# Industrial innovation path selection based on TRIZ theory

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## Introduction

Technology forecasting is a large research area, including several forecasting theories and approaches. Because its long-term perspective and its emphasis on connecting perspectives of different knowledge areas and different actors, foresight differs from corporate strategic planning, which typically looks three, five or maybe eight years ahead and involves only a very limited number of stakeholders. [1] Theory of Inventive Problem Solving (TIPS), also called TRIZ, is the most important theory in the technology forecasting area.[2] Technical evolutionary theory is the core of TRIZ. It includes the concepts of the technical evolutionary mode, the law of technical evolution, and evolutionary routes. In this theory, the researchers have identified a number of generic evolution steps and including a 'final' level of evolutionary potential. The trends and this 'evolutionary potential' concept act together as powerful guides to help determine future development opportunities. [3,4]  In this paper, we use TRIZ theory to evaluate the maturity of the technology in solar cells industry and identity its potential development trend. Then using tech-mining method to focus on the inner cooperation and competition among research groups in this industry and finally find a suitable innovation path for solar cells' development.

## Data Source

In this paper, we make a suitable search strategy and retrieve the patent data from USPTO. In marking the search strategy, we use software to help us automatically choose the key words. Then we need the advice from experts, since they are the professional researchers in the specific domain and can describe the current status of their domain at both macro and micro levels. The experts help us to identity the more related key words in the solar cells area.
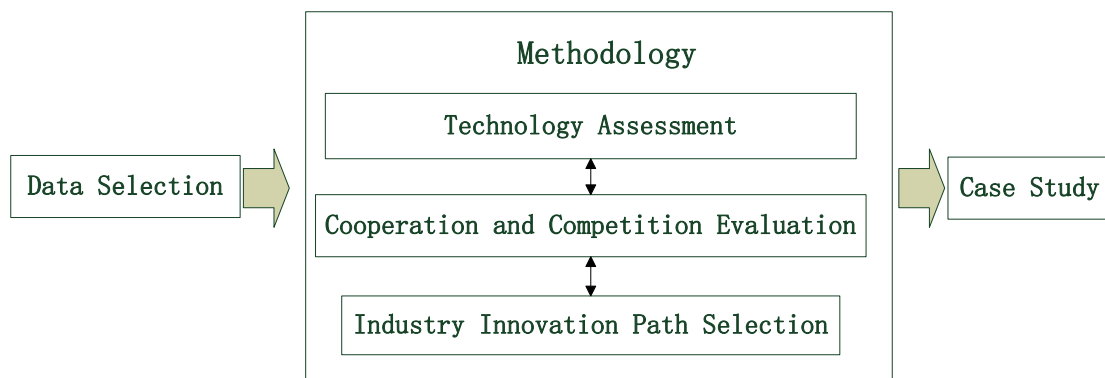
## Method

In this paper, we proposed a selection method to choose the final industrial innovation path. In the first step, we use TRIZ theory to evaluate the maturity of technology and find out the potential development trends. In the second step, we use the tech-mining method to focus on the inner cooperation in the different paths in order to find out the most promising

industrial innovation path for the future development in this industry.

In the first part, this paper assesses the maturity of the core technology in the industry from collecting the patent data in the USPTO. According to the changes in number and classification of patents, we created the trend curve. From fitting a growth model (S-curve), we gauge the maturity of the technology. At this level, we do not involve the specific details of the technical evolution, but just estimate the general trajectory. Then, according to the technical evolution mode of TRIZ, we analyze the different evolutionary paths for the key components in a certain technology.

In the second part, we use tech-mining method to focus on the inner cooperation in this "value chain", and find out relationships among these key components, and at last deeply investigate the inner cooperation in this industry. Based on forecasting the development trend of those key components and the inner R&D relationship, we identify a promising industrial innovation path for the development of this industry. At last, we apply and assess this analytical process via a case study for solar cells. The framework is as follows:

**Reference**

[1]Per Dannemand Andersen & Mads Borup: Foresight and strategy in national research councils and research programmes, Technology Analysis & Strategic Management, 2009.21(8):917-932.

[2] Janghyeok Yoon, Kwangsoo Kim. An automated method for identifying TRIZ evolution trends from patents. Expert Systems with Applications. 2011. 38: 15540-15548.

[3]Darrell L. Mann.Better Technology Forecasting Using Systematic Innovation Methods. Technology Forecasting and Social Change.2003.70: 779–795.

[4] D.L. Mann, Hands-On Systematic Innovation, CREAX Press, 2002.