

A Method for Emerging Innovation and DX by Using P2P and Go

Maho Hoshiai*, Shingo Hoshiai**, Takumi Uemura**, Yutaka Naito**, Takashige Hoshiai**

**Social informatics, Chuo University, 742-1 Higashinakano, Hachioji, Tokyo, Japan*

***Sojo University, 4-22-1 Ikeda, Nishi-ku, Kumamoto, Japan*

maho.hoshiai@gmail.com, hoshiai.shingo@ai-go.info, t_uemura@cis.sojo-u.ac.jp, naito@cis.sojo-u.ac.jp, hoshiai@cis.sojo-u.ac.jp

Abstract—In 1995, a research project started at the NTT Laboratories with the goal of fostering innovation (creating new value through innovative ideas) and promoting DX (digital transformation of society, business, and organizations) through the “loosely connected and autonomous networks” of computers. This became known as “the Brokerless Theory,” the world’s first P2P (Peer-to-Peer) theory, which attracted global attention. From this new concept of “loosely connected and autonomous networks,” numerous innovative social models, business models, and internet services emerged, including Skype (Sky P2P), social networking services, blockchain. Recent research has revealed that a new concept called “the External Vector” is effective for fostering innovation and DX. The External Vector refers to building new, weak, loose, and autonomous connections between different fields, from which new value can be created. Along with technological innovation, which creates new value frameworks as technology advances, the External Vector serves as one of the two essential driving forces behind the emergence of innovation and DX.

This paper proposes the following three points:

- 1) The External Vector is effective for fostering regional innovation and regional DX.
- 2) Building connections using the External Vector requires verbalizing (theorizing) the essence of connections and training in the practical use of the verbalized concept.
- 3) The combination of “P2P Concepts and Principles” and “Go Concepts and Principles” is effective for verbalizing (theorizing) and training.

Furthermore, the effectiveness of combining P2P and Go is quantitatively demonstrated through a questionnaire survey conducted with 486 participants.

Keyword—P2P Theory, Go, Innovation, DX, External Vector



Maho Hoshiai was born in Japan on December 18, 2003. She is currently pursuing the B.A. degree in social informatics at Chuo University, Tokyo, Japan.

She is an undergraduate junior student and a Special Research Fellow at the SCB Lab. Also, She is a high-ranked Go player. She has presented her research at the Information Processing Society of Japan and at the ICACT conferences in 2025 and 2026. Her current research interests include the essence and system design of connections, loose connections and their applications in fields such as education and regional co-creation, as well as the educational value of Go.

Ms. Hoshiai is a student member of the Information Processing Society of Japan and has received the Young Researcher Encouragement Award in 2025.



Shingo Hoshiai was born in Japan on May 18, 1995. received the B.A. degree in sociology from Waseda University, Tokyo, Japan, in 2020. He served as the captain of the Waseda University Go Club.

He is currently a University Lecturer in the Faculty of Sociology at Sojo University, Kumamoto, Japan. His research focuses on the application of Go to regional revitalization and regional innovation.

Mr. Hoshiai served as the captain of the Waseda University Go Club and has won numerous Go titles.



Takumi Uemura was born in Japan on July 27, 1980. He received the Ph.D. degree in engineering from the Graduate School of Science and Technology, Kumamoto University, Kumamoto, Japan, in 2011.

He is currently an Professor in the Faculty of Computer and Information Sciences at Sojo University, Kumamoto, Japan. His research interests include image processing and pattern recognition.

Prof. Uemura received the Outstanding Paper Award at ICACT 2023.



Yutaka Naito was born in Japan on September 25, 1969. He received the Ph.D. degree in engineering from Sojo University, Kumamoto, Japan, in 2022.

He is currently an Associate Professor in the Faculty of Computer and Information Sciences at Sojo University, Kumamoto, Japan. His research focuses on P2P network technologies for regional revitalization.

Assoc. Prof. Naito received the Outstanding Paper Award at ICACT 2023



Takashige Hoshiai was born in Japan on January 31, 1962. He received the Ph.D. degree in engineering from the University of Electro-Communications, Tokyo, Japan. From 1995 to 1997, he was a Visiting Researcher at Bell Laboratories, where he proposed the brokerless model (P2P) in 1998 and later invented the semantic information network architecture, SIONet, which provides a technological foundation for the model. In 2011, he proposed the Social Community Brand (SCB) theory, which applies P2P principles to regional revitalization.

He is the President of the Sojo University IoT/AI Center, a Professor in the Faculty of Computer and Information Sciences at Sojo University, an Invited Researcher at Waseda University, the Director of the SCB Laboratory, and the Principal of the SCB Innovation Academy. He is currently conducting research on regional revitalization and the emergence of regional innovation using SCB theory.

Prof. Hoshiai received the Outstanding Paper Award at ICACT 2023.