

Functional Maturity Based Optimization of Public Service Mode of Urban Road Transportation—Case Study of Taizhou City in China

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Abstract

This paper first introduces the administrative reform in Chinese urban road transport, and then analyzes the current business market and business handling capability of Road Transport Department in Taizhou city. In view of the characteristics and the problems found in the service mode of Taizhou's road transport management, this paper uses covariance structure analysis to evaluate the functional maturity, and proposes to optimize the road transport management. It designs a public service platform and introduces its overall structure and the operation procedure as well as the connections with the old system. After the optimization, the economic and social benefits show that, this method is workable and effective.

Keywords: *road transportation, public service, functional maturity, covariance structure analysis*

1. Introduction

With another round advancement of government institution reform and speeding construction of integrated transport system, the functions of road transport management are changing rapidly [1]. Government employee motivation is one of the most important issues in the theory and practice of public administration. The managing area, function and task of road transport management continue to increase, its mode, focus and requirement also keep changing, especially its fundamental concept [2-3]. The function of the government is changing from guidance-oriented to service-oriented [4]. Enterprises engaged in transport and the public are all expecting the transport department to provide better service [5-8], which is a big challenge to the traditional transport management mode.

Traditionally, many scholars asserted that government employees should be and are strongly motivated by the desire to help the general public. The previous research has generally supported such claims. James Perry used an assessment of construct reliability and validity to measure public service motivation [9]. Gan, *et al.*, then did a test for Perry's proposed scale in China [10]. Wakana gave strategic reason for employing workers with public service motivation [11]. Antonio Nunez argues that traffic maturity results from decreasing marginal utility of transport [12]. However, the reform of administrative examination and approval in the current road transport management moves slowly for the lack of proper system and clear concept. After the implementation of administrative permission law, administrative examination and approval of road transport has been a big problem. The solution to that is to change the administrative function of road transport, put emphasis on performance, carry out customer-oriented strategy, and build new environment for road transport management. With the change of the environment, the some aspects of current road transport management cannot meet the

needs of social development, including the management concept, laws and regulations, policies and management, and etc. To achieve better development in Chinese road transport, the road transport department has to strengthen its macro-control in function and safety management, and to speed up the function marketization and socialization.

According to the regulation issued by Ministry of Transport of the PRC, several opinions on promoting the development of road transport, Zhejiang RTA (Road Transport Administration) proposed three services to build new road transport industry, namely transport serving for economy, management serving for market and operation serving for the public. It also put forward six innovations, namely field innovation, management innovation, development innovation, service innovation, channel innovation and work style innovation. In China, Jiangsu RTA [13] and Guangdong RTA [14] have achieved success in the reform of road transport public service. Guangzhou RTA [15] reached an agreement with Guangzhou post office on providing express mail service for road transport certificate applicants. When the road transport operators apply for the road transport certificate, they can have the certificate delivered to their home by express mail service. Jiangsu province aims at building information service platform for transport management. The application software of the platform includes five sub-systems: public information service, transport managed on the Internet, transport market supervision, transport administrative supervision of law enforcement and emergency handling [16].

The optimization to the public service [17] of road transport management in Taizhou city is carried out under this background. In view of Taizhou RTD (road transport department)'s business handling capability and application system construction, this paper takes a study on the current business situation and supporting platform. Based on the functional maturity evaluation of RTD and covariance structure analysis, it proposes to optimize the RTD's public service from the aspects of service mode, service system, service procedure, service technology and service quality in order to present the new frame of service mode. It also designs its overall structure and the platform business procedure, and gives a demonstration in five aspects, including the way of thinking, characteristics, target, content and key technology.

The remainder of this paper is structured as follows: Section 2 gives the current situation of road transport public service and analyzes the problems found; Section 3 shows the research method and theory; in Section 4, the analysis results and optimization method are presented. Finally, the conclusions are drawn in Section 5.

2. Current Situation of Road Transport Public Service of Taizhou City

2.1. Road Transport Management in Taizhou City

Founded in September 3rd, 2012, Taizhou Road Transport Department was the fourth institution of prefecture level (after Hangzhou, Zhoushan and Wenzhou) which has changed its name into bureau of municipal of Zhejiang province, China. Taizhou RTD is under the guidance of Zhejiang Road Transport Administration and the leadership of Road and Traffic Authority of Taizhou. It supervises 9 RTD of districts and counties (county-level cities). The structure of Taizhou road transport administration is shown in Figure 1. The road transport management of Taizhou city is introduced in two aspects, business market and business handling capability.

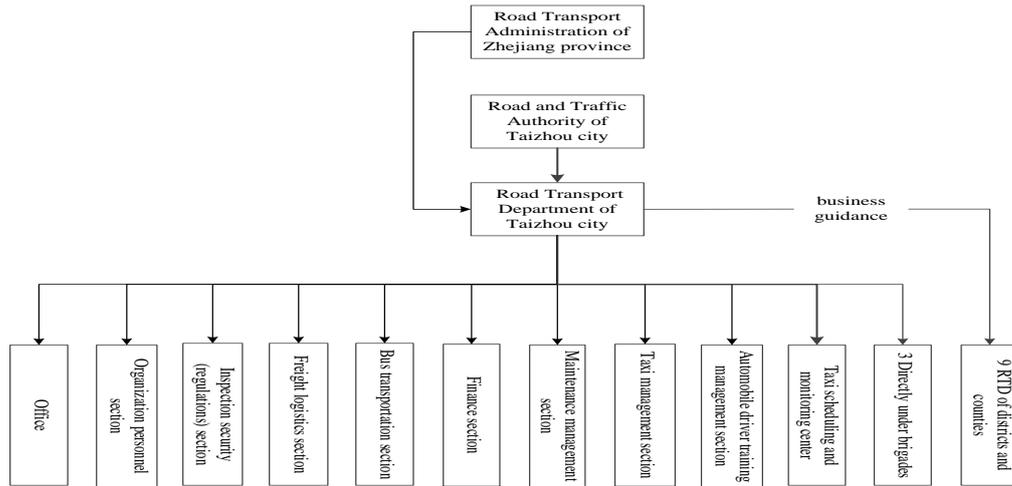


Figure 1. The structure of Taizhou Road Transport Department

Business market - By the end of 2015, there are 36 passenger stations in Taizhou city, including 5 first-class stations, 7 second-class stations, 10 third-level stations and 10 fourth-level stations. Besides, Taizhou has 11 cargo stations, among which 2 stations are first-class stations, 1 second-class station, 3 third-class stations and 5 fourth-class stations. The capability of transport service. In 2015, 30,211 trips were made through the stations of Taizhou and have covered 9,255,620,000 kilometres. The trips made and the distance covered account for 97.8% and 87.1%. Transport operators and automobiles. By the end of last year, there are 49 transport operators (excluding bus and taxi) in Taizhou, including 52,000 cargo road transport operators, 3, 859 operators related to cargo road transport. The number of registered road transport license reaches to 52,000. In the business related to road transport, 72 operators are engaged in station management, 2,321 people in automobile maintenance, and 105 in automobile driving training. There are 8,707 buses in Taizhou city with 174,191 seats and 66,854 trucks with a total of 244,654 loading capability.

Business handling capability - Taizhou Road Transport Department is currently engaged in a variety of business, like issuing road transport license, examining the application form and performing punishment, details of which are listed in Table 1.

Table 1. The Business of Taizhou Road Transport Department

Business Categories	
Taxi driver qualification license	Road transport permission
Taxi business permission	Taxi road transport permission
Inter-county shuttle bus transport in Taizhou permission	For-profit road passenger transport driver qualification license
Inter-county road passenger transport in Taizhou permission	Road transport manager qualification
Dangerous goods transport vehicles license	Road passenger transport vehicles of county-level or above permission
Dangerous goods transport permission	Automobile maintenance permission
Road transport administrative punishment	Road transport manager permission

The common practice for the business in Table 1 is asking the applicants to hand in all the material needed by the registration window and then get the applicants

registered by the officials. Because the materials needed for the application are not presented on the Internet, the applicants probably have to run back home again and again before they could get all the materials ready, which brings great inconvenience both to the applicants and the officials.

2.2. Some Problems

The aim of management is to serve the public. Whether a government department has provided satisfactory service to the public is determined by its service functions. In practice, the functions refer to administrative service, information inquiry, training service and etc. As far as Taizhou road transport department concerned, it puts great emphasis on management, little on service.

From data mentioned in 2.1, some problems are found in the road transport market of Taizhou. First, a great number of road transport operators are involved in this line, but most of them are small, scattered and in disorder state. Second, cut-throat competition lessens the effective competition. Third, the scattered road transport market weakens the competitive ability. Fourth, few operators of middle and high rank are found in the low threshold of the road transport market. Last, the transport market is extremely competitive, but the service it offers is identical.

Therefore, the mode of Taizhou road transport public service needs improving. The solution to that is to optimize the mode of road transport public service.

3. Functional Maturity Evaluations

The optimization to the public service mode of road transport management [18] is to make the public service more effective and scientific. Whether it can provide better service for the public depends on the functional maturity of road transport management institution. At present, functional maturity of road transport management institutions in China is divided into 5 grades according to the function performance of transport management institution. If the functional maturity of institution management is defined as first grade, it means it is in the first phase, and the fifth grade is the highest level. To be specific, the first grade is the start-up phase; the second grade is growing-up phase; the third grade is learning phase; the fourth grade is getting mature phase; the fifth grade is improving phase.

The function of road transport management institution is a complicated and large system, which is affected by a great number of factors. Therefore, this paper uses covariance structure analysis to make a qualitative and quantitative analysis of it.

3.1. Selection of Indicators

Effective evaluation is taken on the scientific selection of evaluation indicator, which should be decided and selected before evaluation so as to get a satisfactory and quick and evaluation [19]. The selection of the indicator is based on the quantitative and qualitative analysis. The initial indicators are obtained according to their score given by the professionals in this field, and compared with the indicators in the study related at home and abroad. In view of the suggestion proposed by those professionals and the conditions of the local institutions, this paper selects the indicators shown in Table 2 to have an analysis of the road transport management functions in Taizhou.

Table 2. The Indicators of Road Transport Management Functions in Taizhou

Objective layer	Criteria layer	Indicator layer
A. The evaluation to functions of the road transport management institutions	B1. Inspection security (regulations) section	a1. Guide and supervise the transport administration and regulation enforcement; a2. deal with the complaints from the public
	B2. Bus transportation section	a3. Decide and examine the transport route; a4. Manage the public transportation in the city; a5. Organize the transportation on holidays; a6. Give training to people in the line of transport; a7. keep the passenger transportation in order
	B3. Freight logistics section	a8. Issue the operation license; a9. Examine annual cargo transport; a10. offer guide to logistics; a11. inspect the source of the cargo; a12. keep the cargo transportation in order
	B4. Maintenance management section	a13. Maintain and inspect the automobiles; a14. annual inspection and safety check
	B5. Automobile driver training management section	a15. Examine and authorize the qualifications of driver's school; a16. supervise, evaluate and guide the driver's school
	B6. Taxi management section	a17. Manager the taxis in the city
	B7. Taxi scheduling and monitoring center	a18. Schedule and monitor the taxis in the city
	B8. Internal affairs institutions (Organization personnel section, financial section, office)	a19. Draw up the regulations for the industry a20. internal affairs management and evaluate one's performance

More than 1,000 questionnaires are collected to make the study more scientific. In the Table 2, the objective layer takes the functions of road transport management institutions as the ultimate goal. The criteria layer contains 8 aspects of the evaluation. The indicator layer is decided by the selection of different aspects of evaluation.

3.2. Evaluation Method

Structure equation model is a statistical method using covariance matrix to analyze the relations between two variables (between observed variable and latent variable, or between latent variables), so it is also known as covariance structure analysis.

Structural equation model usually includes two measurement equation and a structural model.

$$x = \Lambda x \xi + \sigma \tag{1}$$

$$y = \Lambda y \eta + \varepsilon \tag{2}$$

$$\eta = B \eta + \Gamma \xi + \zeta \tag{3}$$

The equation (1) and (2) belongs to measurement model, and equation (3) is structural model. Of all these relations of variables in the equation, Λx refer to the relations between endogenous indicator and endogenous latent variable; ξ is the exogenous latent variable vector; η is the endogenous latent variable, B means the relations between endogenous latent variables; Γ is the impact of exogenous latent variable to endogenous latent variable; σ is the deviation of exogenous indicator x ; ε is the deviation of endogenous indicator y ; ζ is the residual error of the structural equation which reflects the unexplained part of the equation.

According to the weight of each indicator, Figure 2 will be obtained after reconstructing the model and inputting the data.

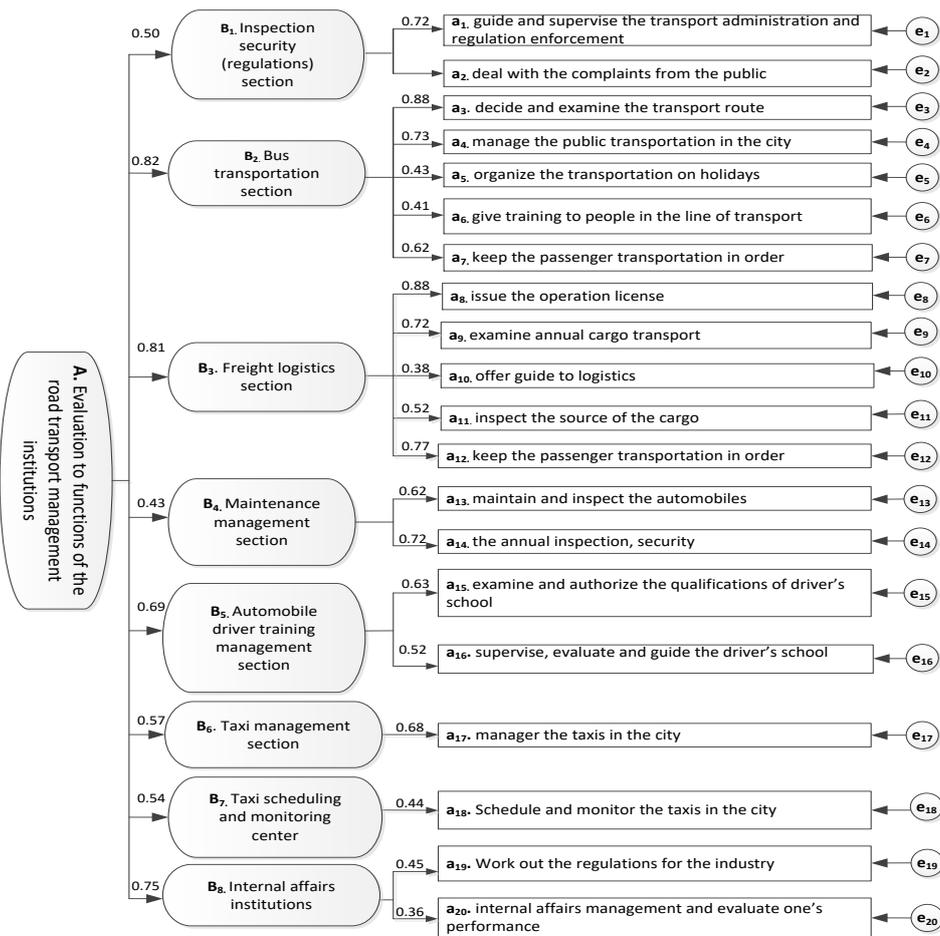


Figure 2. Estimate of the Functional Evaluation Model of Taizhou RTD

In Figure 2, A is the functional maturity of the institution; $B_1 - B_8$ are the sections belonging to Taizhou RTD; and e_i is the residual error.

The linear equation B, the comprehensive evaluation to the maturity of institution function, is constructed by structural equation.

$$A = 0.50 \times B_1 + 0.82 \times B_2 + 0.81 \times B_3 + 0.43 \times B_4 + 0.69 \times B_5 + 0.57 \times B_6 + 0.54 \times B_7 + 0.75 \times B_8$$

$$B_1 = 0.72 \times a_1 + 0.63 \times a_2$$

$$B_2 = 0.88 \times a_3 + 0.73 \times a_4 + 0.43 \times a_5 + 0.41 \times a_6 + 0.62 \times a_7$$

$$B_3 = 0.88 \times a_8 + 0.72 \times a_9 + 0.38 \times a_{10} + 0.52 \times a_{11} + 0.77 \times a_{12}$$

$$B_4 = 0.62 \times a_{13} + 0.72 \times a_{14}$$

$$B_5 = 0.63 \times a_{15} + 0.52 \times a_{16}$$

$$B_6 = 0.68 \times a_{17}$$

$$B_7 = 0.44 \times a_{18}$$

$$B_8 = 0.45 \times a_{19} + 0.36 \times a_{20}$$

The overall fitting effect statistical of model is shown in Table 3.

Table 3. The Overall Fitting Effect Statistics of Model

Fit indices	Chi-Square (DOF)	CFI	NFI	P	IFI	AGFI	RBI
Results	98.9 (75)	0.975	0.976	0.07	0.968	0.911	0.931

From Table 3 we can see that the P value of corresponding chi-square is 0.07, which performances not significant. Ratio of chi-square value to degrees of freedom is less than 3. Besides, the values of CFI, NFI, and IFI are close to 1. Indicators meet the requirements of model test and goodness of fit test, indicating that the fitting effect of the model fit very well.

3.3. Results Analysis

The grading standard for the level of the observation variable should be laid down, and the indicators of the second level also have to be divided into 5 levels of grading standard. The research on the maturity of the management department functions is taken by questionnaires, and the data about the registration officials and the people who are in charge of the road transport are collected by face-to-face interviews. This paper uses quantitative analysis to make analyze the percentage of each indicator in different level, and the analysis results are shown in Table 4.

Table 4. Statistics Analysis Result of Evaluation Indicators of Taizhou RTD

functional maturity indicators	start-up phase (1 point)	growing-up phase (2 point)	learning phase (3 point)	getting mature phase (4 point)	improving phase (5 point)	average score
a ₁	3.50%	3.20%	62.70%	26.70%	10.90%	3.593
a ₂	2.00%	6.20%	31.70%	54.80%	8.30%	3.702
a ₃	0.00%	9.30%	31.70%	23.30%	26.70%	3.404
a ₄	4.00%	23.80%	33.50%	27.30%	15.40%	3.383
a ₅	0.00%	6.80%	32.00%	18.00%	49.30%	4.281
a ₆	0.00%	1.00%	53.00%	19.70%	34.30%	4.113
a ₇	0.00%	6.80%	52.00%	17.80%	22.40%	3.528
a ₈	0.00%	0.00%	53.50%	32.70%	12.80%	3.553
a ₉	0.00%	0.00%	62.80%	22.50%	12.70%	3.419
a ₁₀	0.00%	2.20%	23.50%	34.80%	42.20%	4.251
a ₁₁	0.00%	12.30%	32.70%	29.20%	32.80%	4.035
a ₁₂	0.00%	1.00%	12.70%	42.00%	32.30%	3.696
a ₁₃	0.00%	2.00%	2.30%	53.00%	43.70%	4.414
a ₁₄	0.00%	0.00%	2.20%	62.40%	32.40%	4.182
a ₁₅	0.00%	2.70%	21.40%	22.40%	52.50%	4.217
a ₁₆	0.00%	0.00%	31.00%	28.00%	39.00%	4.000
a ₁₇	0.00%	6.30%	12.50%	43.10%	22.10%	3.330
a ₁₈	0.00%	0.00%	12.70%	52.50%	22.80%	3.621
a ₁₉	0.00%	3.20%	27.10%	42.60%	22.00%	3.681
a ₂₀	0.00%	0.00%	16.30%	53.50%	27.20%	3.989

According to the average scores of 20 indicators shown in Table 4, the results calculated are $B_1=3.49$, $B_2=3.45$, $B_3=3.87$, $B_4=4.20$, $B_5=4.18$, $B_6=3.88$, $B_7=4.19$, $B_8=3.89$, $A=3.96$ respectively. Therefore, the maturity of the functions of road transport management institution in Taizhou city is obtained: the overall score of the functions of

the road transport management institution is 3.96, which indicates that the service is in the maturing phase.

From the analysis results of the evaluation, it is found that the maturity of the function of the road transport management institution is satisfactory, but not all the departments have been evaluated in the research, which needs further study in the future. Although the evaluation result is in the maturing phase, there is slight chance that some uncertainties may exist in the investigation, which might lead to a little deviation in the evaluation.

Therefore, great efforts should be made in order to enhance the maturity so as to optimize the public service mode.

4. Service Mode Optimization

To offer satisfactory service to the public is the ultimate goal of developing transport management, and the innovation in the service mode is of great significance to the development of transport management. Motivated by innovation, the optimization to the public service is aiming at improving the working efficiency and service quality so as to build a public service platform for road transport management in Taizhou city and achieve “boost the economy, serve the public, and manage with innovation, road transport with wits”.

4.1. Thinking of Optimization

Under the help of information technology, innovation starts with the demonstration of information application in order to improve the industrial service and management ability to a new level. The service platform built for the transport management department together with the current administrative licensing procedures enable those applicants to get registered on line, which extends the service of road transport department and narrows the distance between government institutions and the public. In others words, they bring great convenience to the applicants who used to run to the registration window to hand in all the materials required. They also make the information available both on intranet and internet. Last, the service quality will be improved whereas the cost of the labor will be reduced. 3 principles are emphasized in the process of construction.

Simplification of information exchange - The data of each application system on the public service platform under integrated road transport system should be separated from specific application, but in related and clear coupling relations with specific application, which can ensure that the all the data are reliable, safe to transfer and the interface are all standardized so as to exchange the data in different format between different systems.

Coordinated scheduling & supervision - Public service platform under the integrated system uses advanced communication and digital technology to construct an information system, which is in the conformity of other transport mode in the aspects of transport, scheduling, supervision and monitoring. In this way, the information can be shared, connected and cable scheduling can work with wireless scheduling. Moreover, reasonable arrangement of vehicles and transport mode will help form integratedly coordinated scheduling & supervision mode, which is under unified supervision, multiple correlation and collaborative scheduling.

Diversity of service mode - The public service platform constructs a well-developed public information service system and enriches the contents of information service to release information through the Internet, application terminal, telephone, radio and display screen. It also increases the information service channels and modes and improves the visualization, which can obtain the information about road transport and other related transport modes by voice, data and video.

4.2. Content optimization

From the perspective of public service, the optimization of road transport management public serve in Taizhou mainly focuses on the construction of the public service platform. The design of the overall structure of public serve platform initiated from the idea of modularization, which puts the whole system into certain independent modules and activate the functions of the whole system through the design of the module and the coordination between modules as can be seen in Figure 3.

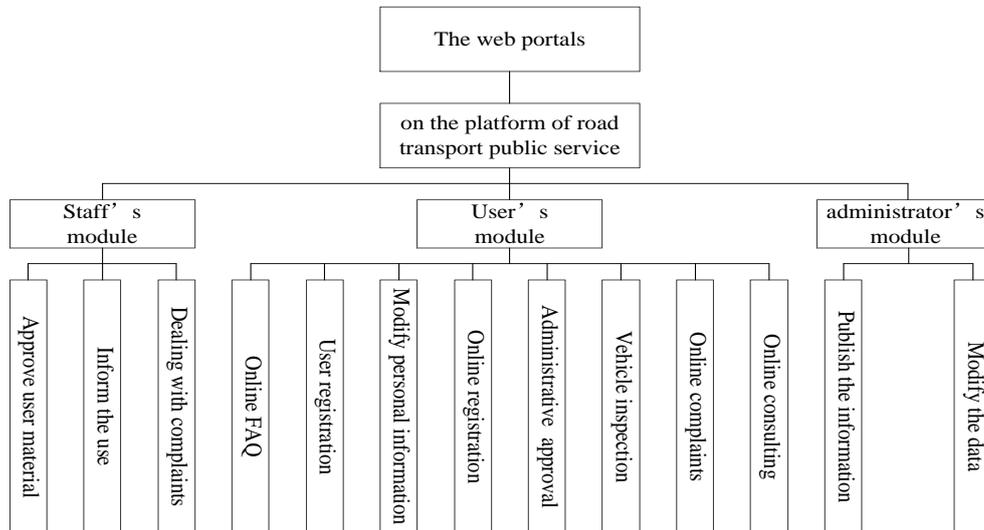


Figure 3. The Overall Structure of the Platform

Three modules have been designed on the platform of road transport public service on the web portals: staff's module, user's module, and administrator's module. The mullion under each module represents the functions of the module.

The analysis to the business procedure of public service platform can survey every move in the business management and learn the contents, functions, information input/output, data storage and information process of the business management, which lays down the foundation for constructing the data and logic model for management information system. As shown in Figure 4.

4.3. Benefits Analysis

The public service platform for road transport management in Taizhou city has been put into use for half a year, the data representing the volume of business increase significantly. Take automobile for example, by the end of February 29th, 2016; the automobile maintenance industry has performed 4.52 million times repairs and maintenance, 44,600 times more than the year of 2015.

After the enforcement of new service mode, a big sum of money are save on information system construction, management & maintenance, labor and management, as a result of which, direct and indirect economic benefits and social benefits are obtained.

Direct economic benefits - Direct economic benefits include the following three aspects. First, a big sum of system construction fee is saved thanks to the new developed public service platform, which also brings great convenience to the subsequent business update and system maintenance. Second, the management and maintenance fees are saved.

The staging mode of the public service platform is centralized mode with a single center. It sets up only a service center in the RTA together with a set of application and database server, which can save a great amount of expenses on IT software investment and daily maintenance, reduce the costs on labor and management. Third, the front-line

officials' work efficiency is greatly improved. The road transport management concerns the management of operator, automobiles and thousands of practitioners. Besides, all the business is closely related to each other. For example, if an automobile violates the traffic regulation in another county and the road transport certificate is beheld, the owner of the automobile decides not to take the punishment but go to the certificate issuing institution and declares that he has lost the certificate and needs to apply for a new one. In this way, the owner of the automobile avoids being punished, but brings unsafety to the road transport. The build of the public service can technically block the loopholes in management and at the same time; improve the management's work efficiency.

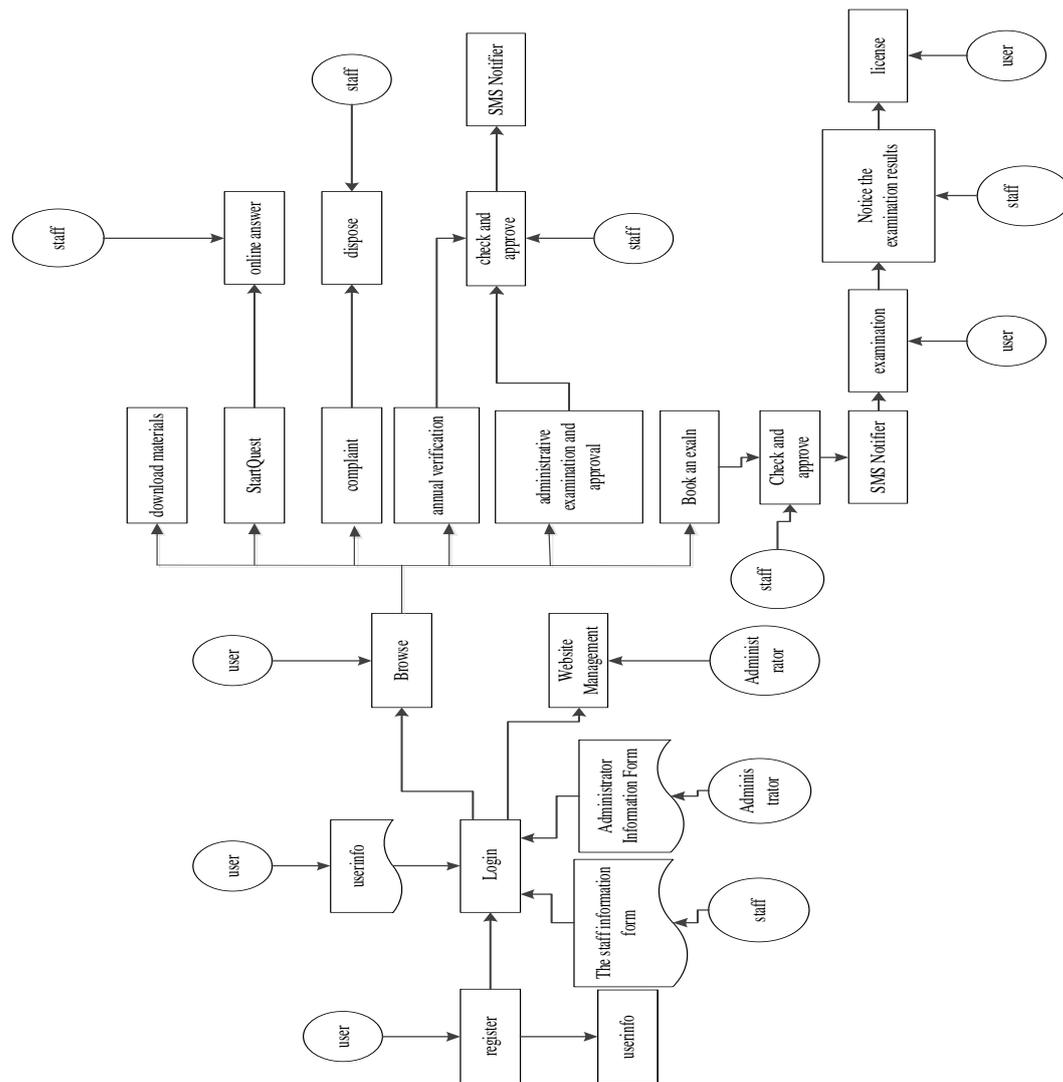


Figure 4. New Business Procedures of Public Service Platform of Taizhou RTD

Indirect economic benefits - The build of public service platform can standardize the data exchange and business process within the department, between the department and the public, which could avoid many problems, rose by unified standard in data processing, and avoid management loss and unnecessary waste of money.

Social benefits - The data collected indicate that 90% of the people in the Taizhou city own a computer. When the public service platform is built, some activities can be carried out on the Internet, like administrative examination and permission, practitioners' signing

up, automobiles' annual inspection, and etc. The build of public service platform save people much travel time and traffic cost, which is beneficial to have a low-carbon and better society from the perspective of energy saving and emission reduction.

5. Conclusions

The purpose of this paper is to optimize the service mode of urban road transport management. We put much effort into the research to make sure that the optimization could run smoothly. We had a study on the various forms of new public service mode in different sectors horizontal and vertically, and also on the history of Taizhou's road transport administration and its reform. The paper makes an introduction of the current business market in Taizhou, and analyzes the problems found. Based on the data collected by questionnaire, this paper uses covariance structure analysis to evaluate the functional maturity, and then proposes to optimize the road transport management. It is found that the new mode has produced great economic benefits after it is put into use for 8 months.

The fast developing information technology in China has deep influence on the development of public road transport management. Road transport, as the basic industry of local economy, needs further development and optimization, which not only is the choice made by the modernization of traffic, but also an important way to achieve rapid development of traffic. Optimization is an on-going process, and to keep up with the changing society, it needs to be innovative in five aspects. First, it should be innovative in the serve mode to adapt to the construction of integrated transport system. Second, it must be innovative in the serve system to improve the managing capability. Third, it needs to be innovative in the serving procedure to strengthen the industrial competition consciousness. Fourth, it has to be innovative in service technology to improve the safety supervision system. Last, it should be innovative in service quality to enhance the service efficiency. Therefore, motivated and guided by the five innovations above, we should put great efforts in enhancing the public service level of road transport management in Taizhou.

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