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The Influences and Interactions Between various Scientific Research and Technological Domains in case of Canadian Nanotechnology

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In today's world, relationship between domains of science and technology is getting stronger as science contributes to technology in different ways. The interaction between scientific and technological domains is happening in complex innovation processes in which new technological ideas emerge as a result of new discoveries in science. This research aims to investigate interactions between various emerging scientific and technological domains and their influences in the development of both patents and publications in the field of nanotechnology.

The study uses real data of the journal articles and patents in nanotechnology between 1995 and 2008 which we clustered into scientific and technological domains. In clustering phase, terms and phrases were located in each record using singular value decomposition algorithm and then documents were assigned to cluster labels by applying standard vector space model algorithm on them. To achieve our research goals, in next step, we built the network of nanotechnology article-patent citations and investigated various network topological parameters over all nodes. The patent-article network is built on citation links among different nodes of patents and articles, while patent nodes cite a set of NPLs (Non-Patent Literature) and NPLs are also citing another set of articles as their references. Focusing on the role of NPLs, we studied trend of network topological parameters like betweenness centrality and degree centrality while looking at correlation between them. We highlighted leading patents in technology and leading articles in NPLs and their cited articles set which could be seeds of innovation in nanotechnology.

Our main results of this research are focused on the role of NPLs as gate-keeper nodes in bridging ideas from scientific to technological domains. Comparing NPL citation counts to articles and patents, results show higher range of NPLs' contribution to the development of scientific fields than technological domains in Canadian nanotechnology. We also highlighted most cited and citing NPLs nodes of article-patent citation network as significant nodes in connecting science and technology. Using average of citations per article metric, we calculated the rate in which different technological domains influenced by scientific NPLs and also the impact of NPLs on development of different scientific and technological domains. Regarding the contribution of top cited NPL articles in development of scientific domains, we discovered a positive correlation between citation count and betweenness centrality measure of articles, which indicates the more an article is cited by patents and other articles, the more influence it has on the transfer of ideas from scientific to technological domains. We also observed that citation count value of journals in our citation network has a positive relation with the number of scientific domains it contributes to. In addition, we discovered the positive relation between patent citations count and journal's impact factor. This is interesting to us since we can see the more articles of a specific journals are cited by patents, the more impact factor the articles of that journal have. In other words, impact factor not only shows the impact of articles on development of scientific domains, it also shows how the articles of a journal have impact on development of technological domains. Regarding the NPLs contribution to development of technological domains, we found a positive relation between NPL journals' citations to technological clusters and the number of technological clusters they cover. Results showed the increasing trend of journals' contribution to different technological domains as citation count value of journals increases.

It is worth to mention that this study is the first to examine the flow of ideas from scientific to technological fields which uses a citation network of both patent and article nodes, and investigating leading articles and patents which play a crucial role in keeping this knowledge flow alive in nanotechnology related sub-fields.

Biography:

Hadi has a bachelor degree in Computer Science and Masters in Information Technology. Currently he is a M.Sc. student at Concordia Institute for Information Systems Engineering at Concordia University in Montreal working as a research assistant in fields of innovation networks. So far, he collaborated in several other publications of the same field focusing on collaboration networks and scientific output of researches. His current research interests involve the investigation of science and technology interactions through study of citation networks.