

# Towards Prescriptive Analytics for Increasing R&D Competitiveness

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**Abstract**— This paper introduces a prescriptive analytics service prototype to provide researchers in various perspectives and strategies, and advise their future research direction. The prototype uses several heterogeneous types of data sources on science and technology such as papers, patents, reports, web news, magazines, and Linked Data. It also provides three analytic and advising services. For a given researcher, the groups of his/her role model are provided through SWOT analysis, activity trends tracking. The researcher can get prescriptive descriptions in various aspects of 5W1H to let his/her reach the level of role models. The prototype finally generates an advisory report with goals and strategies for increasing R&D competitiveness.

**Keywords**- *Advisory Report; Prescriptive Analytics; SWOT; Activity Trend; Mentoring System*

## I. INTRODUCTION

Business analytics is the activities which continuously explore and investigate past and current business performance to get insight and drive business planning[1] and is divided into three phases such as descriptive, predictive and prescriptive analytics[2]. Descriptive analytics is the most common and well understood type of analytics and many analytic tools usually support this. Predictive analytics analyzes to predict the future while prescriptive analytics suggests decision options with their implication. The recent announcement of Gartner says that current trend on analytics is proceeding to prescriptive analytics via predictive analytics[3]. The same trend applies to technology area, i.e., technology analytics.

Technology analytics including trend analysis, prediction and advice on technology is the very critical activities for researchers and companies to establish their research strategy, make a future research plan and explore potential research partners[4]. However, it takes too much time and efforts to manually perform technology analytics even for precise analysis of experts in a specific technology area because we need to analyze huge amount of diverse and heterogeneous literature. To solve this issue, we have been developing the automated technology analytics system, InSciTe, using text mining and semantic web technologies. We have tackled predictive analytics as well as descriptive analytics on technology area[4][5], and we are now developing an automated prescriptive analytics service prototype, based on a big-data processing platform, to provide researchers with recommendation of their role

models and advice on research direction toward role model group.

To improve the competitiveness of a researcher, the prototype consists of three analytic and advising services such as AS-IS (current status analytics), TO-BE (prescriptive analytics) and advisory report. Especially, users can receive a report in PDF by e-mail and get data-based advice on their R&D strategy and planning and exploration of potential R&D partners. The following section introduces each service briefly.

## II. PRESCRIPTIVE ANALYTICS SERVICE PROTOTYPE

A prescriptive analytics service prototype performs data-based analytics on technology and researcher's competitiveness to diagnose a current level of a researcher and advise a researcher on his/her next research direction. This section describes the three analytic and advising services one-by-one. They are implemented using HTML5 to support multi-platform.

The prototype starts with selection of a one among researchers searched by researcher, organization, and technology name. When a researcher is selected, it instantly shows current status of the researcher on the aspects of his/her R&D activity and capacity as AS-IS. And it also recommends groups of his/her role models with their characteristics and strengths as TO-BE. Finally the researcher can have prescriptive descriptions to achieve the level of the group as well.

### A. AS-IS function

The main objective of AS-IS is to help a researcher figure out his/her current status at a look. So, the AS-IS consists of activity trend analysis and SWOT analysis to understand activity range and research capacity respectively.

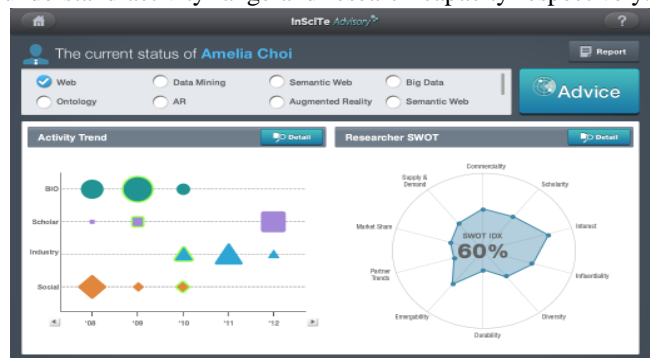


Figure 1. The snapshot of AS-IS function



Figure 3. The snapshot of TO-BE function

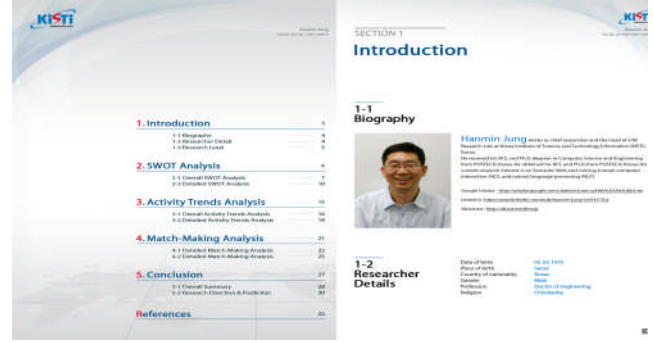


Figure 2. The snapshot of report service

For the activity trend tracking of a researcher, we analyzed research-related activities by year such as scholar, industrial, social, and biographical activities. And the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is carried out through defining several features to measure internal research performance and external research environment of each researcher[6]. By using the AS-IS function, the researcher knows what he/she has done, what strengths and weaknesses he/she has, and where he/she is positioned in the R&D aspect. Figure 1 shows a snapshot of AS-IS function.

### B. TO-BE

We assume that people who use the prototype service want to get detailed strategies on the aspect of 5W1H (what, who, where, when, why, and how) to improve their competitiveness. To provide such strategies, we designed TO-BE function like figure 2. The prototype evaluates current status of a researcher in detail in various aspects and finds potential groups of role models who is positioned in one-step higher level of research activity and performance in the similar research areas. This means that, even though two researchers work in the same research area, it could recommend them different role models if their current research levels differ from each other. And if a researcher wants to select a different group as his/her role models, he/she can choose a new group. If a group is selected, TO-BE provides its characteristics and strengths and suggests prescriptive descriptions to reach the level of the group in 5W1H aspects through comparing them with the researcher.

- Why and How: ‘Why’ and ‘How’ are the most important factor for prescriptive analytics because people should know abundant and reliable clues before deciding a strategy. In our system, these factors are melted in What, Who, Where, and When.
- What: For a given researcher, it provides what to do to reach the level of the role model group. And ‘What’ can contain many activities as goals like “A researcher needs 2 SCI journals on business intelligence and prescriptive analytics.”
- Who: Sometimes, a researcher needs co-worker, consultant, or another organization to innovate an idea and to attain his/her goal more fast. ‘Who’ recommends appropriate researcher(s) and organization(s).

- Where: Researchers may want to know an answer for which conference or journal, even in a certain level to be tackled. ‘Where’ includes its answer.
- When: As a final stage of prescriptive analytics, this part is about strategic roadmap. ‘When’ provides specific timeline for each goal like “you should publish one paper(s) on a technology(s) in a conference(s) (or a journal) over a certain level before a deadline.”

### C. Report

An advisory report in PDF is finally given. This report totally summarizes analytic and advising comments of the above two services, especially to help researchers improve their R&D competitiveness(see Figure 3).

## III. CONCLUSION

This paper gives a brief explanation of predictive analytics service prototype, a prototype for mentoring researchers. It analyzes current global and domestic position of researchers in some specific research area and does provides prescriptive advice in 5W1H aspects to enhance their R&D competitiveness. We strongly expect the users can usefully refer the system for identifying and increasing their R&D capability and competitiveness.

## REFERENCES

- [1] Michael J. Beller, Alan Barnett, “Next Generation Business Analytics Technology Trends”, <http://www.docstoc.com/docs/7486045/Next-Generation-Business-Analytics-Presentation>
- [2] Prescriptive Analytics, [http://en.wikipedia.org/wiki/Prescriptive\\_analytics](http://en.wikipedia.org/wiki/Prescriptive_analytics)
- [3] Gartner Inc., “Hype Cycle for Emerging Technologies, 2013”, <http://www.gartner.com/technology/research/hype-cycles/>.
- [4] J. Kim, M. Hwang, D. Jeong, S. Song, and H. Jung, “InSciTe Adaptive: Intelligent Technology Analysis Service Considering User Intention,” In Proceedings of the Semantic Web Challenge co-located with ISWC 2012.
- [5] M. Lee, S. Lee, H. Jung, P. Kim and D. Seo, “Decision-Making Support Service based on Technology Opportunity Discovery Model,” CCIS 264, pp.263-268, 2011.
- [6] J. Kim, M. Hwang, S. Song, D. Jeong, S. Lee, and H. Jung, “Intelligent Research Performance Appraisal Model based on Internal/Environmental Evaluation Feature,” ATSD 2013, 2013.