The Commercial Model of Car Breakdown Recovery Service in China

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Abstract. With the rapid increasing of automobiles in China, there are the pressing needs of high-efficient vehicle rescue system. However, lagging development of the latter brings heavy economic losses in China currently. In order to improve the roadside assistance system, this paper carries out a survey of both car owner’s and service providers’ opinions toward the Chinese current vehicle rescue service. According to deciding factors the extensive road exploration has been conducted to select elementary service providers with starting scores. Applying algebraic algorithm and information technology, this paper finally builds a commerce-based model, comparing with membership-based model in abroad, to calculate the Service Providers’ Value (abbreviated as SV) to choose the optimal service provider. The result of this study would help working companies to conduct a more efficient and cost-efficient automobile rescue service.

Introduction

Traffic accident and automobile breakdown have become a common social problem, resulting road congestion and affecting the development of national economy in China since the explosive growth of vehicles. The general definition of roadside automobile rescue service is: “without disintegration, the automobiles in trouble can be repaired via spare tires replacing, oil delivery and other roadside assistance within half an hour and the implementation of professional car towing service for automobiles unable to continue their driving. Meanwhile, some assistance for general traffic problems is also included in the service, such as vehicles trapped in road wells, road ditches and so on” [1].

Roadside assistance has been very mature abroad for a long time. A relatively perfect emergency rescue system has been formed in the construction of laws and regulations for traffic accident and automobile breakdown recovery, the establishment of institutions, rescue teams, the decision-making of rescue programs and the support and insurance system. The breakdown recovery target is to resume driving in the shortest time, so the requirement is very high, including the technology, equipment and spare parts and the fast repair personnel as well. Therefore, carefully building an overall automobile rescue system and vigorously developing such industry have become an important part of China’s social security system. For automobile rescue agencies, the goal of all partners is to implement recovery quickly and efficiently [2]. Borrowing methodology from traffic management, mathematics and information technology, this paper has tried to setup a model to decrease the cost and increase the efficiency, help automobile rescue agencies make the profit. The establishment of such commercial model is very necessary, and the Selected Service Providers’ Value (abbreviated as SSV) and the New Service Providers’ Value (abbreviated as NSV) have been proposed.
Automobile Rescue Service and Its Innovation

Car Breakdown and Risks
(1) The cause of breakdown. 1) vehicle failures, long driving mileage or years and lack of maintenance; 2) drivers factors, insufficient driving experience, little knowledge of vehicle mechanism, adjustment and maintenance, incorrectly operation during driving.
(2) The risks of breakdown. 1) cause economic losses to passengers and delay the journey; 2) traffic congestion or accidents; 3) pressure to traffic management.

The Essence of Automobile Club. In order to achieve mutually beneficial cooperation, membership system must be adopted. Therefore, those members who pay different annual fees to obtain certain annual membership (e.g. junior, intermediate and senior) can enjoy the corresponding membership services and preferential rights such as insurance, automobile purchase, etc. The first modern co-operative was established in Rockdale, UK, and rules were put forward originally and eventually summarized to seven internationally recognized Co-operative Principles (abbreviated as CPs) below [3]:

(1) Voluntary and Open Membership.
(2) Democratic Member Control.
(3) Members' Economic Participation.
(4) Autonomy and Independence.
(5) Education, Training and Information.
(6) Cooperation among Cooperatives.
(7) Concern for Community.

Automobile Clubs in Abroad and Domestics. The automobile clubs offer all-round automobile services to their members following the above CPs, and the membership in abroad is the core mechanism of such model like AAA, ADAC, JAF, and AAAA.

(1) American Automobile Association (abbreviated as AAA) was established in 1902. For more than 117 years, AAA's service scope and types have been expanding evidently [4].
(2) Germany Automobile Club (abbreviated as ADAC) was founded in Stuttgart on May 24, 1903 and registered as an association in Munich on June 1, 1905. Service providers’ selection scope includes all road explored automobile repair shops [5].
(3) The Japan Automobile Federation (abbreviated as JAF) was founded in 1962 and now has 17.2 million members. The basic membership fee is ¥2000 Yen per year [6].
(4) Australian Automobile Association (abbreviated as AAAA) was founded in 1905 and consisted of clubs from eight states and regions all over the country. At present, there are 6.2 million members and seven state-owned automobile clubs in Australia, providing 537 road emergency rescue services every year. Since 1991, a single number system for road rescue services has been employed, i.e., 13111 [7].

Ref. [8] shows that there are also some roadside cars’ assistance in Australia provided by insurance company like Insurance Australia Group Limited (abbreviated as IAG), which co-owns the NRMA brand with National Roads and Motorists’ Association Limited (abbreviated as NRMA) under the terms of the demutualization agreements. Therefore, NRMA has respectively the exclusive rights of roadside assistance and other motoring services (except smash repairs), motoring products, transportation and travel.

In China previous car breakdown recovery has been provided customarily to the members by 4S shops, finance and insurance agencies. Automobile clubs are developing gradually so that not all consumers have been covered. The Chinese largest automobile club is Dalu Club (Abbreviated as CAA) that setup in 1995 in Beijing. In 2000, NRMA Insurance launched its joint venture with CAA.

The Innovation of Automobile Rescue Service. Mr. Fu summed up five rescue models in China: (1) The Automobile Clubs Model. (2) The Professional Trailer Company Model. (3) The Automobile Sales Organization Model. (4) The Insurance companies Mode and (5) Traffic Police
Departments of Public Security Model [9]. Model (3) and (4) provide value-added after-sale service, such as 4S shops and Allianz [10], while Model (5) focuses on public and social benefits. There are some professional trailer companies like “123 Rescue” in Tianjin, which uses the traditional telephone customer service to respond to queries finding out and informing the nearest maintenance shops for rescue [11].

Because of the immaturity of the buying habit the automobile owners are very prudent to select the service providers and very sensitive to their price and quality domestically. Hence, the third party of the car breakdown recovery service in China is explored, not based on membership but commerce that the profit is the main object to purchase which is the promotion of the merging industry [12]. In most cases, the owner is not clear about both the location of maintenance in the surrounding area and the service technology of the maintenance service provider. If the wrong service providers are selected, the waiting time will be longer, and the journey will be seriously delayed. At the same time, some service providers will even have the phenomenon of fee raising and unqualified service. How to select good service providers has become an urgent problem to be solved [13]. The new service based on commercial model discussed in this paper has been created and operated in some areas of China.

The Establishment of the Model

The Initial Stage

(1) Selection: According to the algorithm of "shortest distance in crow flies, radiating and extending in concentric circle, elasticity in work time ", all service providers who have conducted road exploration are selected to give a starting score and pushed first to the users directly shown in Figure 1.

(2) Generation of Service Provider Initial Components: All service providers who have explored the roads are given a starting score according to the process shown in Figure 2.

The Accumulating Process. The initial scores are dynamically corrected and optimized based on online duration, service attitude, arrival speed, specialization level, refusal behavior, disputes, and customer complaints.

Through the system, the timeliness of the service provider and the evaluation of the order given by the automobile owner will automatically affect the SV. In other cases, the customer verification after service is performed and the SV is manually processed shown in Figure 3.

Service Providers Apply for Deduction. In the order record of the service provider's App, each order with a demerit point has the function of applying for “exemption of deduction”, which is mainly used when the rescue waiting time exceeds 15 minutes, resulting in deductions. The service provider can apply for with the owner agrees to extend the arrival time to exempt the deduction, and
the customer service will verify and take appropriate action. Agreement cooperation providers can add points and exempt points.

![Flow chart](image)

**Figure 2. Generation flow chart of the initial points of service providers.**

**Calculation of Scores**

1. **Score Tables.** When an automobile owner submits a rescue order, the score directly affects the priority of the order push. In addition to the judgment of geographical location, the service provider with higher score is preferred and the system gives priority to push since its SV is the highest.

![Flow chart](image)

**Figure 3. Flow chart of the method of score processing.**

1) To create a new field “scores” in “automobile service company” (the service provider table) to save the SSV. The default is 100;
2) To create a new service provider plus or minus event table “automobile service company scores event”, which lists all the impacts on SV and the corresponding score?
3) The development of the front desk has added the function of manual customer service processing and reviewing and subtracting points;
4) The server API adds events that the client affects the score;
5) Poll the new providers of car rescue service and add into the tables.

2. **SSV.** 1) Let $f_1(x) -$ online duration, $f_2(x) -$ service attitude, $f_3(x) -$ arrival speed, $f_4(x) -$ professional level, $f_5(x) -$ rejection behavior, $f_6(x) -$ liability for disputes, $f_7(x) -$ customer complaints, etc., $a_i \leq 0 \quad (i=1, 2, 3, ..., n)$, which consist the first category - the reduction items so the following equation is obtained:

\[ a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 = 0 \]
\[ f(x) = \sum_{i=1}^{n} a_i f_i(x). \] (1)

2) Let \( f_1(y) \) - agreement cooperation price plus points, \( f_2(y) \) - exemption points, etc., \( b_j \geq 0 \) (j = 1, 2, 3, ..., m), which consists the second category - bonus points, as following equation:

\[ f(y) = \sum_{j=m}^{j} b_j f_j(y). \] (2)

3) SSV is as follows:

\[
SSV = f_n(x) + f_m(y)
= \sum_{i=1}^{n} a_i f_i(x) + \sum_{j=m}^{j} b_j f_j(y), (i = 1, 2, ..., n, j = 1, 2, ..., m).
\] (3)

Ref. [14] helps to establish the Eq.1, Eq.2 and Eq.3.

(3) NSV. NSV adheres to the algorithm of “shortest distance in crow flies, radiating and extending in concentric circle, elasticity in work time”. Calculating of NSV is just similar to the Eq.1, Eq.2 and Eq.3 so that it is unnecessary to repeat in the paper.

Each existing SSV is compared with NSV, and SV with highest score between SSV and NSV is assigned to the rescue task list, and the segmentation elastic algorithm is used to implement the service provider's choice.

**Conclusion**

The paper has discussed the co-operative and membership system in car breakdown recovery roadside service, which is well developed and served in USA, Germany, Australia, Japan, and other developed countries. China's automobile industry is prospering just in recent decades, so a new social security system is needed and the automobile rescue agencies with the goal to provide the assistance quickly and efficiently must be supported in order to set up the appropriate automobile rescue system. The paper has proposed the value SSV, NSV, and SV in order to establish the commercial model, which will help the new rescue companies to develop faithfully. This model in the paper could hopefully be applied to other roadside rescuers of China, though there are still some other problems need to study and be solved further.

(1) How to make sure the rescuers and automobiles are on-line when rescuers send a distress signal. If not online, how to contact them to participate in the rescuing work, that is, how to send or confirm the message received by the service providers? Can a system be set up to complete a series of message transmission and service without human participation?

(2) Calculating the path information of rescue automobiles, including automobiles to be rescued and rescue automobiles. 1) Longitude and latitude of automobiles to be rescued, driving direction, etc.; 2) If it is elevated, while in the road level, that is, altitude at for different levels so that the right road levels and lanes could be acquired in time?

(3) Study the heaviness of traffic in the transportation as a variable in the calculation of SSV, NSV and SV.

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