

論文 / 著書情報  
Article / Book Information

題目(和文)	日本の鉄道会社の効率性評価研究：COVID-19の影響とビジネスモデルの視点から
Title(English)	Evaluation Study of Japanese Railway Companies: Impact of COVID-19 and Business Model Perspective
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学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)  
Doctoral Program

## 論文要旨

THESIS SUMMARY

系・コース： イノベーション科学 系  
Department of Graduate major in イノベーション科学 コース  
学生氏名： 遠藤 英明  
Student's Name

申請学位 (専攻分野)： 博士 (工学)  
Academic Degree Requested Doctor of  
審査員主査： 後藤 美香  
Chief Examiner

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words )

The prolonged COVID-19 pandemic and resultant sporadic lockdowns have led to a decline in demand for travel, causing the number of railway passengers to decline. In Japan, private railway companies, which had been profitable in the railway business before the pandemic, became unprofitable after the pandemic. The motivation of this study is to provide vital information to railway company management and policymakers by quantitatively assessing the profit structures and the cost efficiency of railway operations and qualitative analysis of management strategies through text analysis.

This doctoral thesis consists of the following two analyses. The first analysis is how the COVID-19 pandemic influenced a decline in their revenues and changes in their profit structures which are based on Japanese listed railway companies' investor relations information. In addition, I conducted a text analysis of the differences in management strategies between loss-making and profitable companies and explored the management strategies that characterize profitable companies. The second analysis is that I examined the cost efficiency of railway companies by Stochastic Frontier Analysis (SFA) using data from 2005 to 2020, covering the early years of the COVID-19 pandemic. Then, I analyze the factors that influenced the cost efficiency of railway companies before and after the pandemic. Furthermore, I classify the companies into four groups by cost efficiency levels and the characteristics of the best-practice companies. Finally, I discuss the sustainable business practices and measures of digital transformation (DX) that can be applied to improve efficiency and survive severe events like the pandemic.

The result of the first analysis is that the companies' passenger transportation revenues showed a drastic drop from 4Q FY2019 to 1Q FY2020, hitting the lowest level, and increased thereafter. I observed a minor change in the revenue structure in business segments such as Retail, Real estate, and Leisure. Before the pandemic, all business segments were profitable, but after the pandemic, only Non-transportation businesses were profitable, and Transportation-related businesses turned loss-making. The findings suggest that a sustainable profit structure for private railway companies, post-pandemic, would require effectively strengthening the Non-transportation segment that generates enough revenue to compensate for the loss-making segments.

The analysis also showed that profitable companies are characterized not only by their management strategies but also by the accuracy of their earnings forecasts for profits. This may be related to the

accuracy of forecasting uncertainties in Transportation-related business due to the pandemic. The results of these analyses indicate that, as a management strategy, profitable companies structure a sustainable business portfolio that takes pandemic risk into account and forecasts earnings with a high level of accuracy.

The result of the second analysis is that during the measurement period, the worst cost efficiency (highest cost efficiency values) for the Japanese listed railway companies was in 2020, due to the COVID-19 pandemic. The second-worst efficiency (second-highest cost efficiency values) was in 2009 due to the financial crisis. No significant impact of the Great East Japan Earthquake in 2011 was observed in this study. On the contrary, the best cost efficiency (lowest cost efficiency values) was in 2014. The results of this study showed that the best-practice railway companies were operating exclusively in the Tokyo Metropolitan area. This implies that better cost efficiency is correlated with high population density. Moreover, I identified that the top-ranking railway companies were operating in large cities such as the Tokyo Metropolitan area and Osaka prefecture, holding Japan's first and second largest population. I suggest how railway companies can improve cost efficiency from the empirical results of this thesis. The results imply that high cost efficiency companies succeeded in securing profits through the creation of new services in cooperation with the local community by making effective use of customer databases through proactive DX investments in marketing and asset management.

The theoretical contribution of this study proposes that managers of railway operators or public sector policymakers can assess the impact of a severe one on the demand for railway services, such as the COVID-19 pandemic. It enables quantitative analysis, such as examining business portfolios to avoid risk and estimating future railway passenger forecasts.

The practical contributions of this study are: quantifying the deterioration in the efficiency of Japanese private railway companies due to the pandemic; analyzing the cost efficiency of railway companies to characterize best-practice railway companies, and clarifying the relationship between cost efficiency levels and measures and investments for improved efficiency. It also proposes a new analytical framework that combines existing methods.

The results of this thesis provide suggestions for management strategies for corporate groups centered on railways to sustain and develop stable railway operations by improving efficiency in the event of a significant decline in demand for railways such as a pandemic. And it can be used for subsidies and other support from the public sector to railway operators as well as private railway companies, and policy making.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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