

# International Workshop on Emerging Research Detection by Bibliometrics

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Date: March 22th (Fri) 13:00-16:00

Place: Room No.812 at Tamachi Campus of Tokyo Institute of Technology

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## Program

- Illustrating Emerging and Evolutionary Path of Science  
Yuya Kajikawa (Tokyo Institute of Technology)
- 'Looking back' to trace the evolutionary paths of change of emerging nanotechnological systems – The case of ZnO nanostructures  
Alfonso Avila-Robinson (Tokyo Institute of Technology)
- Detecting Research Fronts based on Weighted Citation Network Analysis  
Katsuhide Fujita (Tokyo University of Agriculture and Technology)
- Separating the wheat from the chaff – Detecting emerging topics in science by a multivariate analysis  
Carolin Michels (Fraunhofer Institute for Systems and Innovation Research ISI)

## Abstract

### **'Looking back' to trace the evolutionary paths of change of emerging nanotechnological systems – The case of ZnO nanostructures**

This presentation puts forward a quantitative approach aimed at the understanding of the evolutionary paths of change of emerging nanotechnological innovation systems. The empirical case of zinc oxide (ZnO) nanostructures is used. In line with other authors, 'problems' are visualized as those aspects guiding the dynamics of innovation systems. It is argued that the types of problems confronted by an innovation system, and in turns its dynamics of change, are imprinted on the nature of the underlying knowledge bases. The latter is operationalized through the construction of co-citation networks from scientific publications. These co-citation networks are endowed with directionality through the allocation of a particular problem area, drawn from a 'problem space' for nanomaterials, to each network node. By analyzing the structural and cognitive changes undergone by these problem -attached networks, it is attempted to infer the nature of the paths of change of emerging nanotechnological innovation systems. In broader terms, the results stress the evolutionary

mechanisms underlying change in a specific nanotechnology field. It is also observed that 'looking back' at the nature of the knowledge bases underpinning technologies may provide crucial insights into the level of technological emergence.

### **Detecting Research Fronts based on Weighted Citation Network Analysis**

One of the important methodologies for detecting the research fronts is the citation network analysis. Especially, citation network analysis with weights has possibilities of finding the new research fronts compared with non-weighted and single type of citation networks. In this presentation, we perform a comparative study to investigate the each type of citation networks in detecting a research front using visibility, speed, topological relevance and keyword similarity.

### **Separating the wheat from the chaff – Detecting emerging topics in science by a multivariate analysis**

Emerging topic detection oftentimes relies on citation-based indicators. Drawbacks of these kinds of indicators are that timely analysis is not possible because of the citation window and that the trends to be discovered and their respective documents must have already been noted by other scientists. However, history shows that important publications have been ignored by the scientific community as it happened for example in the case of Mendel. In this presentation we propose an approach that only uses indicators that are available at the time of publication of the analysed documents. For instance, the vocabulary used in the publications is compared with that of former topics and publications to deduce whether new concepts are introduced or not. A likewise procedure is performed with the references of the documents to see whether the documents rely heavily on single former established concepts or on a mixture of these. Other indicators like the journals chosen for publication, the age of references

### **Bio**

**Alfonso Ávila-Robinson** received a B.S. degree on Industrial and Systems Engineering from the Universidad de Monterrey (Mexico) and a M.S. degree in Production Engineering from the RWTH Aachen (Germany). Currently, he is about to complete his Ph.D. in Innovation Management at the Tokyo Institute of Technology (Japan). From coming April, he will be working in the Institute for Integrated Cell-Material Sciences (iCeMS) at Kyoto University. His main research interests include: emerging technologies, technological dynamism, S&T policy, and bibliometric approaches.

**Dr. Katsuhide FUJITA** is an Associate Professor of Faculty of Engineering, Tokyo University of Agriculture and Technology. He received the B.E., M.E, and Doctor of Engineering from the Nagoya Institute of Technology in 2008, 2010, and 2011, respectively. From 2010 to 2011, he was a

research fellow of the Japan Society for the Promotion of Science (JSPS). From 2010 to 2011, he was a visiting researcher at MIT Sloan School of Management. From 2011 to 2012, he was a Project Researcher of School of Engineering, the University of Tokyo. His main research interests include Bibliometrics, Multi-Agent Systems, Decision Support Systems.

**Carolyn Michels** is a researcher in the Competence Center Policy and Regions at the Fraunhofer Institute for Systems and Innovation Research ISI and a doctoral candidate at the Institute for Applied Computer Science and Formal Description Methods at the Karlsruhe Institute of Technology (KIT). She studied information engineering and management at the University of Karlsruhe (TH), graduating with a German Diplom. From March 2006 until September 2009 she worked as a student researcher at the Institute for Information Systems and Management at the University of Karlsruhe (TH). From September 2009 until October 2010 she was employed as a research assistant at the Institute for Applied Computer Science and Formal Description Methods and at the Karlsruhe Service Research Institute in the KIT. Her research interests include indicators for emerging topics in science as well as extent, cause and implications of brain drain for individual countries.