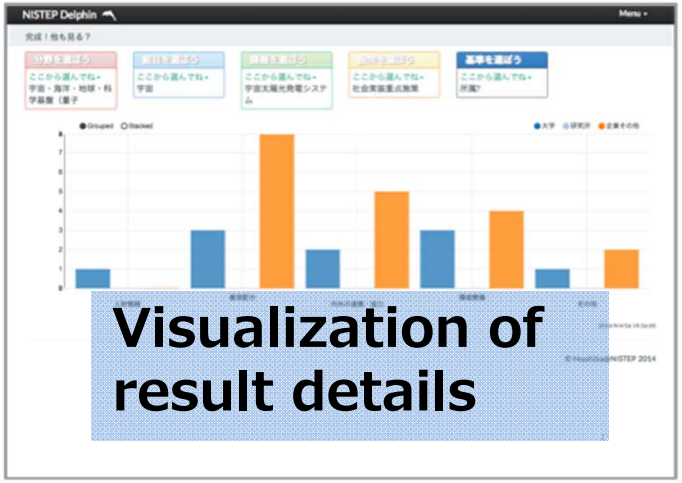
Analyzing System : Delphin Core

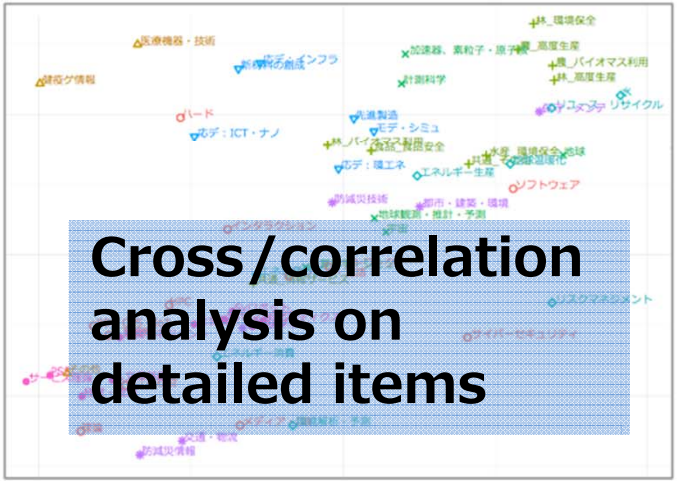
- Developed a system to process mass data – analyzing and visualizing - efficiently











Mounting functions timely and searchingly by self manufacturing necessary functions while using at practical level

Characteristics

- **Recognize the status promptly**
  - Enable to recognize registration and response status by fields in real time
    - Enable to take measures such as additional recruitment by detecting a shortage of responses
  - Enable to present counting results timely (not complied this time)

- **Analyze data easily**
  - Realize visualization from various perspectives only by mouse operation
  - Realize the comparison by demographics on site

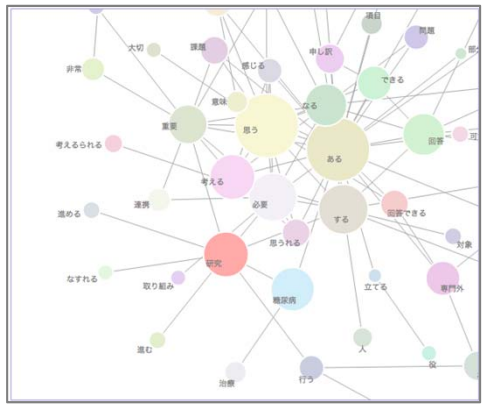
- **Mount tools for data science**
  - Latent Semantic Analysis and calculating similarity of topics by using Natural Language Processing
  - Crawling related articles from web sites

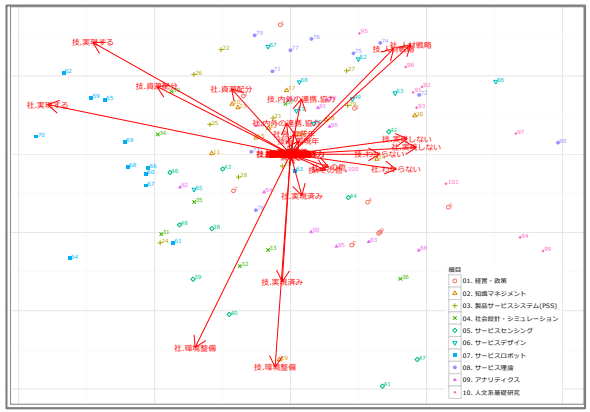
Example of analytics function of Delphin

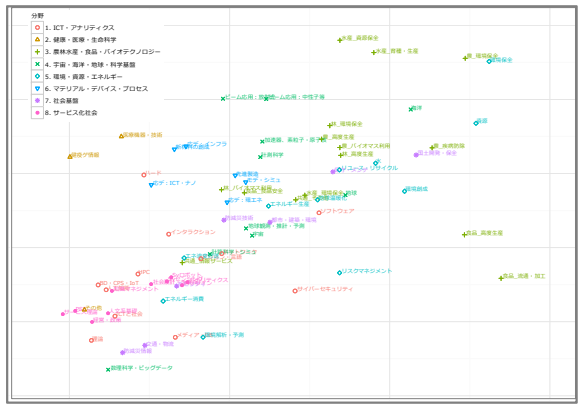
- **Dimensionality reduction**
  - Principal component analysis(PCA),Multi Dimension Scaling (MDS) , Self Organization Mapping (SOM)
  - PLSA, LDA

- **Natural Language Processing**
  - Calculating correlation of free answer
  - Related Topics / Policy search (at web)

- **Others**

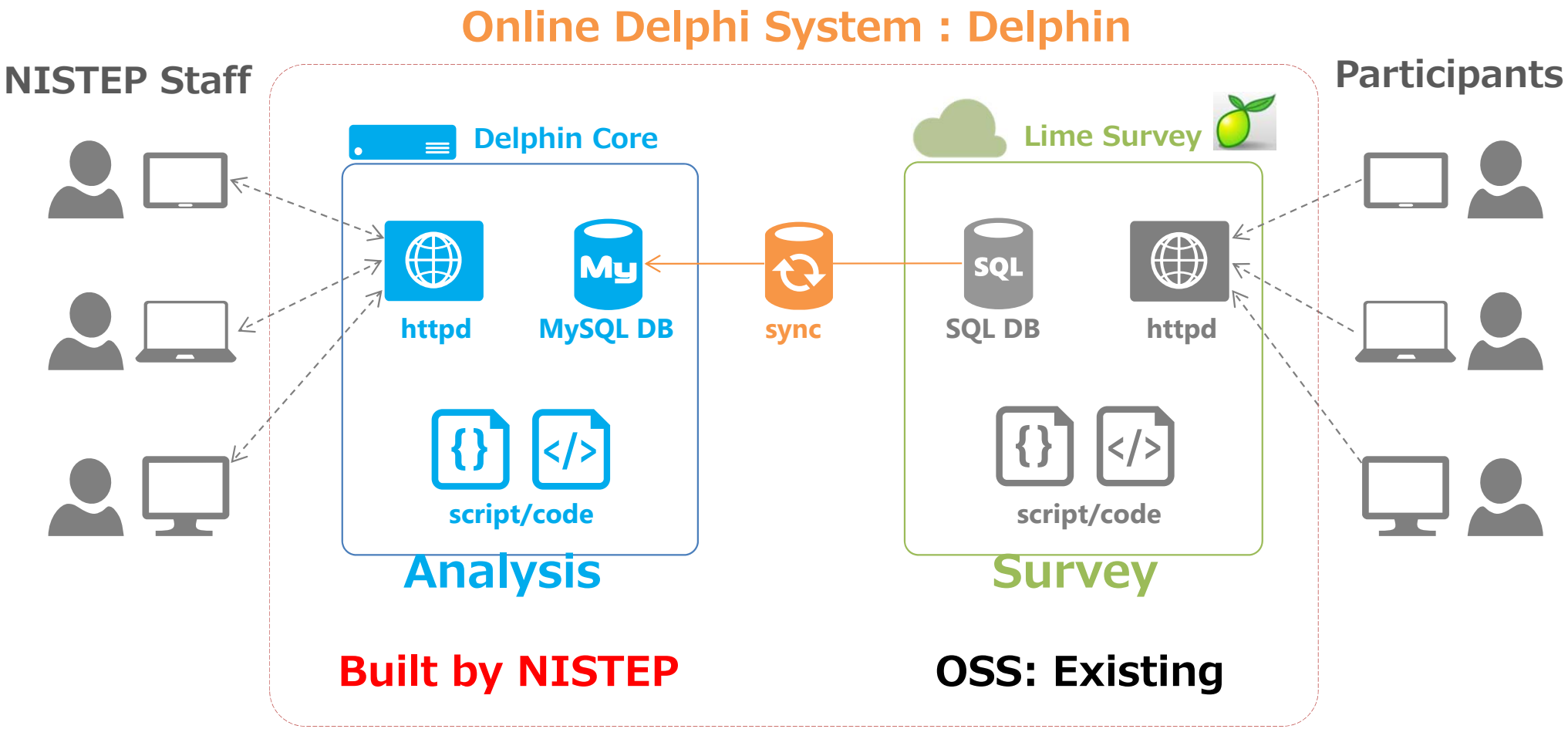






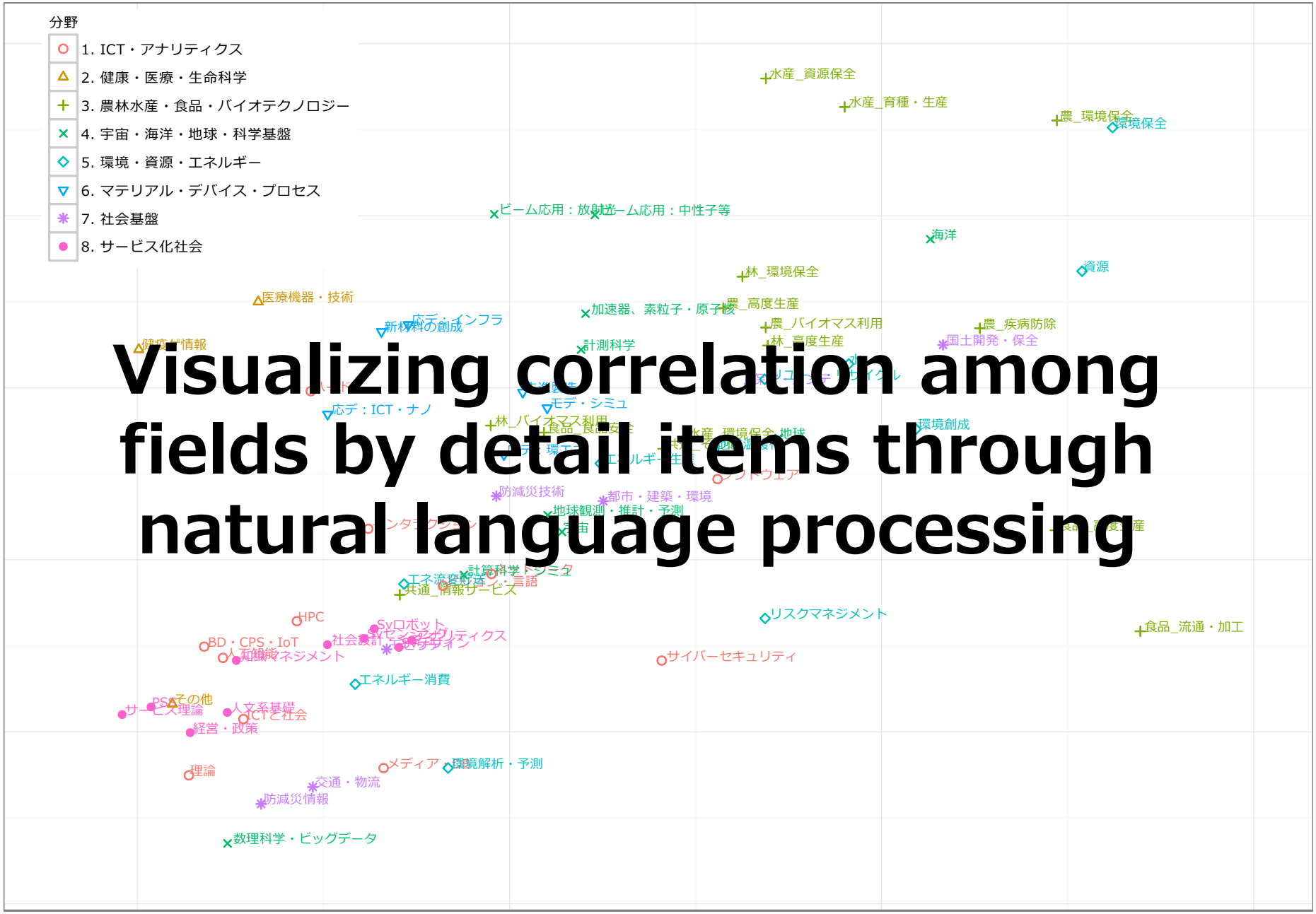
System Structure

- **Delphin(Online Delphi System) constructed by 2 components**
  - Survey : Use existing OSS (Open source Software), Lime Survey.
  - Analysis (Delphin core): Developed from scratch
    - Constructed by DB, Web server, D3, R, php and java script.



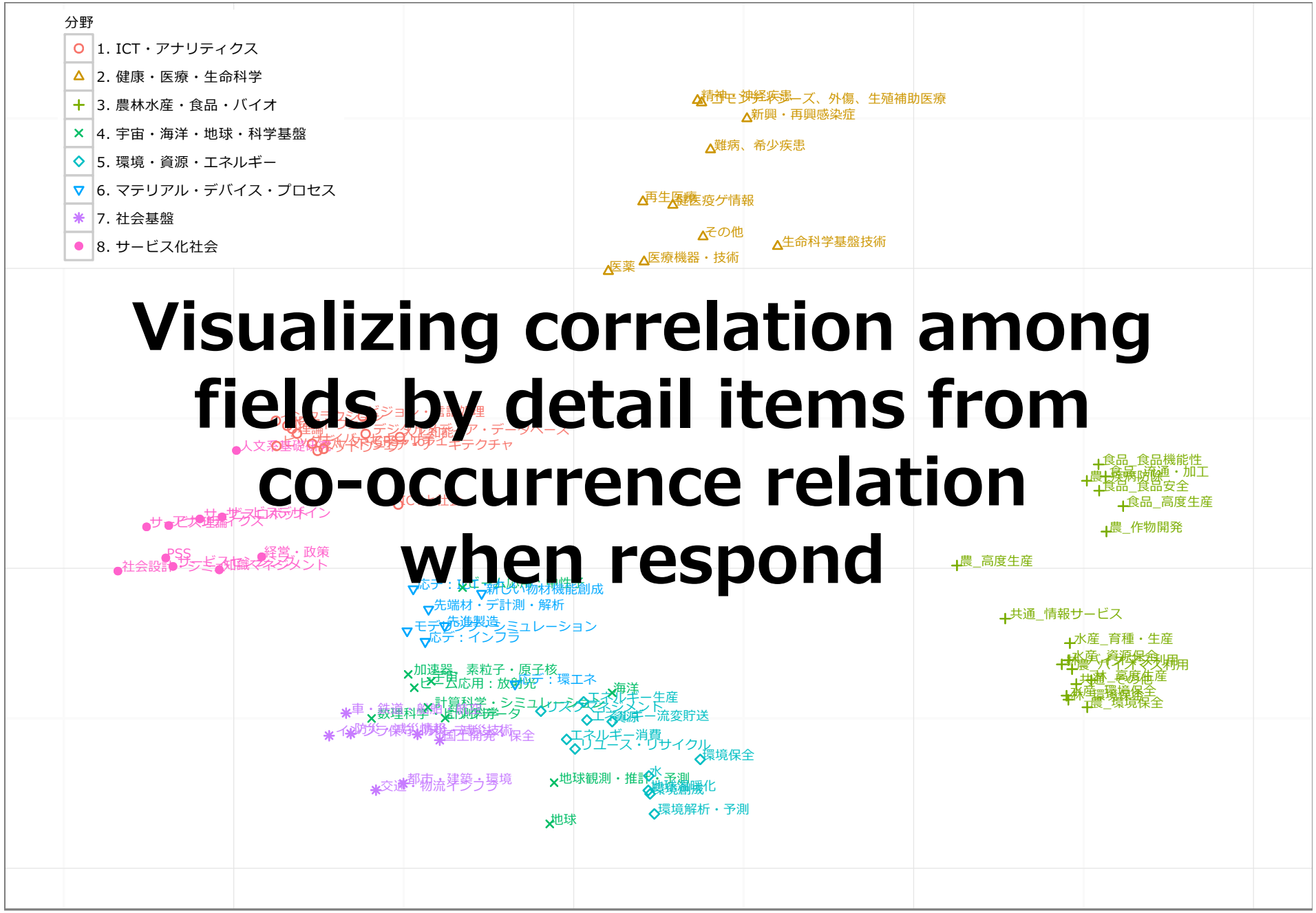
Demonstration

Future Technology Conceptual Map



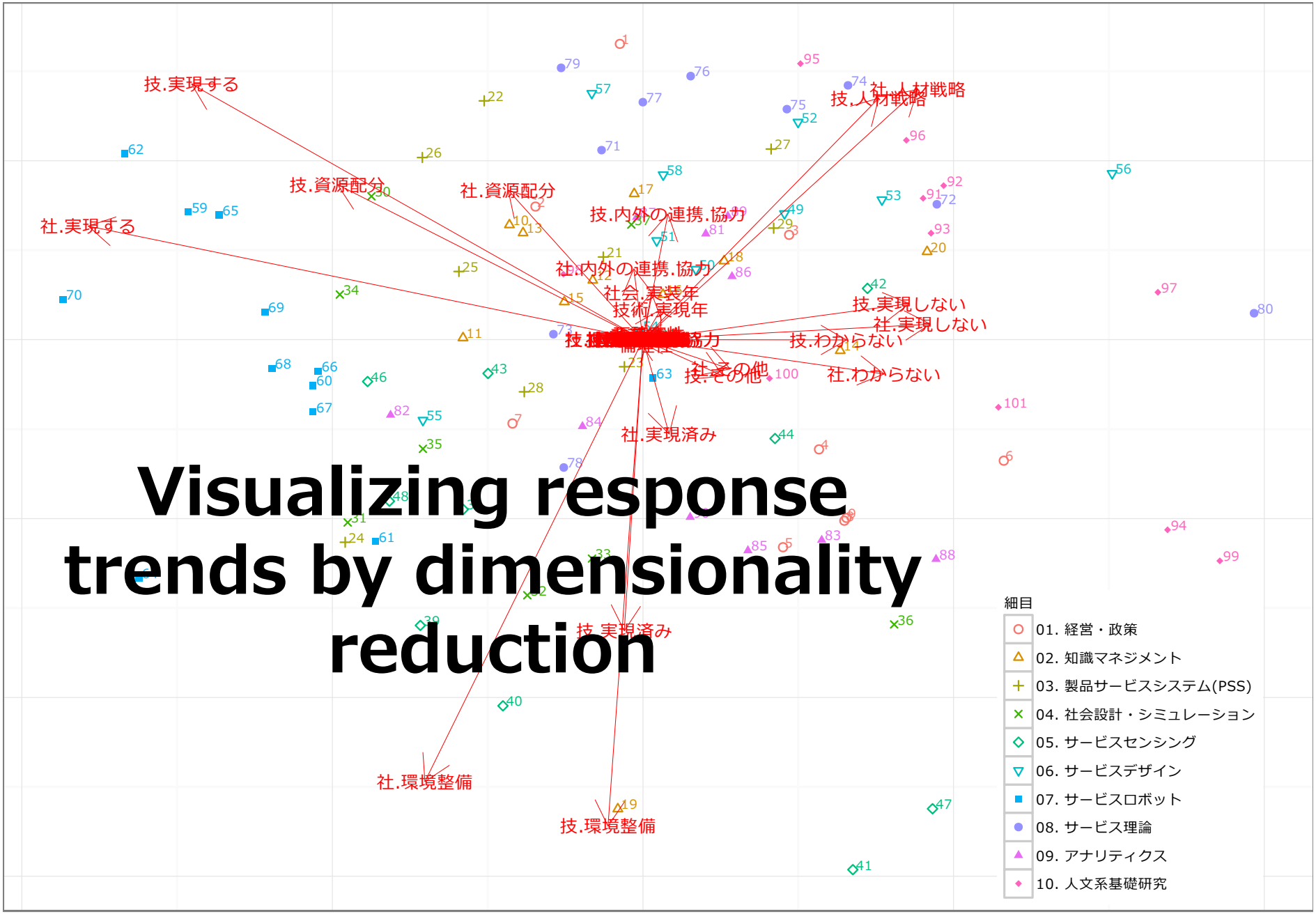
Visualizing correlation among fields by detail items through natural language processing

Co-Occurrence Relation Map



Visualizing correlation among fields by detail items from co-occurrence relation when respond

Response Trends Classification Map : PCA Based



Visualizing response trends by dimensionality reduction

Issues

Survey

- Generalized questionnaire systems cannot fully deal with Delphi method in some points due to its particularity.
  - Dozens of question items for one Delphi topic
  - The number of topics is from dozens to thousands
    - Questionnaire with hundreds questions are usually not constructed (organized).
    - Be creative in UI
  - After 2nd round, present last count result and re-enter

Revising and developing questionnaire system is considered

Issues

Analytics

- Difficult to handle data in Excel due to a large amount of data

- Methods are available to use for data science but difficult to judge what is appropriate.
  - Difficult for outsourcing as required functions are searched and found during practice

Developing continuously by a teams of data scientists, persons with work experience and experts

Summary

- **Identifying fields' future vision is important work for S&T policy**
  - NISTEP implemented Science and Technology Foresight Survey by Delphi method
- **Improving analyzing speed is a challenge along with social diversification**
- **Using ICT to deal with the challenges but facing the difficulty to handle a large amount of data**
  - Difficult to introduce simplest systems due to structural issues
- **Not only digitized but developed online Delphi System called Delphin as a new initiative directing Data Science in Foresight**