

Mapping the Emergence of Innovation Ecosystem

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This session aims to demonstrate empirical methods to analyze the emergence of innovation ecosystems. The five talks in this session are about newly developed techniques for studying emerging innovation and entrepreneurship ecosystem emergence. The first paper in this session applies Agent-based Modeling Simulation (ABMS) to explore the formation of technology licenses in the biotech sector. The second paper studies the technological profile of MNCs and SMEs in South Korea and Taiwan. The third paper in this session attempts to apply the analytic hierarchy process to organize the keywords to improve the patent search strategy. Followed by an empirical study on innovative city development initiatives in Macau. Finally, the session concluded with an extensive literature review study exploring the methodologies applied in the innovation ecosystem research. The anticipated contribution of this session aims to demonstrate the novel methods of mapping the innovation ecosystem, encouraging the emerging industry to enhance the innovation performance, and facilitating the paradigm shift of technology development for the next generation. The abstracts of the five talks presented in this panel consist of the following research:

Explore the Rational Behind Partner Selection Using Data-driven Agent-based Modeling Simulation

This research facilitates abundant data from a commercial database, data analytics, and computational simulation to expand our understanding of the emergence of collaboration. This paper focused on strategic alliance and partner selection in the biotech sector. The reason behind our choice is because strategic alliance and partner selection are not only the common topic in innovation studies but the primary measure to be employed to acquire the external resource in technology-intensive industries. The biotech sector is selected because the inventor is not necessary to commercialize the new product/technology from the beginning to the end. Instead,

the product/technology in every explicit phase of product development can be considered the dealing object, becoming a commodity to exchange the complementary resource for competitiveness and survivability. Computational models are increasingly used to assist in developing, implementing, and evaluating public policy, and innovation policy is no exception. We facilitated the Agent-based Modeling Simulation (ABMS) to explore the formation of R& D collaboration. We started with critically reviewing the strengths and limitations of agent-based modeling, not just in general applications but also in the context of the applications for the innovation ecosystem. We then discuss new insights agent-based models have provided and report the preliminary outcome of a promising real-world data-based ABMS for technology policy. We explained in detail how machine learning on sizeable strategic alliance data assisted in the parameter configuration of ABMS. The data analytics findings indicate that the more mature the licensor is, the more attractive the licensee finds, and the more discontinued product development the licensor has the higher the alliances success. Based on the findings, we then highlighted how a data-driven agentbased model is designed and implemented. We explore the possibility of building a what-if decision support tool for policymakers and actors from different levels to understand the effectiveness of various policy/strategy interventions and how these choices will affect the future development of the industry sector via virtual experiment. We applied a machine learning approach to discover essential factors of partner selection and ultimately establish a dynamic partnership simulation model using an agent-based modeling approach. The theoretical contribution is bridging the literature gap of analyzing partner selection criteria using a multilevel perspective of company data; the practical contribution is providing corporate a simulation method for making strategies in a dynamic business environment.

Contrasting Inventiveness between the Haves and have nots: Mapping the technological profile of MNCs and SMEs in South Korea and Taiwan

The catching-up literature notes the successful deployment of industrial upgrading strategies in South Korea and Taiwan. This study supposes that the upgrading of big and smaller firms is bounded and gravitated by institutional lock-in to some extent. This study tracks the agglomeration of inventions through the measurement of patent data sourced from the US Patent and Trademark Office from 2001 to 2021; measuring patenting trend, specializations, reach and flow of patents from original assignee to current assignee. The data presented in this study aimed to visualize aspects of patenting behaviour in the two economies and the indications that the two cases

reveal regarding innovation culture. The study reinforces the notion that Korea's hierarchical structure tends to see SMEs play a subservient role in the innovation ecosystem, primarily supporting the continued growth of MNCs and not forging their own space in the international market. On the other hand, Taiwan has shown that SMEs have a more active role in international markets though, with less interactions internally. The study results aim to propose a means to separate MNCs from SMEs by considering established lists of wealth rankings to illustrate the technological profiles and gaps between MNCs and SMEs in more detail.

Applying the Analytic Hierarchy Process on Patent Search Strategy

The IPC codes are usually adopted as the primary indicator for patent search and analysis. However, IPC categories were categorized manually by the patent examiner, which can not be the only indicator. Adopting AHP hierarchy analysis on establishing search keywords, this study aims to establish a new set of patent search and analysis strategies. This research takes education, industry, and service robots from the robotics industry as the empirical application example. The AHP hierarchical analysis method could enhance the accuracy of the analysis of the emerging technologies which might have relatively small number of patents. This set of search strategies can be generalized in studying most of the emerging sectors.

Keywords: Ontology, AHP, robot industry, IPC code

Realizing Diversification and Innovation Ecosystem: A Case Study of Macau SAR's Smart City Development Capabilities

The emergence of digital technologies has transformed organizational innovation and entrepreneurship with important implications for a city, its economy and its policymaking. Despite this, research on how capabilities underpin industrial diversification and operationalization of smart city policy is still lacking. Besides, whilst diversifying is attractive it is difficult for cities and regions to accomplish. To address this knowledge gap, we conduct an empirical investigation on smart city development initiatives in Macau. The case study adopts a qualitative approach and predominantly an interpretive stance. Data collection was conducted through fieldwork observations and in-depth interviews with stakeholders representing public and private players in smart city development in Macau. The data were complemented by analysis of secondary documents. The study develops a stage-based assessment of innovation capabilities related to the use of technologies in smart cities development. It identifies three stages characterized by specific city-level innovation capabilities: sensing, seizing and transforming. This study uncovers important features of Macau's innovation

ecosystem, public-private partnerships, the intermediary role of digital platforms, and, more significantly, the development of technology-enabled capabilities in organizations to help propel the city's transformation. The case of Macau's smart city also has important implications for theory and policymaking: As a former Portuguese colony and now special administrative region (SAR) of China, Macau's local governance maintains a high degree of institutional autonomy from mainland China. This study, the first of such kind about a city where "the East meets the West", offers first-hand insights into its smart city development, with recommendations for future policymaking.

Keywords: smart city; innovation ecosystem; dynamic capability; diversification; sustainable development; Macau

Landscape of innovation ecosystems: Opportunities and shortcomings

The field of innovation studies brings together diverse disciplinary perspectives to formulate theories on the management, practice and outcomes of innovation. In the past twenty-five years, innovation ecosystems is a theory that has gained prominence and in 2020 five different journals issued calls for papers (CfPs) and later published special issues based upon this theory. Since five different journals undertook parallel efforts to issue special issues, it suggested the field might be coalescing around a shared definition of innovation ecosystem. This led us to ask: Is the field of innovation studies reaching consensus about the theoretical underpinnings and methodological approaches to investigate innovation ecosystems? To explore this question, we drew from the references provided to prospective authors responding to the calls for papers from the five journals: Research Policy, Industry Marketing Management, IEEE, Industry and Innovation, and Business Research were cataloged and then forward citations were identified. A total of 76 references were provided for the five different CfPs and that yielded 14,439 forward citations. Surprisingly there is only one paper out of the 14,439 that references at least one paper in each of the CfPs. That suggests a high-level of divergence in the field about the theory of innovation ecosystems and offers evidence that there is no shared foundational literature. Thematic analysis of 126 papers that were sampled from this group revealed further methodological divergence as well as diverse research foci between network complexity, complementary forces and ecosystem performance. Our findings show that the concept of innovation ecosystems is fragmenting rather than coalescing. Scholars are interpreting the concept to fit their disciplinary and methodological training rather than engaging in cross-disciplinary research.