

An Analysis on the Situation and Opinions of Taxi Business Industry in Rural Areas of Japan under COVID-19 crisis

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Taxi is an important means of transportation that forms local public transportation. However, the declining trend of users in the long-term in rural areas did not change, in addition to this, taxi business is facing various challenges increasingly during the COVID-19 crisis. In this paper, a survey was conducted to examine the actual condition and perspectives of small and medium sized taxi companies in whole Japan, as well as the impact of COVID-19 crisis and taxi subsidy scheme (TSS). As a result, more than 50% of companies are facing the 60% drop on business profit compared to last year caused by the pandemic. About the taxi subsidy scheme (TSS), about half of companies said that TSS is an important service content for taxi industry especially with small sized companies. By using multiple regression analysis, business sale model was developed to estimate the influence of each explanatory variables such as population density, scale of area, aging ratio, number of taxi companies in each corresponding area, number of taxi and staff, as well as the influence of TSS.

Key Words : taxi company, rural areas, COVID-19 crisis, taxi subsidy scheme (TSS), regression model

1. INTRODUCTION

With the super-fast development of modern technologies, transportation in urban areas are welcoming tremendous achievements in a lot of ways, on the contrary, the mobility in rural area, especially for the special groups like elderly and disabled people is facing various challenges, which have direct influence on improving of people's quality of life in their late ages. For securing the mobility of elderly people living in rural areas, lots of measures are being employed such as normal taxi service, taxi subsidy scheme (TSS), on-demand ride-sharing taxi and private paid passenger transportation system (Jikayou Yusho transport system). In this paper, mainly focus on the taxi business from operator side to find out what kind of problems and challenges are existing.

A taxi is a public transportation with the characteristics of individual transport like "door-to-door" service, while other public transportation such as railways and buses perform mass transportation, it can respond to various needs that cannot be met by mass transportation. Today, nearly all large and me-

dium sized communities deregulated their local taxi industry¹⁾. With the revised Road Transport Act of 2002, demand adjustment restrictions on taxi business were mitigated, in large cities, the competition among business operators was promoted by reductions in fares and increases in the number of vehicles²⁾. However, the declining trend of users in the long-term did not change, and as a result, the driver's working environment deteriorated, working hours increased, wages decreased, and accidents increased. For this reason, the "Special Measures Act on the Optimization and Revitalization of General Passenger Vehicle Transportation Business in Specific Areas" was enacted in 2009, also some solutions to "optimize" the business have been made, such as reductions in company numbers and increase in fares³⁾.

Furthermore, in the "Act on Revitalization and Rehabilitation of Local Public Transportation Systems" revised in 2019, local governments are obliged to make efforts to create a "local public transportation plan" which respond to the local transportation needs by fully utilization of local buses, taxis and private transportation.

Looking at the socio-economic situation nationwide, the population and birthrate are declining, but the aging rate is increasing. By 2050, the total population will be 100 million or less, and the aging rate (the ratio of 65 years or older to the population) is estimated to be about 40%. All these factors put pressures on business conditions that about 80% of regional railway companies, 70% of private bus transportation companies and about 90% of public companies are in deficit. In this way, transportation companies in rural areas are in a difficult business situation⁴⁾. For taxi industry, the situation in rural area is different from urban areas. Even though taxis are now providing the area with mobility service, low demand for service, high operation cost, needs for rejuvenation on drivers cause difficulties for maintaining the business properly. Even though, in some area are implementing the demand type shared taxi, because of the individual usage, the sharing ratio is still low and inefficient⁵⁾. Recently, many studies have pointed that for this type of low and dispersed service demand, it is better to investigate the individual type of transportation service by taxi which can respond to the individual demand by achieving flexible door-to-door service rather than focusing on the establishment of public transportation according to the characteristic of rural areas. along with taxi service, taxi subsidy scheme is implementing by local governments to provide these special groups to use taxi more often for their daily life activities to brought convenience to their daily life. Whether the taxi subsidy scheme has a positive influence on using taxi service need to be considered.

2. EXISTING RESEARCH

Rural transport receives less concern from government in infrastructure and service provision so that rural people face many problems related to rural accessibility and mobility. Until now, provision of rural public transport (RPT) service has not been firmly regulated by government. There has no specific regulation that control RPT operation and service like in urban area. Such condition let RPT operation has no strong foundation⁶⁾.

Challenges in public transport provision for rural areas are similar across countries, it is difficult for conventional public transport to meet different accessibility needs of different user groups. Demand-responsive transport is seen as one of the key options to meet public transport challenges in rural areas. There is a clear case for maintaining qualitative regulation in the taxi industry, including vehicle standards, requirements for driver training, safety and minimum service standards. These qualitative

regulations should, however, be designed carefully to enable development of innovative services and market structures that benefit from reforms⁷⁾.

Lots of efforts have been made to maintain the taxi industry for securing the mobility of rural area in Japan. In order to improve the service effectiveness, it is advocated to diagnose the real situation. Lots of private bus operators have withdrew form public services due to the deficit. However, in areas where bus demand was originally low, the number of passengers was small, and due to the low population density, fare revenue could not cover operating costs, it is fairly difficult for operators to continue the business, also sharing type of business is still inefficient. The need for revitalizing and rehabilitating the regional public transportation system have been giving pressure on local government, various situations in different regions require unique and proper policy, to which the problem cannot be solved in a uniform manner.

According to the research⁸⁾, NPO carried out using private cars for public transport for residents in transportation vacant area within reasonable fee not for profit, which is basically reservation system, not an immediate dispatch. Another research conducted in the east part of Japan⁹⁾ shows that small and medium sized taxi operators owning the number of vehicle 1-5 is the major part running in the depopulated areas. Both studies above indicates that rejuvenation on drivers is the major problem for maintaining the business and introduction of taxi subsidy scheme was considered as the promotable policy for using taxi to secure the mobility of elderly effectively in remote areas.

3. RESEARCH METHOD

(1) Aim of research

The aim of this study is to examine the characteristic of small and medium sized taxi companies in rural areas, existing problems and their perspectives about issues and future business management, also the situation during this special time, COVID-19 pandemic. The opinions from operators' side towards the policy of taxi subsidy scheme (TSS) which is introduced as the policy to support the mobility vulnerable group in rural areas with distributed amount of taxi ticket as a part of taxi fee and it's influence on business management were also examined.

(2) Content of questionnaire survey

In this study, questionnaire survey is organized with basic information for the structure of company (number of vehicles, staff and drivers as well as the

age construction of drivers, the change during the pandemic); impact on sale before and during the pandemic; opinions about the future business management; infection prevention infrastructure; implementation status and opinions about TSS; opinions on future business improvement and expectations from local government.

(3) Sampling method of questionnaire survey

A questionnaire survey was sent to small and medium sized taxi operators. According to the list from National taxi companies’ directory 2018 version, among 5886 taxi companies, 2993 companies were chosen as a target companies with 1 to 20 vehicles running in the rural areas registered in the Ministry of Internal Affairs and Communications.

(4) Results overview

As a result of this survey, responses from 803 companies are obtained, the response rate is 26.8%. For this collected data, these companies are divided into three categories according to the number of owned vehicles, such as type A company with 1~5 vehicles which accounts for 261 samples with 33.3% of respond, type B company with 6~10 vehicles which is 248 samples about 31.6%, and type C company with over 11 vehicles which is 275 samples representing 35.1%.

4. THE SITUATION OF RURAL TAXI BUSINESS UNDER THE IMPACT OF COVID-19

(1) Change on the structure of company

During the impact of pandemic, a lot of business industries are faced to close down or narrow the business scale, so we make a comparison about the basic structure of company with last year before the pandemic. As shown in Fig.1 on number of vehicles and Fig.2 on number of drivers, type A company shows stable trend compared to others, like 89% and 84% response respectively with no change. About drivers situation, type B and C company both shows that it is difficult to increase the number of drivers with more than 55% response, as shown in Fig.3. As for the age construction shown in Fig.4, 60 to 70 years old drivers account for large portion, that is 68%.

(2) Impact on business sale with COVID-19

With the outbreak of corona virus, all carriers in different fields have been impacted severely by the pandemic, taxi industry was not an exception. We collected the data about the daily business sale per car about last year, and the average business profit

was 15,567 JPY for companies with under 5 vehicles, 19,802 JPY for companies with 6~10, as well as 22,562 JPY for companies over 11 as it shown in Fig.5 and Fig. 6. For all types of company, business sale was dropped severely about 60~80% from last year for more than 60% companies, as it is shown in the Fig.7. If situation goes like this, for all three type of companies, about 48% said the business may not be continued.

(3) Infection prevention infrastructure

When asked about the infection prevention measures such as boundary between driver and passenger; mandatory mask wearing for drivers, high frequency of disinfection work, high frequency of inside-vehicle ventilation, records for drivers temperature and physical condition, installation of disinfection alcohol, prohibition of handing money/use of trays for this special period, whatever the small or medium sized taxi operators, they all almost well implemented all required measurements for preventing the spread of corona virus.

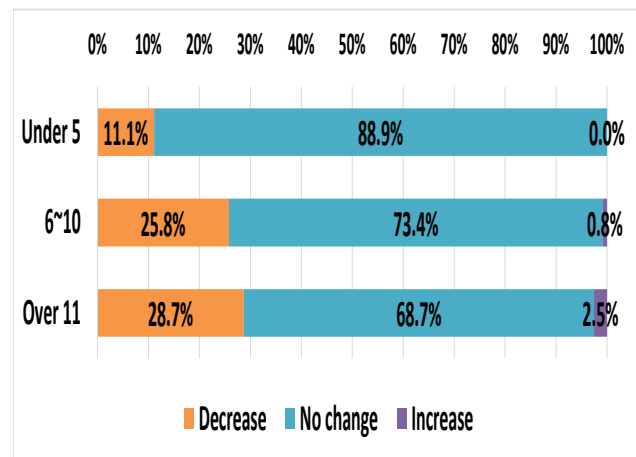


Fig.1 Comparison on the number of vehicles before COVID-19

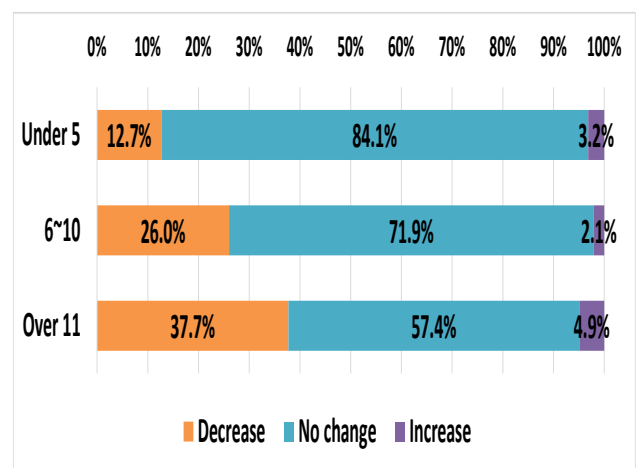


Fig.2 Comparison on the number of drivers before COVID-19

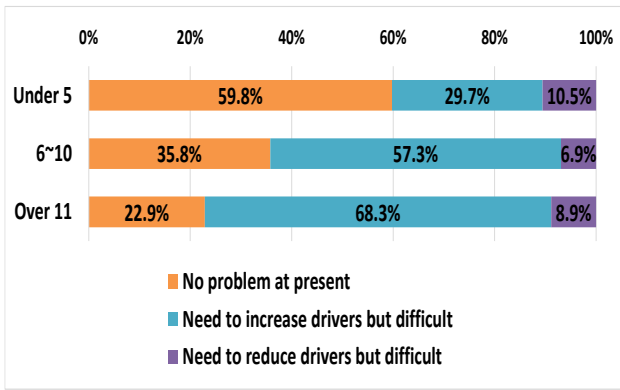


Fig.3 Situation of drivers

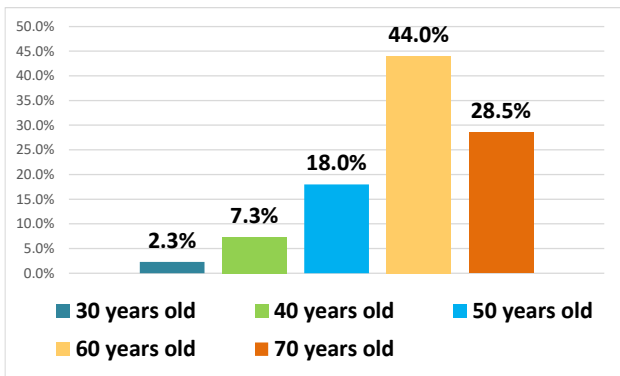


Fig.4 Drivers age construction



Fig.5 Daily business sale per car from last year

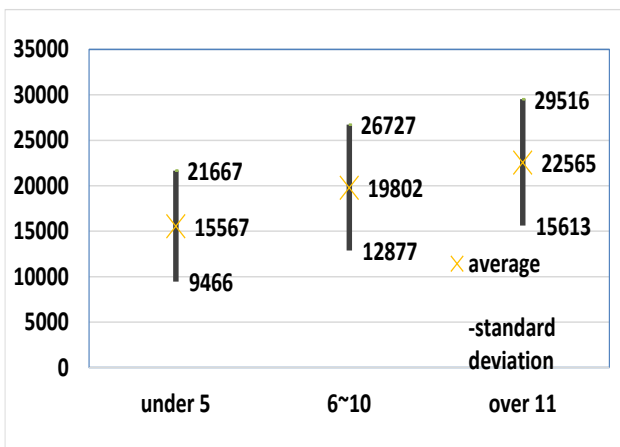


Fig.6 Average business profit per car from last year

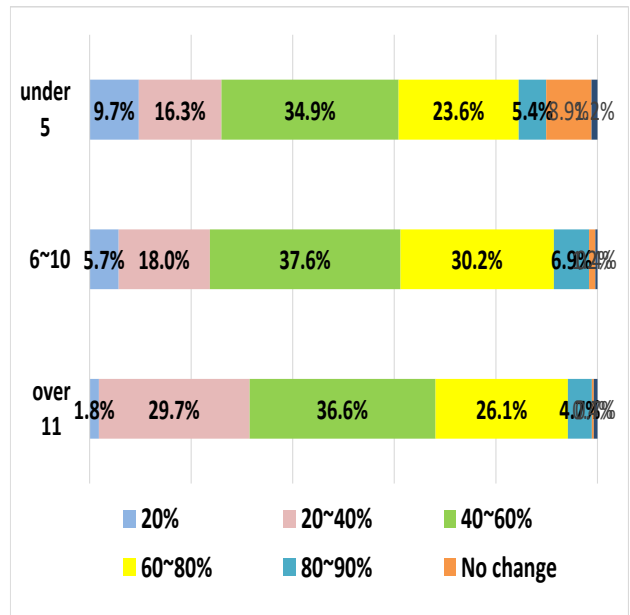


Fig.7 Comparison on business profit before COVID-19

5. ANALYSIS FOR TAXI SUBSIDY SCHEME (TSS)

(1) Introduction of taxi subsidy scheme (TSS)

As for the introduction of TSS, 82% of companies said TSS is introduced in their area shown in Fig.8. when asked about the willingness for the introduction of TSS from the part that have not introduced yet, they show high willingness about 72%. Disabled people form the big portion of targeted users for this policy, elderly stands second.

(2) Contribution of taxi subsidy scheme (TSS)

About the usage of TSS, there is a daily user with high response, 55% shown in Fig.9. The contribution of TSS on sale is remarkable from this questionnaire, for all types of company, it has a certain amount of contribution with 48% shown in Fig. 10. However, the usage ratio of TSS decreased 35% because of the pandemic.

(3) Expectation for improving the policy of taxi subsidy scheme (TSS)

When asked about the expectation for this policy by several items like expansion on targeted people, distributed ticket, service available area, and the discount rate supported by local government, and also reducing the burden of paperwork, simplification for confirmation of user authority, among them the expansion on targeted people and distributed ticket accounted for large portion with 35% and 44% respectively shown in Fig.11.

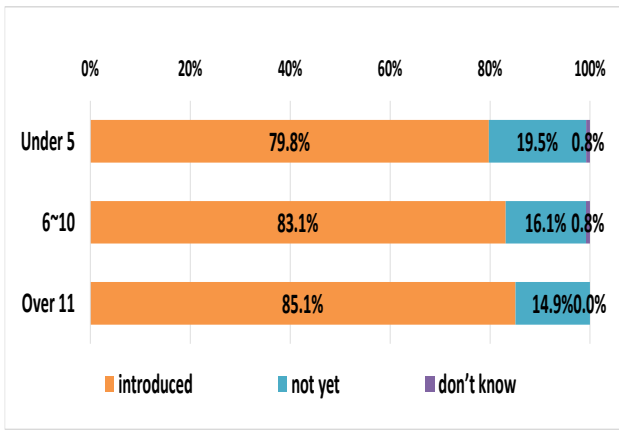


Fig.8 Introduction of TSS

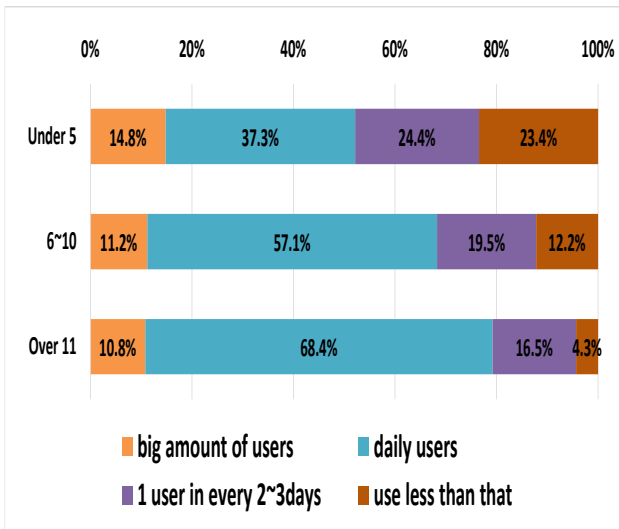


Fig.9 Usage portion of TSS

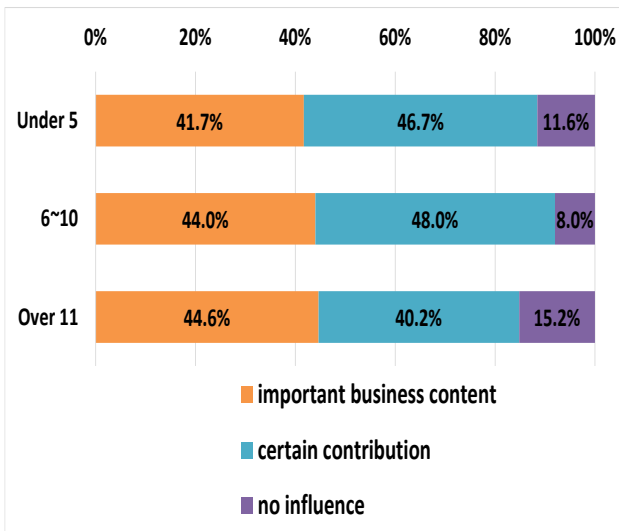


Fig.10 Contribution of TSS on business

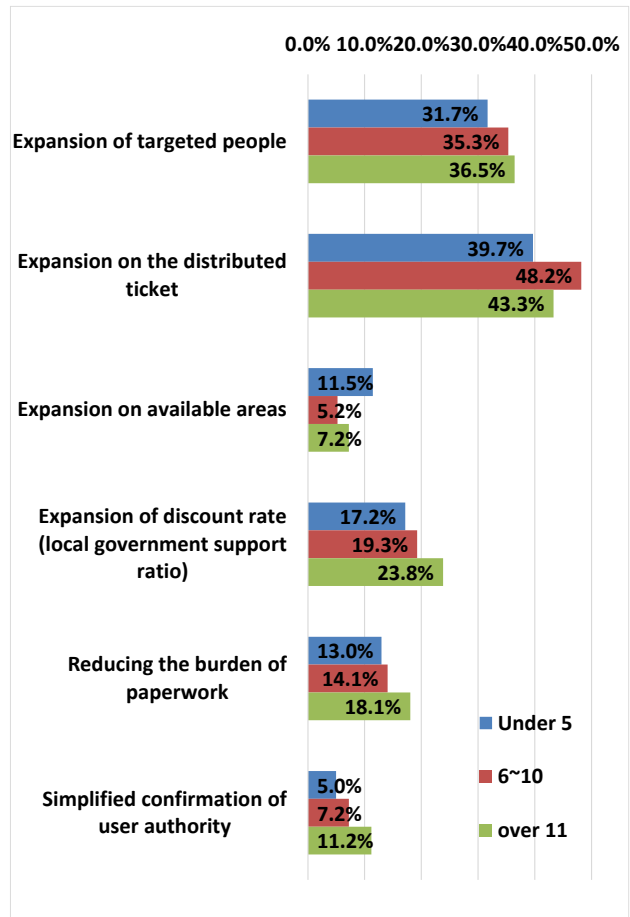


Fig.11 Expectation for improving of TSS

6. OPINIONS AND EXPECTATIONS FOR RURAL TAXI BUSINESS

(1) Opinions about current situation

Based on the current situation of taxi industry, perspectives, expectation, and opinions on improving of taxi business for future development were also examined. For future improvement measures, we got almost half of the opposite response for introduction of fixed fare policy, private paid passenger system in transport vacant area, nursing care taxi business, welfare taxi business, outsourcing of reservation and dispatch and IT based dispatching, which are considered to not necessary for future business. on the contrary, they show higher desire for items like fuel-efficient vehicles for reducing operation cost, vehicles with safety support system, enhancing work style and benefit for attracting drivers as it is shown in Fig.12.

(2) Expectations for future business management

As an expectation from local government towards taxi industry, they show surprisingly higher desire, 45%, for introduction and expansion of TSS, subsidy for purchasing safety support and

fuel-efficient vehicles, introduction of reservation type shared taxi, as well as the financial support for dealing with corona influence, which is shown in Fig.13.

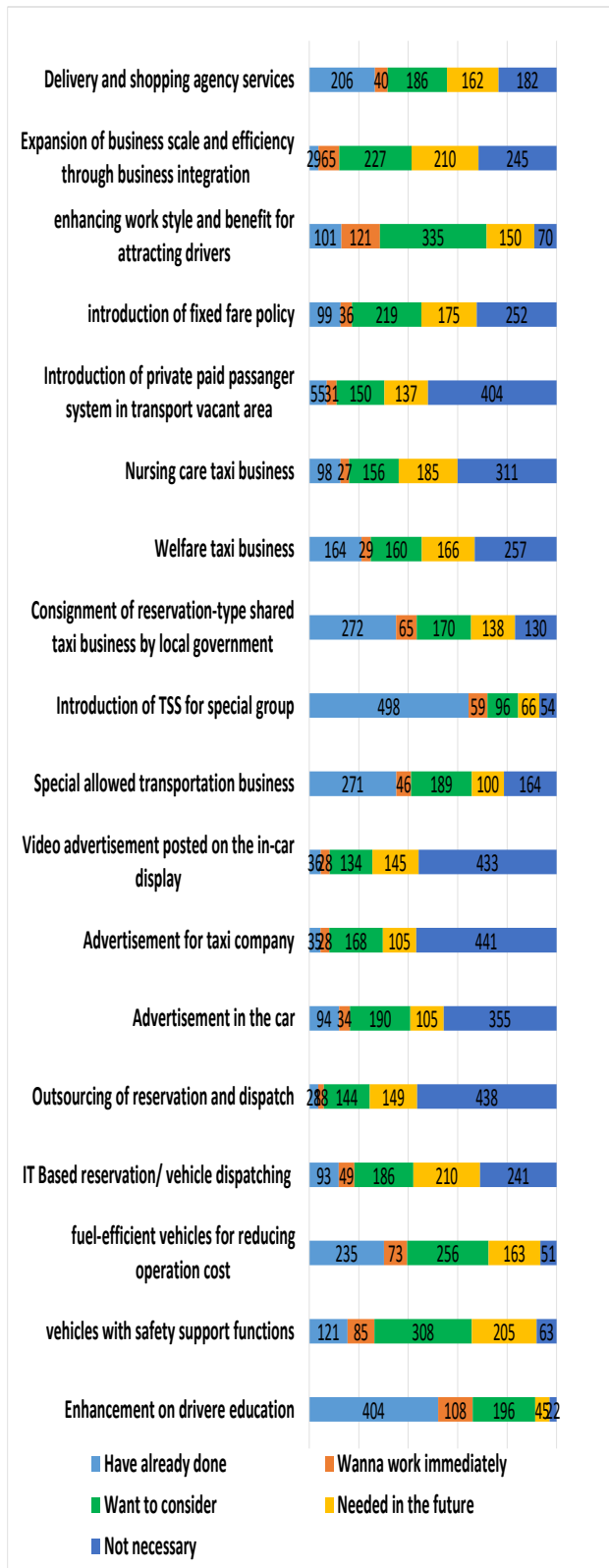


Fig.12 About the future improvement measures

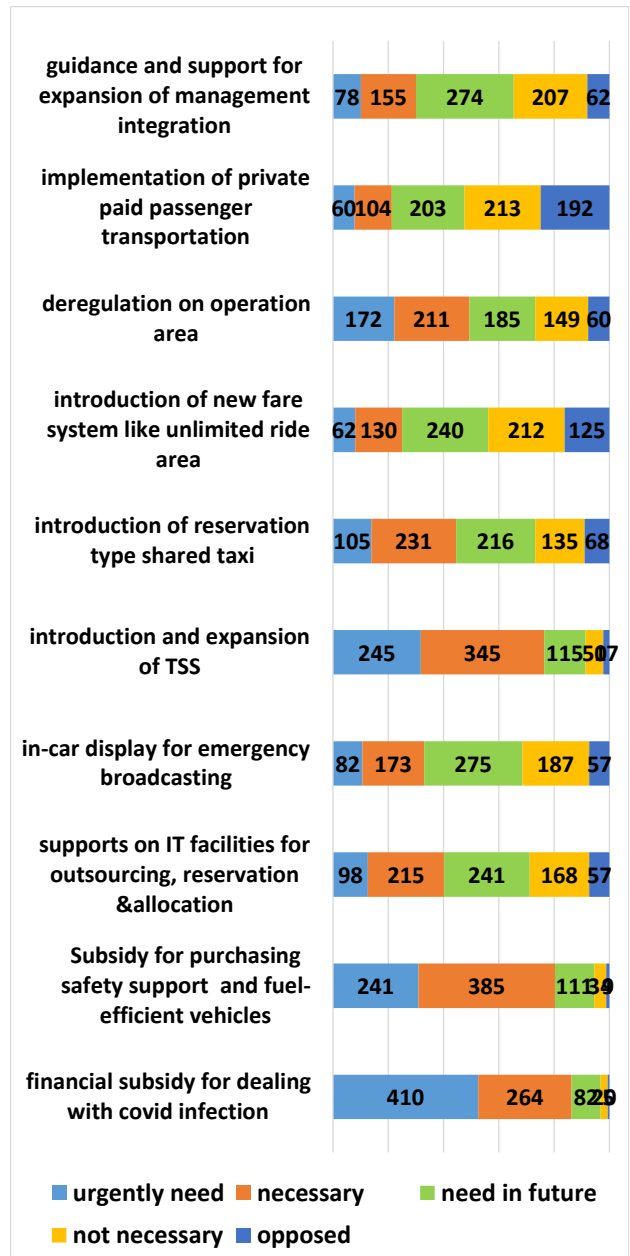


Fig.13 Expectation from local government towards taxi industry

7. QUANTITATIVE ANALYSIS ON THE TAXI BUSINESS

Considering from the position of taxi operators, increasing the profit may be referred as a priority. To find out what kind of factors in which level have influence on increasing the profit, a multiple regression analysis conducted in this research. Multiple linear regression is a statistical technique that uses several explanatory variables to predict the outcome of a response variable, the formula of multiple regression is as following:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_p X_{ip} + \epsilon \quad (1)$$

Where, for i is the number of observations, Y_i is dependent variable, x_i is explanatory variable, β_0 is Y-intercept, β_p is slope coefficients for each variable, and ε is the model's error term.

In this research, data was collected from taxi companies with 1~20 vehicles from whole Japan. According to the response data, 60% of answers come from small sized companies with vehicles under 10, which can be thought to represent the situation of rural areas. As a factor which can influence the business sales, area scale, population density, aging ratio, number of taxi company in each area, number of staff working in the company, number of owned vehicle and introduction of TSS as well as the TSS contribution on sale were chosen as explanatory variables. Area scale, population density and aging ratio were obtained from 2015 Census (Statistics Bureau, Ministry of Internal Affairs and Communications). We chose 654 companies as sample, so the number of taxi company in each area which is corresponding to respondent is made by searching the administrative code one by one.

To examine the relationship between business sales and each explanatory variable, multiple linear regression model is implemented. The result confirmed that the model variables were selected correctly, this allows to estimate the coefficients of each parameters in the model, the values of which are presented in **Table 1**. In this result, t-value for the model is 8.64 and the associated p-value is $< 0.2e-15$ ***, which is strongly significant.

Table 1 Coefficients for each parameter in multiple linear regression model

Variable	Estimate parameter	Std. Error	t-value	p-value
Intercept	20636	2387.7	8.642	0.000 ***
Scale	-0.167	0.947	-0.171	0.864
Population density	0.974	0.308	3.161	0.000 ***
Aging ratio	-209.89	59.544	-3.525	0.000 ***
N. of Taxi company	-49.847	12.689	3.928	0.000 ***
N of Staffs	359.58	63.646	5.650	0.000 ***
N of Car	67.060	111.853	0.600	0.549
TSS	1300.8	838.008	1.552	0.121
TSS sales	16.187	173.712	0.093	0.925

followings:

$$Y_i = \beta_0 - \beta_1 S_i + \beta_2 PD_i - \beta_3 AR_i - \beta_4 TC_i + \beta_5 ST_i + \beta_6 NC_i + \beta_7 TS_i + \beta_8 TSP_i \quad (2)$$

Where:

β_0 : intercept is 20636

$\beta_1 S$: -0.167 * scale

$\beta_2 PD$: 0.974 * population density

$\beta_3 AR$: -209.893 * aging ratio

$\beta_4 TC$: -49.847 * number of taxi company

$\beta_5 ST$: 359.584 * number of staff

$\beta_6 NC$: 67.065 * number of car

$\beta_7 TS$: 1300.869 * taxi subsidy ticket (TSS)

$\beta_8 TSP$: 16.187 * TSS influence on profit

Population density, aging ratio, number of taxi company in each area and number of staff turned out to be statistically significant. For one unit increase in population density, there will be 0.94 increase in business sales, which, to some degree, explain the situation of low population density areas. Surprisingly, although taxi is considered as a transport mode for elderly people, for one unit increase in aging ratio result in 209.9 decrease in business sales, which shows that the higher the aging ratio in rural areas is, the lower the usage of taxi becomes. Low frequency of outgoing and high fare of taxi may cause this result. As we know the current taxi industry is facing a lot of challenges after the deregulation policy, the model shows that one unit increase on the number of taxi company will result 49.847 decrease on business sales, which may increase the competition severely. While a lot of companies complaining about the difficulty of increasing the number of drivers, the model shows that one unit increase on the number of staff will increase the business sales 359.6 unit. However, this time, the relationship between taxi business profit and introduction of TSS is also examined, but the p-value is 0.1210, which is statistically insignificant. This means that because of the TSS users overall are very low so it has a little influence on taxi business sales. On the other hand, few distributed taxi subsidy ticket and high price for taxi ride may limit the elderly from using taxi, which is turned out to be true in the above result, aging ratio. It means the higher the aging ratio, the fewer the usage of taxi. So, expansion of taxi subsidy scheme is advocated.

So, the formula of the model can be written as

8. CONCLUSION

The aim of this paper was to examine the actual condition and problems of small and medium sized taxi companies in rural areas all over Japan, also their opinions, as well as the impact of COVID-19 crisis to taxi industry business. Results showed that small sized taxi companies with under 5 vehicles tend a stable trend about the changes on number of vehicles and drivers. On the contrary, when the scale of company gets bigger, the burden of management gets severe. More than 50% of all sorts of company are facing the 60% drop on business sales compared to last year because of the COVID-19 pandemic, but they all are committing their effort for preventing the spread of COVID-19 to keep the business sustainable. About the introduction and opinions on taxi subsidy scheme (TSS), more than 80% companies respond that they have introduced TSS policy, and about half of them said they have daily TSS users, which can be seen as an important service content for taxi industry especially with small sized companies.

As a result of introduction of regression model on the business sales, the explanatory variables chosen such as population density, aging ratio, number of taxi company and number of staff turned out to be statistically significant. Form population density and aging ratio, it seems that compared to relatively populated area, business sustainability face more challenges in the area with low and dispersed population. Growth on the number of taxi company and declining on the number of drivers which is the consequence of the deregulation policy in taxi industry shows the negative impact on business. Even though, in this model, TSS influence examined insignificant, it may be caused by the low frequency of usage and few amount of distributed ticket. So, raising on frequency for usage of taxi and securing the mobility of elderly at the same time by popularization of taxi subsidy scheme (TSS) is recommended.

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(Received March 5, 2021)

過疎地域の中小タクシー事業者のコロナ禍における 実態と改善意向に関する一分析

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