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論文審査の要旨
Summary of Dissertation Review

博士の専攻分野の名称 Degree	博　士　（　工学　）	氏名 Author	SHUANGJIN LI
学位授与の要件	学位規則第４条第①・２項該当		

論　文　題　目　Title of Dissertation

Exploring Associational Factors to COVID-19 and Evaluating Non-pharmaceutical Interventions and Recovery Measures: Perspectives of Built Environment and Human Mobility

論文審査担当者　Dissertation Committee Members

主　　査 Committee Chair　ZHANG JUNYI, Prof.　印 Seal
審査委員 Committee Member　FUJIWARA AKIMASA, Prof.
審査委員 Committee Member　FENG TAO, Prof., Graduate School of Advanced Science and Engineering
審査委員 Committee Member　KASHIMA SAORI, Assoc. Prof.
審査委員 Committee Member　CHIKARAISHI MAKOTO, Assoc. Prof.

〔論文審査の要旨〕Summary of Dissertation Review

Motivated by the ongoing COVID-19 impacts and the lack of scientific evidence as well as future uncertainties, this dissertation study has made one of the initial attempts in the pandemic-related literature by focusing on the roles of the built environment and human mobility. Focusing on three key phases related to COVID-19, the study investigated the virus spread mechanisms at initial stages (Task 1), explored effective packaged policies related to the during-pandemic virus containment and maintenance of economic development (Task 2), and examined the recovery from the pandemic (Task 3), in China, Cambodia, and Japan, respectively. Different types of non-pharmaceutical policy measures at each phase were directly and/or indirectly examined. Task 1 focuses on China during a short period before and after Wuhan was locked down in January 23, 2020. Task 2 presents scientifically sound answers about how to balance pandemic control and economic development in the context of tourism in Cambodia. Task 3 derives scientifically sound answers about how to make cities resilient to pandemics, especially in the field of urban planning.

The applicant published the following three SCI/SSCI-indexed papers, which contents are fully connected with this dissertation study. Two more relevant papers are under review.

1. (*joint first-author*) Ma, S., **Li, S.,** & Zhang, J.* (2021). Diverse and nonlinear influences of built environment factors on COVID-19 spread across townships in China at its initial stage. **Nature - Scientific Reports [Q1]**, 11, 12415. https://doi.org/10.1038/s41598-021-91849-1 [**IF=5.134**]
2. **Li, S.,** Ma, S., & Zhang, J.* (2021). Association of built environment attributes with the spread of COVID-19 at its initial stage in China. **Sustainable Cities and Society [Q1]**, 102752. https://doi.org/10.1016/j.scs.2021.102752 [**IF=10.696**]. **[highly cited paper]**
3. **Li, S.,** Ma, S., & Zhang, J.* (2022.01). Building a system dynamics model to analyze scenarios of COVID-19 policymaking in tourism-dependent developing countries: A case study of Cambodia. **Tourism Economics [Q1]** https://doi.org/10.1177/13548166211059080 [**IF=4.582**]

The applicant further published the following three more SCI/SSCI-indexed papers, which contents are methodologically connected with this dissertation study.

4. **Li, S.,** Ma, S., Tong, D., Jia, Z., Li, P., & Long, Y., (2021). Associations between the quality of street space and the attributes of the built environment using large volumes of street view pictures. **Environment and Planning B: Urban Analytics and City Science [Q2]** https://doi.org/10.1177/23998083211056341 [**IF=3.619**]
5. Li, F., Li, F., **Li, S.**, & Long, Y. (2020). Deciphering the recreational use of urban parks: Experiments using multi-source big data for all Chinese cities. **Science of the Total Environment [Q1]**, 701, 134896. [**IF=10.753**]
6. **Li, S.**, Zhang, J.*, Moriyama, M., & Kazawa, K., (2021). Spatially heterogeneous associations between the built environment and objective health outcomes in Japanese cities. **International Journal of Environmental Health Research [Q2]** https://doi.org/10.1080/09603123.2022.2083086 [**IF=4.477**]

This study is one of the initial attempts in the literature to make a comprehensive and consistent investigation about the roles of built environment and mobility factors in the context of COVID-19 by targeting three key pandemic-related phases: i.e., pre-pandemic, during-pandemic and after-pandemic periods. Firstly, its novelty is reflected in terms of using massive multi-source and multi-scale data and integrating multiple modeling approaches to derive scientifically sound evidence about the understanding of COVID-19 related phenomena and the policymaking against the pandemic. Secondly, the focus on initial stages of the pandemic allows researchers and policymakers to identify key built environment and mobility factors that may contribute to effectively control the spread of an infectious disease in future before it will cause a pandemic, globally. Thirdly, using the system dynamics model to explore how to balance pandemic control and economic development allows policymakers to identify effective policy packaging strategies by addressing the various dynamic causalities related to COVID-19 phenomena and input-process-output relationships for policymaking. In theory, such a policy-oriented system dynamics modeling framework is also applicable to investigate future pandemics and other unprecedented health-related crises. Fourthly, use of convolutional neural network (CNN) model and guided Grad-CAM (GG-CAM) model based on massive multi-source and multi-scale data allows researchers and policymakers to figure out how to re-build urban spaces/facilities/functions and re-design urban services after suffering from such a painful pandemic spreading over the whole world for more than two years, based on a better inference of the urban recovery mechanisms. Fifthly, even though three countries are targeted for the three research tasks, separately, the methodologies used in the three tasks are well connected, which can be integrated as a conceptually-unified and logically-consistent analysis framework. Sixthly, various immediate policy responses, short-term interventions and long-term strategies were empirically derived from this study, which may have long-lasting values to both researchers and policymakers. Finally, this study has reconfirmed the power of open data and big data, supported by various GIS and deep learning techniques, for dealing with large-scale complicated cross-sectoral urban issues in the pandemic context.

As a result of the above review, the members of the committee found that this dissertation is of sufficient value to award the author the degree of Doctor of Engineering.