

# Strategy for Developing Technology Planning Support System

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**Abstract.** As the business and industry grows, the importance of technology strategy also grows bigger. To establish technology strategy, technology planning such as selection of target emerging technologies, when and how to acquire target technologies should be well performed. In this paper, we explain core strategy for developing technology planning support system. We first present a strategy for acquiring useful knowledge from various technology literatures using text mining and Semantic Web technologies and then suggest services appropriate for each step of technology planning. Considering recent growth of mobile environment of users, our system will be running on tablet PCs.

**Keywords:** Technology Planning, Technology Intelligence, Knowledge Acquisition, Information Analysis, Text Mining, Semantic Web

## 1 Introduction

To achieve successful business, technology strategy should be well established and closely connected with business strategy. Business strategy (or strategic management) means the identification of the objectives of a particular organization and the plans and actions to achieve the objectives [1] and technology strategy includes the objectives, strategies and tactics related to development and application of technologies within an organization [2]. As the business and industry grows, the importance of technology strategy also grows bigger. Especially, to establish technology strategy, technology planning such as selection of target emerging technologies, when and how to acquire target technologies should be well performed in the early time of business. To do this, each organization needs active technology intelligence. Technology intelligence refers to activities for supporting an organization's decision-making process by collecting and forwarding information on new technologies [3].

Technology planning in an organization is generally performed with the following five steps: (1) understanding of meaning and hierarchy of a target technology; (2) understanding of core and strategic technologies related to a target technology; (3) understanding of technical competencies and technology competitors; (4) establishment of technology strategy; (5) execution of technology strategy. These

steps require decision-making by executives such as chief technology officer (CTO) of an organization. To support technology planning, especially, decision-making of executives in the first four steps, we design and discover knowledge resources and information analysis services using text mining and Semantic Web technologies.

The rest of this paper is organized as follows. Section 2 describes requirements from executives. Section 3 explains knowledge resources for technology planning and how to acquire the resources and Section 4 suggests information analysis services for supporting technology planning, which is followed by conclusion in Section 5.

## 2 Needs from Executives

Before developing *InSciTe*<sup>1</sup>, which is a technology intelligence service [4], we surveyed what is the most important information for establishing their business and technology strategy by executives in institutions and small and medium-sized enterprises (SMEs). Fig. 1 shows the responses from executives, which could be summarized into analysis and prediction in three different aspects such as technology, business, and sociology. We are currently focusing on technology and business aspects, such as relationship between technologies, technology gap, technology hierarchy, technology convergence, discovery of emerging technologies, leading organizations and recommendation of partner candidates, because these information can be discovered and derived from technological literature such as papers, patents, news and magazines using existing text mining technologies.



Fig. 1. Important information for establishment of business and technology strategy

## 3 Information Acquisition

In this section, we describe text data to be used and steps to process the data into knowledge. Target data need to include news and magazines as well as papers and patents because news and magazines timely reflect rapid changes in technologies and products where the technologies were implemented. We collected articles belonging

<sup>1</sup> We have been developing *InSciTe* from 2010 and this year version is *InSciTe Adaptive* which is enhanced with mobility and user-adaptiveness.

to technology-related sections from 14 news and magazine sites since 2001. We also targets Wikipedia documents because they provide rich descriptions about various terminologies including technologies and organizations. LOD (Linking Open Data) is another target data because they provide rich knowledge well constructed in ontology.

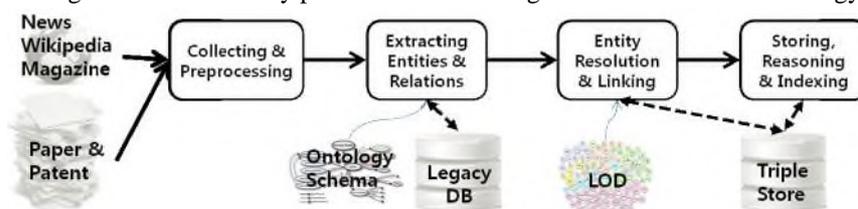


Fig. 2. Overall processes from data collection to triple store

The collected data is processed into triple knowledge through several steps as shown in Fig. 2. We define ontology schema to represent concepts (i.e., classes) such as technology, product, and agent (organization or nation) and relations between them. For example, we define following seven relations between two technologies: *is-a*, *compete*, *succeed*, *substitute*, *elementary*, *converge*, and *similar*. Here, *succeed* and *substitute* is defined as sub-relations of *compete*. The text data is processed to extract entities and their relations defined in ontology schema. We apply hybrid approach combining pattern-based and machine learning-based methods to extract entities and relations. Extracted results and meta-data of text data are converted into triple knowledge based on the ontology schema. Each entity is resolved to identify same entities in LOD [5]. Triple knowledge is stored, inferred, and indexed to efficiently manage and query. All these steps are tightly coupled so that newly collected data is propagated to triple store through whole steps without any manual interaction within a limited time.

## 4 Information Analysis Service

*InSciTe Adaptive* is designed to support the first four steps of technology planning described in Section 1. As the first step, *InSciTe Adaptive* provides navigation of ontology. Users can explore hierarchy of technologies including elementary technologies, products and agents related to technologies to select their interesting technologies or agents. After selecting target technology or agent, *InSciTe Adaptive* suggests emerging, elementary, and convergeable technologies related to a target technology or agent as the second step. Users are helped to understand their concerned technologies better. Users can also track issues such as product launch and M&A related to the concerned technology. After that, *InSciTe Adaptive* provides comparison of technology levels among agents as the third step to help users understand technical competencies of agents and identify technology competitors or collaborate candidates. Finally, *InSciTe Adaptive* suggests technology roadmap and makes a summary report at the fourth step.

The above four steps of *InSciTe Adaptive* services do not mean strict order of services. We adopt and design flexible service steps by allowing users to go back to

previous service steps but adaptively guiding users to final service steps. We explored several kinds of user scenarios to design and guide service flows of *InSciTe Adaptive*.

Each service is designed to provide insight for users. Insight indicates the meaning entailed by a service result and will help users to well understand each service result.

We also adopt mobile first strategy to support current mobile user environment. We targets tablet PCs such as *iPad* and *Galaxy Tab* considering that our services should be visualized on enough wide screens.

## 5 Conclusion

In this paper, we explained our strategy for developing technology planning support system. We investigated the information needs from executives of organizations when they establish business and technology strategy for their organizations, and designed our system based on the survey result. We first made a strategy for acquiring useful knowledge from various technology literatures using text mining and Semantic Web technologies. We next designed services appropriate for each step of technology planning. Considering recent growth of mobile environment of users, we are developing our system running on tablet PCs.

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