Network Structure of Inter-organizational Alliances in the Health Insurance Industry undergoing Digitalization

Fumihiko Isada
Kansai University, Japan
Yuriko Isada
Kwansei Gakuin University, Japan

Abstract

This study takes a novel approach to exploring the changes in inter-organizational relationships in the health insurance industry, which is currently undergoing a digitalisation environment change known as InsurTech. As a unique research method, we constructed a database of the most recent six years of inter-organizational alliances among firms in the health insurance industry and analysed it quantitatively using the social network analysis method. The analysis showed that new entrants, such as IT firms, had expanded their affiliated networks in addition to the traditional primary health insurance industry. First, the network structure tends to be decentralised, and the expanding firms adopt a platform-type network structure.

Keywords: Inter-organizational alliances; social network analysis; InsurTech
JEL classification: M15

Paper type: Research article
Received: 7 March 2023
Accepted: 1 May 2023

DOI: 10.54820/entrenova-2023-0026

Introduction

The health insurance industry is currently undergoing a structural change due to digitalisation, known as InsurTech (or InsureTech, etc.). In this novel study, we aim to empirically explore the impact of such environmental changes on the network structure among organisations in the health insurance industry, a topic that has not been extensively researched before.

Recent developments in the insurance industry are witnessing a transformative wave of various "Insurance Technology" (InsurTech) innovations. The proliferation of digital technology in the insurance industry is revolutionizing the way insurance products and services are delivered, business models, and the customer experience (Stoeckli et al., 2018). The emergence of insurance technology companies (InsurTechs) through easy access to digital technologies is reshaping the entire insurance industry and heralding a new era of business models. With digital technologies such as big data analytics, robo advisors, and mobile distribution models or blockchain, InsurTechs are challenging the prevailing position of traditional insurance institutions (Greineder et al., 2020).

The typical inter-organizational relationship in the traditional health insurance industry is a highly centralised structure of a few giant health insurance companies, which has been stable over the long term compared to other financial industries. The main reason for this can be attributed to the insurance product. That is, the role of insurance products is to compensate for events with a low probability of occurrence but with large losses when they occur, and the main role of insurance companies is to have the financial capacity to handle such large losses. The characteristics of the product are long-term compared to other financial products, and the need for insurance companies is high reliability. Therefore, the relationship between the insurance company and its affiliated organisations must also be based on the trust that is fostered through long-term relationships.

Meanwhile, InsurTech has broadened the role of insurance products. For example, they are used not only for medical care after injury or illness but also for various areas throughout life, such as daily prevention and post-prognosis health promotion. In the background, social needs such as efficient use of medical expenses due to the declining birth rate and an ageing population are also increasing. In this context, attention is focused on the effective utilisation of various big data related to medical care by sharing them. For example, today's focus is on individuals' medical information, such as personal health records (PHR) and personal health information (PHI) generated from various IoT devices. Various IT companies, such as Apple, have entered this field and are expected to provide personal health management and early intervention by medical institutions. Such big data is expected to be used in a variety of integrated ways by merging medical chart data called electronic medical records (EMRs) generated by individual medical institutions and data called electronic health records (EHRs) shared among medical institutions.

However, it is not easy to integrate various big data generated by individuals and medical institutions. Data cannot be used simply by handing it over. In order to utilise data across organisational boundaries, it is necessary to reorganise and integrate business processes to enable the utilisation of the data. Naturally, medical data are personal information that requires a high level of confidentiality, so ethical considerations are also essential. Therefore, strategic alliances among organisations are important for the integrated use of health big data among organisations. By collaborating firmly between organisations, both parties' business processes can be coordinated and integrated, and highly confidential data can be shared and utilised more easily.

Therefore, the goal of this study is to analyse temporal changes in the structure of alliances among affiliated firms related to health insurance. Specifically, we search for firms expanding alliances in the health insurance area and clarify what kind of network structure these firms adopt. In analysing the network structure, we use social network analysis, which makes it possible to evaluate the characteristics of the network structure quantitatively.

Previous Studies

The popularity of big data has inspired insurance companies to utilise big data at their core systems and advance financial operations, improve customer service, construct a personalised environment and take all possible measures to increase revenue and profits (Banu et al., 2022). The International Association of Insurance Supervisors (IAIS) presents the following three scenarios for the development of FinTech in the insurance industry: (1) Existing insurance companies succeed in maintaining relationships with their customers; (2) The insurance value chain is fragmented, and existing insurers are unable to maintain relationships with their policyholders; (3) Giant technology firms lockout traditional insurers (IAIS, 2017). Digital transformation creates new roles for value creation in the insurance industry and, thus, affects the entire ecosystem. The ecosystem shows that robot advisors, big data, or short-term insurance providers penetrate the market and, thus, threaten the value creation of traditional insurance institutions (Greineder et al., 2020). Digital transformation is partly driven by new players, including start-ups, who transform incumbents' business models. The community of start-ups and incumbents form an entrepreneurial ecosystem where cross-fertilizations, symbiosis, and competition amidst collaboration can constantly occur (Van-Meeteren et al., 2021).

In the study of healthcare-related research using the method of social network analysis, there have been a number of excellent research results, such as a study on the R&D of pharmaceuticals using jointly applied patent data. As for previous studies analysing inter-organizational relationships in insured healthcare, Park, Y. et al. (2022), for example, is a full-scale excellent study analysing the digital healthcare industry in Korea. Newspaper articles were collected for a limited period from 2016 to August 2021, when the mobile healthcare project was promoted in Korea centred on public health centres. The results of the analysis showed that the Korean government and the Ministry of Health and Welfare showed the highest centrality and appeared as major stakeholders. Their common major issues were “reviewing the introduction of telemedicine,” “concerns about the bankruptcy of local clinics,” and “building an integrated platform for precision medicine.” In addition, the major stakeholders of medical institutions and companies were Seoul National University Hospital, Kangbuk Samsung Hospital, Ajou University Hospital, Samsung, and Vuno Inc. The authors considered that all government, medical institutions, and industrial companies need to apply digital health care to the medical system through telemedicine and health care business establishment and that cooperation is necessary among the government, medical institutions, corporations, research institutes, and related stakeholders (Park et al., 2022).

Analysis Subjects and Research Hypotheses

In this study, private companies involved in health insurance in Japan were the subjects of analysis. In Japan, in particular, a large proportion of the overall health insurance is provided by the national public health insurance system. If the entire health insurance system were to be analysed, it would be expected that public

insurers and the Ministry of Health, Labour and Welfare would be highly central to the analysis. On the other hand, the private sector is expected to be the main player in new health insurance, such as InsurTech, so only private firms are included in the analysis.

The first research hypothesis concerns the types of firms expanding their alliances in the health insurance industry. We hypothesise that large health insurance companies have dominated the traditional health insurance industry, but changes in the industry environment have led to an increase in the number of new entrants and other firms.

Hypothesis 1: The share of inter-organizational alliances in the health insurance industry is decreasing for large traditional health insurance companies.

The second hypothesis concerns the structure of the alliance networks of firms that are expanding their alliances in the health insurance industry. Regarding the network structure, we considered two hypotheses. First, as a hypothesis on the centrality of the network, we assumed that the centrality of the network is decreasing. In the conventional health insurance industry, it is thought that the relationship was vertically integrated, with a small number of giant insurance companies playing a central role in aggregating and managing large insurance premiums, each of which formed a group of companies providing various related services. On the other hand, with the spread of InsurTech, as various types of firms enter the health insurance industry and provide a wide variety of services, it is assumed that not only specific firms will necessarily be positioned as the centre of the collaborative network.

Hypothesis 2: Regarding inter-organizational alliances in the health insurance industry, the centrality of firms that are expanding their alliances is declining.

We also assumed that digital networks, such as InsurTech, would be suitable for so-called platform-type inter-organizational relationships. Platforms such as GAFAM are expanding their platforms by specialising in specific functions in the value chain, providing standardised interfaces to a wide range of industries, and partnering with complementary companies. In the health insurance industry, as InsurTech spreads, companies that form alliances across multiple healthcare domains, such as prevention, treatment, and prognosis, will become platformers and form complementary relationships with various other companies, leading to a horizontal division of labour-type inter-organizational relationships. In the network analysis, the platformer's network structure will be characterised by the positioning that bridges multiple other firms.

Hypothesis 3: Regarding inter-organizational alliances in the health insurance industry, firms that are expanding their alliances are in a bridging position.

Survey and Analysis Methods

Survey

Information on alliances among firms in the health insurance industry, the source of the analysis, was collected from newspaper articles and firm press releases. Newspaper articles provide relatively objective and accurate information in a timely manner, but the information published as articles is limited. Therefore, the addition of information from press releases makes it possible to increase the comprehensiveness of the data. The original data was collected from Nikkei Telecom, an article search service provided by Nikkei Inc. The Nikkei is the largest economic magazine in Japan and is considered to have the most comprehensive amount of information on companies compared to other newspapers. Furthermore, in addition to the Nihon Keizai Shimbun, Nikkei Telecom offers a total of more than 180 major newspapers in Japan, including national newspapers, newspapers in each of the 47 prefectures, and

industry-specific speciality newspapers. The period covered by this study was six years, from 2017 to 2022, the period when InsurTech began to spread.

Analysis Method

Using social network analysis, we analysed the structure of the network surrounding each firm as a node and the partnerships among firms as edges. Network analysis can calculate various network indices that indicate the characteristics of the network structure, and the following network indices were used in this study.

First, for the objective variable, the size of the network was used as a proxy variable for the expansion of each firm's alliance. That is, we evaluated the degree of alliance expansion by the number of alliances announced in newspapers or press releases. Strictly speaking, the cases in which the alliances among firms were announced in newspapers but did not materialise may be included. However, we did not consider their impact on the overall trend of the statistical network to be significant.

Next, among the explanatory variables, eigenvector centrality and eigenvector centrality were used as indicators of network centrality. Eigenvector centrality is not a simple measure of the number of ties but a measure of centrality that weights the ties of nodes with strong centrality in the network. As mentioned earlier, in the traditional health insurance industry, we assume that major insurance companies have high centrality and strong alliances with others, and we consider this centrality index to be suitable for representing such a situation. As an indicator of bridging in the network, we used the degree of constraint based on the theory of structural holes (Burt, 1992). Structural voids represent the bridging condition between clusters of nodes in a network. The fewer the nodes bridging clusters around a node, the smaller the value of the degree of constraint. UCINet 6 was used to calculate the network indices, and SPSS 27 was used for statistical analysis.

Survey Results

Summary of the Survey

The number of articles and press releases on business-to-business alliances in the health insurance industry during the six years from January 2017 to December 2022 was 681 in total. In order to analyse changes over time, we divided the study period into the first half and the second half and compared the differences between them. The number of articles and press releases in the first half, from 2017 to 2019, was 359, while the number of articles and press releases in the second half, from 2020 to 2022, was 322. The number of firms extracted from those original data was 415 and 391 in the first and second halves, respectively. The number of alliances among firms was 698 in the first half and 600 in the second half, respectively. The number of alliances is the number of pairs of firms. For example, the number of alliances between firms A and B is counted as one, and the number of alliances among firms A, B, and C are counted as three (A-B, A-C, and B-C).

Analysis Results

First, in order to compare the increase in the number of affiliations between the first half and the second half, we focused on the firms with a particularly large number of affiliations. We checked the number of large traditional insurance companies in the top 10 affiliations. As a result, the number of major health insurance companies was 6 in the first half of the period from 2017 to 19 but decreased to 3 in the second half from 2020 to 2022.

Next, a single regression analysis was conducted with the number of affiliations of each firm as the objective variable and an indicator of the network structure of each firm as the explanatory variable. The results of these analyses are shown in the tables below, comparing the first three years with the second three years.

Table 1
Relationship between the number of alliances and eigenvector centrality

Year	First half (2017-19)	Second half (2020-22)
Standardised coefficient	0.344	5.7
Significance probability	<0.001	0.505

Table 2
Relationship between the number of partnerships and the degree of constraint

Year	First half (2017-19)	Second half (2020-22)
Standardised coefficient	-0.592	-0.586
Significance probability	<0.001	<0.001

Source: Authors

As shown in the table, there is a difference in the analysis results for network centrality between the first and second half of the survey period, with the result that only in the first half, the more central a firm is, the greater the number of alliances it has. On the other hand, there is no difference between the first half and the second half of the survey period in terms of the degree of network constraint, and in both cases, the lower the degree of constraint, i.e., the stronger the nature of the bridge point, the greater the number of alliances.

Discussion

The first hypothesis concerns the firms with growing alliances. Although it is a simple comparison, the ratio of large traditional insurers to the top 10 firms with the largest number of alliances has been reduced by half, indicating that the number of alliances may be increasing for other firms rather than for the large insurers. In the first half of the period, the majority of the top 10 firms were traditional insurers, with Nippon Life Insurance Company, the largest insurer in Japan, having the largest number of alliances, followed by Dai-ichi Life Insurance Company and others. On the other hand, in the latter half of the period, the ratio of traditional insurers dropped to less than half, and Nippon Life Insurance Company was not among the top 10 insurers in terms of the number of alliances.

The top 10 firms in the latter half of the period were classified into three major groups. The first group consisted of traditional insurance companies, the second group consisted of IT-related companies, and the third group consisted of Japanese general trading companies (Sogo Shosha). Among the second group of IT-related companies, DeNA was the company that was expanding its partnerships the most. DeNA is a major Internet-related company whose main business is Internet auctions and Internet games. In recent years, it has been aiming to expand its business in the medical field by rapidly acquiring medical IT-related venture companies. The Sogo Shosha group also included Mitsui & Co., Sumitomo Corporation, and others. Japanese Sogo shosha are said to be a type of business unique to Japan, and in fact, they are more of an investment company or holding company than a trading company. In Japan, Sogo Shosha often takes risks and invests in business development at an earlier stage than financial institutions. Sogo Shosha is a group of giant companies that do not specialise

in a particular field but handle a wide range of products and services. In recent years, the company has been strategically expanding its business in areas such as the digital transformation of healthcare. Thus, it is clear that not only traditional insurance companies but also IT ventures and business companies are entering the health insurance-related business.

Next is the hypothesis regarding the network structure of firms that are expanding the number of partnerships. This hypothesis can be divided into two categories: the centrality of the network and the bridging nature of the network. With regard to centrality, we find differences between the first half and the second half of the period covered by the survey. That is, in the second half of the period, it is not that some highly centralised firms and their affiliated firms are expanding their alliances but that the alliance network structure of firms is becoming more decentralised. This is consistent with the situation in which a variety of firms are entering and expanding, as revealed in the case comparison described above.

On the other hand, the relationship between the number of alliances and the degree of bridging was confirmed both in the first half of the study period and in the second half of the study period. As mentioned earlier, a high degree of constraint implies a small structural hole and a weak degree of bridging. Hence, a negative regression coefficient of constraint on the number of alliances implies that the number of alliances is larger for firms with a stronger degree of bridging. The results of this analysis suggest that the so-called platform-type alliance structure is not unique to IT-related firms but may be a characteristic of the network structure of insurance companies and other firms that are expanding their alliances. Existing insurance companies and new entrants, such as IT-related companies, might be currently competing with each other, responding to changes in the environment, developing new products and business models, and trying to expand their platforms.

Conclusion

This study empirically explored changes in industry structure and inter-organizational relationships in the health insurance industry, which is changing the digitalisation environment known as InsurTech. As a contribution of the study, the possibility that companies expanding their inter-organizational networks in the health insurance industry are changing from traditional health insurance companies and the bridging structure in the networks of these companies was clarified.

One limitation of this study is that InsurTech is still in the early stages of growth, and its impact on the industry structure is still in flux. In addition, since the survey was conducted mainly in Japan, Japan-specific environmental factors may have affected the results of the analysis. Continued research and international comparative studies are required as future issues.

References

1. Banu, A. (2022). Big Data Analytics–Tools and Techniques–Application in the Insurance Sector. In M. Khosrow-Pour (Ed.), *Big Data: A Game Changer for Insurance Industry* (pp. 191-212). Emerald Publishing Limited.
2. Burt, R. S. (1992). *Structural Holes: The Social Structure of Competition*. Harvard University Press.
3. Greineder, M., Riasanow, T., Böhm, M., & Krcmar, H. (2020). *The generic InsurTech ecosystem and its strategic implications for the digital transformation of the insurance industry*. 40 Years EMISA 2019. Bonn: Gesellschaft für Informatik, 270, 444-448.
4. IAIS. (2017). *FinTech Developments in the Insurance Industry*. International Association of Insurance Supervisors.

5. Park, Y., Park, S., & Lee, M. (2022). Digital Health Care Industry Ecosystem: Network Analysis. *Journal of Medical Internet Research, 24*(8), e37622.
6. Stoeckli, E., Dremel, C., & Uebernickel, F. (2018). Exploring characteristics and transformational capabilities of InsurTech innovations to understand insurance value creation in a digital world. *Electronic Markets, 28*(3), 287-305.
7. Van-Meeteren, M., Rubin, T. H., & Watson, J. (2021). *The Role of Start-ups in the Insurance Knowledge Space*. Loughborough University. https://repository.lboro.ac.uk/articles/report/The_role_of_start-ups_in_the_insurance_knowledge_space/14485278/1

About the authors

Fumihiko Isada is a professor at the Faculty of Informatics, Kansai University. He graduated from Osaka University, where he got his PhD with the topic "A Study on Business Model of Virtual Project Company". His research interests are international corporate strategy and innovation management. He can be contacted at **isada@kansai-u.ac.jp.**

Yuriko Isada is a professor at the School of Policy Studies at Kwansei Gakuin University. She graduated from Kansai University, where she got her PhD with the topic "A study on target approach for multi-objective optimisation and its application to planning and management of software development ". Her research interests include multi-objective optimisation, decision support systems, and computer simulation. She can be contacted at **yuriko@kwansei.ac.jp.**