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Inferior search engine's optimal choice: Knowledge-sharing service versus search quality

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ABSTRACT

Google has been steadily increasing its market share in the US, although its main competitor, Yahoo, began developing a successful knowledge-sharing service in 2005. To verify whether a knowledge-sharing service may increase a search engine's competitiveness, this study considers the competition between an inferior search engine that has an option of introducing a knowledge-sharing service and a superior search engine without this service. We specifically investigate the conditions under which it would be more profitable for the inferior search engine to introduce a knowledge-sharing service rather than increase its search quality. We show that the inferior search engine's profit-maximizing strategy mainly depends on both the amount of information available on the Internet and the difference in search quality between it and the superior search engine. When the search quality difference is small, the inferior search engine should introduce a knowledge-sharing service keeping its answer database inaccessible to the superior search engine. When the search quality difference is large, the inferior search engine generally had better improve its search technology. We also show the inferior search engine's market-share-maximizing strategy when it introduces a knowledge-sharing service.

1. Introduction

Knowledge-sharing websites connect online users with questions and those who can answer the questions. As adopted by Kim and Tse (2011), the former group is referred to as *questioners* and the latter group as *answerers*. Questioners post their questions and wait for replies from answerers. This process is especially valuable if questioners fail to obtain the information they seek from search engines. Online users may also find answers to their questions by searching an answer database that stores pre-answered questions.

Answerers may participate in knowledge-sharing services due to various reasons. They may want to help questioners find relevant information, learn about particular topics of their interests, or generate certain demands for their businesses (Nam et al. 2009). The answerers' motivation of promoting their businesses here implies knowledge-sharing services can be online channels of their sales. Some answerers participating in a leading knowledge-sharing service (called Knowledge-In) in South Korea tried to capture potential customers of their insurance sales by answering their questions (Nam et al. 2009). Many other businesses are also possible via knowledge-sharing services. Car salesmen, private hospital doctors, and restaurant owners may obtain customers by providing them with relevant information. In addition, answerers may receive monetary rewards in return for their answering services. Some knowledge-sharing websites such as Mahalo Answers, Just Answers, and UClue provide pay-for-answer services (Hsieh et al. 2010).[1] These websites thus serve as online platforms via which experts can sell their knowledge.

Many search engines have been successful in obtaining a huge number of these answerers (as well as questioners) for their knowledge-sharing services. In the US, Yahoo's knowledge-sharing service, Yahoo! Answers, has been successful since its beta launch in December 2005.[2] As of January 2011, Yahoo! Answers had about 48 million monthly users in the US.[3] In South Korea, many domestic search engines as well as Naver introduced online knowledge-sharing services to improve their search capability because of a lack

[1] While anyone can answer on Mahalo Answers, Just Answers and UClue recruit answerers.

[2] "Yahoo! Search Leverages Human Knowledge from Yahoo! Answers to Improve Web Search; Yahoo! Answers Surpasses 10 Million Answers to Everyday Questions from Real People." Business Wire, May 15, 2006, http://search.proquest.com/docview/445231173?accountid=14558 (accessed November 5, 2013).

[3] Kiss, Jemima. "In Focus: Technology: How Q&A Web Brands Rose to be the Hottest Properties on the Net in 2011: Quora, Set up by Two Ex-Facebookers, has become the Darling of Silicon Valley (and Ashton Kutcher is a Fan Too). It's the Latest in a Growing Number of Answer Sites, but is its Valuation of $1bn another Sign of an Overheating Internet Market?" The Observer, February 27, 2011, http://search.proquest.com/docview/853935971?accountid=14558 (accessed November 5, 2013).

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of online information in Korean. Among these, Naver's Knowledge-In has been very successful, contributing to the success of Naver,[4] which leads the Korean search engine market.

To a certain extent, Naver's knowledge-sharing service has induced Korean users to use Naver by making its answer database *closed* (i.e., inaccessible to other search engines). Given that most Koreans search for information on the Internet in Korean, its closed answer database has become a valuable tool to Korean users because the amount of online information in Korean is relatively small. In 2002, Yahoo Korea was dominant with about 80% market share.[5] However, Yahoo Korea had kept losing its market share ever since Naver's Knowledge-In became successful. Yahoo Korea finally closed its operation in South Korea as of December 31, 2012. Naver's market share in South Korea in 2010 was 72%, while Google's market share at that time was less than 5%.[6] Given that Google has been dominating many countries in Europe, South America, and Asia, its small market share in South Korea is surprising.[7]

Although it has a huge membership, Yahoo! Answers does not appear to have helped Yahoo obtain more user visits. The market share of Yahoo in June 2005 was 30.4%, and decreased to 28.5% one year later.[8] Since then, Yahoo has continuously lost market share, dropping to about 11% in July 2013.[9] Unlike the closed-answer database of Naver, Yahoo has kept its answer database *open* (i.e., accessible to other search engines). Therefore, users do not have to use Yahoo to search its answer database. Furthermore, the value of Yahoo's answer database in attracting users seems to be limited because the amount of online information in English is enormous. It would appear worthwhile questioning whether Yahoo could have gained more market share by making its answer database closed.

Unlike Yahoo and Naver, Google currently does not provide a knowledge-sharing service.[10] Google did at one stage initiate an answering service, called Google Answers. Its users obtained answers to their questions from recruited answerers for a fee. However, Google shut down the service in December 2006. Google Answers was different from general knowledge-sharing services in that its service users and hired answerers did not impose cross-group network externalities on each other. In contrast, as indicated by Kim and Tse (2011), on knowledge-sharing websites, more questioners attract more answerers, which in turn attract more questioners. Given that most answer databases of successful knowledge-sharing services are open,[11] Google has not needed to build its own knowledge-sharing service.

Given that Google is considered to have a superior search technology, inferior search engines may still increase their search capabilities or introduce their own knowledge-sharing services to better compete with Google. Since Google can enjoy its competitive edge from its huge database of indexed pages, it would be extremely difficult for inferior search engines to surpass Google in terms of search quality (Argenton and Prüfer 2012). However, users may still visit inferior search engines if their initial search on Google is unsatisfactory. To capture this residual demand, inferior search engines may choose to improve their search technologies. However, if the amount of online information is small, they may rather choose to develop a knowledge-sharing service, as Naver did. In this case, they need to decide whether to keep their answer databases closed.

By keeping its answer database closed, an inferior search engine can use the database as a proprietary asset to increase its attractiveness to searchers. On the other hand, if the inferior search engine makes its answer database open, it indirectly helps superior search engines access more information. In this case, users may never reach the inferior search engine, because their initial search results on the superior search engine would have included the entries from the inferior search engine's answer database.

To clarify these trade-offs, our study investigates the optimal choice for an inferior search engine between improving its search technology and introducing a knowledge-sharing service with a closed or open answer database. To this end, the proposed game-theoretic model of competition between inferior and superior search engines focuses on the former's optimal choice, assuming that the latter does not develop its own knowledge-sharing service. The proposed model reflects the current search engine market in which Google is considered to have a superior search technology (without a knowledge-sharing service), while competing search engines, such as Yahoo and Microsoft, either have or had their own knowledge-sharing services.[12]

2. Related literature

Our study is mainly related to the literature on search engine competition. Telang et al. (2004) show that inferior-quality search engines may coexist with superior search engines because the former can be visited by searchers who fail to find satisfactory results from the latter. The proposed model modifies theirs by incorporating the value to searchers of a knowledge-sharing service into the utility of an inferior search engine. In addition, as adopted by Kim and Tse (2012), the proposed model considers the amount of online information as a factor that influences the utilities of search engines. Kim and Tse (2012) show that the value of a knowledge-sharing service to an inferior search engine decreases as the amount of online information increases by modeling the open-loop differential game between an inferior search engine with a knowledge-sharing service and a superior one without it. Their model assumes myopic behavior by searchers, but our study is built on a fulfilled expectations equilibrium in which searchers' expectations of the utility of search engines are realized. Kim and Tse (2012) analyze the impact of developing a knowledge-sharing service on the competition between inferior and superior search engines, assuming that their search qualities are fixed. In contrast, the proposed model allows an inferior search engine to choose between improving its search quality and introducing a knowledge-sharing service.

The likelihood of Google's dominance in the worldwide search engine market has been investigated. Pollock (2010) concludes

[4] Sang-hun Choe, "South Koreans Connect through Search Engine," The New York Times (accessed October 20, 2013).

[5] Eunhe Jeong, "The collapse of Yahoo in South Korea," E-Journal, http://www.e-journal.co.kr/news/articleView.html?idxno=783 (accessed April 1, 2014).

[6] Michael Bonfils,"Search Marketing Guide to Naver, Korea's Most Popular Search Engine," Search Engine Watch, http://searchenginewatch.com/article/2070244/Search-Marketing-Guide-to-Naver-Koreas-Most-Popular-Search-Engine (accessed November 6, 2013).

[7] Bas van den Beld,"Google market shares around the globe," State of Digital, http://www.stateofdigital.com/google-market-shares-around-the-globe/ (accessed November 7, 2013).

[8] Comscore, "Google's U.S. search market share continues to climb in June; Yahoo! also post gains," http://ir.comscore.com/releasedetail.cfm?ReleaseID=245876 (accessed November 7, 2013).

[9] Matt Southern, "Google's search market share back up to 67%; Bing up 2% from last year," http://www.searchenginejournal.com/googles-search-market-share-back-up-to-67-bing-up-2-from-last-year/67568/ (accessed November 7, 2013).

[10] Google provides Google groups in which people may discuss issues related to any topics. However, we do not consider Google groups as Google's knowledge-sharing service. First, Google groups can also be used for private group communications. Second, Google groups' postings cannot be searched unless they are set available to the public. Finally, Google groups' advertising revenue is zero while Naver and Yahoo's knowledge-sharing services generate advertising revenues.

[11] There are exceptions, such as Naver and ExpertsExchange (a membership-based IT knowledge-sharing service provider).

[12] Microsoft had its own knowledge-sharing service, which it subsequently closed in 2009.