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A model for disruptive technology forecasting in strategic regional economic development

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Abstract

As regions look to increase their economic development activities, technology-based developments and the penchant for long-term developments in disruptive technologies like nanotechnology become an important part of the options available to these regions. There are typically many technologies and therefore product areas that the region, however, can further develop by investing resources in these areas. At the same time, other regions in the world are considering the same areas of great growth and potential financial and social returns. This paper proposes a model that analyzes several important factors that can lead to success in analyzing these factors promoting the idea that policy makers should analyze the situation from different perspectives to reach justifiable decisions. These factors include the research capabilities of the region, its commercialization and manufacturing capabilities and the markets on which they should focus. Several mathematical models are then presented to help in that endeavor.

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1. Introduction

As policy makers examine the future economic plans for their regions, they should consider the current state of the region, its capabilities in education, technological research, capitalization and infrastructure. This is especially true for emerging disruptive technologies such as nanotechnologies. These current conditions combine to provide the region with its forecasts of economic and social performance.

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Forecasting allows planners in technology and business to choose the right strategies for the future. Martino [1] suggests that it is as much planning for action as it is the planning to avoid costly mistakes of going down the wrong path. There are many methodologies from Delphi to statistical multivariate analysis that can be applied to many different forecasting situations. These forecasting methods apply to tasks as varied as estimating a small startup's potential number of users to the path that a region needs to adopt to bring technology-based jobs and wealth to that region. Martino [2] in a later effort includes environmental scanning through data mining as part of the new methods used given the advances in computer processing and data manipulation capabilities. Saren [3] uses a diagnosis of the technological capabilities to forecast the trajectory of a technology into the marketplace. However, this paper will explore how many of these have been applied to emerging disruptive technologies such as nano-technology, Microsystems and other potentially disruptive technology bases.

Porter et al. [4] focus on the competitive edge the technology gives a company or a region in pursuing its goals of advancing productivity and other economic agendas. To be able to harness this competitive edge, a manager needs to understand and deal with the uncertainty presented by a future that depends on many variables from technology capabilities to customer preferences to economic, political and cultural drivers. Forecasting is the key to this understanding. Twiss [5] suggests using hard data when possible for forecasting. Otherwise other methods such as scenario analysis or expert opinion should be used to allocate resources under uncertainty of future events. He maintains that forecasting does not negate the need for managing unexpected eventualities but to be prepared to understand the relationship between the different existing factors. Porter [6] indicates that with new information methodologies, one can search for relevant forecasting information in a quick and efficient manner. Devazas [7] shows that logistic equations predict the diffusion of technology and products into markets.

In today's economic climate, technology-based development plays a major part in every region's planning activities. Regions that are interested in maintaining and/or increasing its standard of living turn to technology to make this possible. Many [8,9] maintain that capitalist systems are concerned with two major imperatives: creating new jobs and developing the economy through structural changes of innovation and through productivity improvement. In both of these situations, technology plays a major role. To be able to utilize technology for regional economic development, a region needs to undertake a forecast of its capabilities in R&D, its relative competitive advantage in the areas where they excel, its commercialization and manufacturing expertise and the nature of the markets for the products that can be produced. These products are the result of utilizing the R&D, commercialization, manufacturing and market penetration capabilities of the region to bring jobs and create viable commercial enterprises in that region.

One of the areas where the creation of new jobs and structural changes to the economy occur is the use of disruptive technology in the creation of new small high-technology firms. Kassicieh, Walsh, Kirchhoff and McWhorter [10] examined the role of small firms in technology transfer in disruptive technologies. Birch [11] and Kirchhoff [12] proved the importance of small firms in entrepreneurship and job creation. Kirchhoff, Kassicieh and Walsh [13] highlighted the importance of disruptive technologies to firm creation and Kassicieh et al. [14] showed the importance of small firms in the technology transfer of disruptive Microsystems and nanotechnology discoveries to commercial endeavors.

In this paper we will present a model of analysis that helps regions in analyzing these capabilities and in reaching conclusions on where they should proceed in their economic development based on forecasting and business analysis techniques. In Section 2, we will identify the areas in which the region has its major R&D capabilities and analyze the comparative competitive advantages that these capabilities give to the

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