

論文 / 著書情報
Article / Book Information

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Title(English)	Data instrumentation for management of science based on collaboration and knowledge-structural features
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

系・コース：イノベーション科学 系
Department of Graduate major in イノベーション科学 コース

学生氏名：宮下修人
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申請学位(専攻分野)：博士 (技術経営)
Academic Degree Requested Doctor of

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要旨(英文 800 語程度)

Thesis Summary (approx.800 English Words)

This thesis, entitled 'data instrumentation for management of science based on collaboration and knowledge-structural features', aims at the instrumentation to enable data-driven decision making for the management of scientific research, which consists of five Chapters.

Scientific research, particularly publicly-funded scientific research and development (R&D) for innovation and solving multifaceted societal issues, is significantly increasing in scale and complexity. However, the literature on strategic and organizational management of scientific research (so-called 'the management of science') at universities and public research institutes is still underdeveloped compared to the literature of management of technology that mainly includes industrial R&D. Furthermore, methodologies that enable the acquisition of prescriptive knowledge in the management of science need to be developed alongside the descriptive knowledge that has been nurtured based on conventional scientometrics. To address these outstanding issues, it is essential to develop a methodology for the instrumentation of structural features in scientific research by focusing on collaboration and knowledge structures in large-scale R&D programs and their descendant projects. Based on the understanding, a methodology for capturing the real-time status of a scientific research project was developed to support data-driven decision making by defining activity indicators for scientific research based on network science and conventional scientometrics.

Chapter 1 provides a background of the research including the concept of the management of science, its relation to scientometrics and the significance of instrumentation. The research objective is disseminated in this chapter as to develop a methodology for instrumentation of structural features of research activities by focusing on the collaboration and knowledge structures in large-scale R&D projects centred on science research. Further, a general framework is provided as the micro-meso-macro architecture that corresponds to phenomena at the individual (or team), project and program levels, respectively.

Chapter 2 focuses on the system structure of an interdisciplinary R&D program and its descendant projects based on empirical observation of the FIRST Program and its descendant NanoBio First project. In the program-level analysis, the linkage of research funds and human resources to the outcomes is examined using a structural equation model, which suggests that different mechanisms work in the creation of academic outcomes and intellectual properties. In the project-level analysis, factors that promote or impede the creation of intellectual properties are explored. It was found that a collaboration between a central university and a startup firm (which has a complementary role) established a knowledge logistics system to realize not only the social implementation of research results through joint patent applications but also cultivated a reciprocal mindset and flexible resource management according to the R&D stage.

Chapter 3 explores the interactive dynamics of collaboration and knowledge structures in an interdisciplinary R&D project by visualizing the co-author and the co-word networks, respectively, based on bibliographic analyses of publications. By introducing the graph entropy as a measure of the complexity of these weighted network structures, the instrumentation of individual and institutional R&D activities can be visualized. Co-author and co-word network analyses constructed upon bibliographic information from publications in the case of the COINS project confirmed that these networks have distinctive structural features and different modes of time-course evolution.

Chapter 4 examines a qualitative case study on how changes in the collaboration and knowledge structures at the team and individual levels can influence those at the project level in achieving R&D project goals based on the COINS project. Based on the information from the key participants in the COINS project and the qualitative and time-course observation of the co-author and co-word networks at the individual level, an R&D strategy taken by each observed individual was assigned to one of four quadrants comprised with two independent axes: the production/consumption of core/peripheral knowledge, which was in line with the result of the graph entropy-based collaboration and knowledge structures in Chapter 3. Furthermore, based on the observations and analysis of the COINS project, these results were verified to be consistent with the R&D strategy and organization management in the real world.

Finally, in Chapter 5, the insights obtained from the previous chapters were summarized. The instrumentation of the collaboration and knowledge structures in R&D activities at the program, project, team, and individual levels, respectively, enable the observation of organizational and managerial phenomena at each level and the identification of mechanisms

implemented across levels, which can lead to a structural understanding of large-scale R&D programs and projects. Methodological developments in the instrumentation of organizational and managerial phenomena in scientific research will contribute to the systematization of management of science and will help practitioners to support evidence-based management and data-driven decision making.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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