Evaluation Research on the Innovation Efficiency of Fujian High-tech Industry from the perspective of Innovation Value Chain: Based on Super-DEA

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二．成果简介：

The innovation process of Fujian's high-tech industry in China is divided into two stages, innovation conversion and innovation transformation stages, to analyze the innovation efficiency of Fujian's high-tech industry from the perspective of the innovation value chain. This study uses the super data envelopment analysis (super-DEA) model to estimate the two stages of innovation efficiency of the high-tech industry's innovation value chain of nine cities in Fujian Province from 2008 to 2018 and reveals the current situation and challenges of the innovation efficiency of Fujian's high-tech industry. This research shows that the innovation conversion efficiency of Fujian's high-tech industry is decreasing year by year, but the transformation efficiency is relatively stable. The development in innovation efficiency of the high-tech industry in various regions differs significantly, and the development of two stages innovation efficiency is not balanced.

三．主要研究内容及创新点：

In order to research the innovation efficiency of high-tech industries in Fujian Province, this paper divides the innovation process into innovation transformation stage and innovation conversion stage. Meanwhile the paper uses internal expenditure on R&D and the full-time equivalent of R&D personnel as input indexes, and uses the number of patent applications as the intermediate output. In two-stage, the study chooses input indexes in innovation transform stage and intermediate output as input indexes, and uses the sales revenue of new products as output indexes. Taking the Super-DEA model as the research method of the paper, the study uses MATLAB2019 software to calculate the high-tech industry innovation input and output data of 9 cities in Fujian Province from 2007 to 2018, and draw two-stage innovation efficiency matrix. The result are summarized in Table1 and Figure1.

$$\min \theta$$

$$s.t \begin{cases} \sum_{i=1,\ j\neq k}^{n} \lambda_i X_{ij} + s^- = \theta X_{jk} \\ \sum_{i=1,\ j\neq k}^{n} \lambda_i y_{ir} - s^+ = y_{rk} \\ \sum_{i=1,\ j\neq k}^{n} \lambda_i = 1 \\ \lambda \geq 0, s^- \geq 0, s^+ \geq 0 \end{cases}$$

The Super-DEA model formula

City	2008-2011		2012-2015		2016-2018	
	Innovation conversion efficiency	Innovation transformation efficiency	Innovation conversion efficiency	Innovation transformation efficiency	Innovation conversion efficiency	Innovation transformation efficiency
Fuzhou	0.9	0.86	0.49	0.37	0.23	0.43
Xiamen	1.07	0.93	1	1	1	1
Putian	0.43	0.78	0.44	0.52	0.63	0.66
Sanming	0.37	0.83	1.08	2.47	1.28	1.4
Quanzhou	1.52	0.42	2.55	0.3	1.67	0.52
Zhangzhou	0.44	0.8	0.25	0.44	0.51	0.39
Nanping	1.79	0.7	0.62	0.67	1.01	0.91
Longyan	2.61	1.99	0.91	0.48	0.69	1.17
Ningde	1.78	1.97	2.89	2.98	1.12	2.74
MEAN	1.21	1.03	1.14	1.03	0.9	1.02

Table1. the innovation efficiency of high-tech industry Fujian province

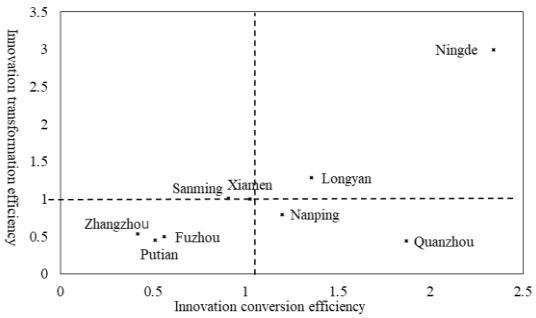


Figure1. Innovation efficiency two-stage matrix

The study found: firstly, the efficiency of the high-tech industry in Fujian Province is not high in creating new knowledge and utilizing innovative achievements. Moreover, the efficiency of innovation transformation is relatively stable, the efficiency of innovation conversion stage is declining, and the development in innovation conversion and transformation of the high-tech industry in Fujian Province is unbalanced. The innovation level of basic research of the high-tech industry in Fujian Province is relatively slow, which deserves attention.

四．主要研究成果及应用情况

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