

## **Knowledge without borders? A re-investigation from the spatial and temporal perspective**

Jue Wang     wangjue@ntu.edu.sg   Nanyang Technological University

Liwei Zhang   Nanyang Technological University

Extended abstract

Knowledge as a key component of assets for economic growth cannot be under-valued. The accumulation and dissemination of knowledge have been the hot topics in science policy. How easily knowledge can be transmitted is partly dependent on the property of knowledge – tacit or codifiable (Polanyi, 1958). Due to its inarticulate nature, tacit knowledge is often disseminated in interpersonal networks from one researcher to another researcher, through channels such as training, observation, discussion, and conferences etc. The transmission is typically localized in both physical and social space as it often requires face-to-face interaction (Breschi & Lissoni, 2005). Therefore, the dissemination of tacit knowledge is bounded by spatial constraints and more likely to occur among those in close proximity, and gradually reaches more distant parties (Sorenson & Fleming, 2004). By contrast, codified knowledge can be converted into symbols, in the form of publication, and is easily transferable. It is less bounded in space and can be broadcast diffused over long distances and across organizational boundaries (Polanyi, 1958). In this context, the existing literature agrees that the localization of knowledge spillover is mainly derived from the tacit component of the knowledge, while in the case of codified knowledge, geographic proximity is not a major issue especially with the assistance of ICT technologies and infrastructure. This paper intends to explore the impact of geographic proximity on the diffusion of codified knowledge and argues that codified knowledge also transmits faster in close proximity and is subject to the similar geographic constraints but to a lesser extent. The availability of the ICT resources reduces such limitation imposed by the physical distance.

The paper uses citation as an indicator to trace knowledge diffusion. We collected three sets of research articles published in 1990, 2000 and 2010, and subsequently collected bibliometric information for all citations by year 2015 for each seed article. We then extracted author affiliation information for both seed articles and citing articles, manually cleaned and standardized the field of affiliation country. As a result, we identified 804 seed articles and 11,200 citing articles for seed articles in 1990, 9970 citing articles for seed articles in 2000, and 10,050 citing articles for seed articles in 2010. The study found that domestic citations accumulate faster than foreign citations and reached their peak in 3-4 years while the foreign citations did not hit the highest point until 11 years. The result shows that geographic proximity does play a role in the transmission of knowledge. Those locate closer to the knowledge origin would be exposed and react to publications faster, but the advantage of geographic proximity fades over time.