Profit Model of Metro Enterprises and Quasi-Market Based Practice of Shenzhen Metro

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Abstract The need to financially support metro enterprises stems from the amplified global enthusiasm for sustainable modes of transport. This paper analyzes the formulation and practice of the profit model based on quasi-marketing initiated within Shenzhen Metro in China. In contrast to previous studies based on a single theory, this paper employs an integrated approach in optimizing gains. Metro enterprises have peculiar attributes such as supply of quasi-public service products, positive externalities, heavy assets, low profit, economy of scale, and economy of scope. Therefore, in order to effectuate sustainable growth, the author has put forward three methods for the profit model based on the quasi-market principle: firstly, generate internal gains of positive externalities through the enterprise's market operation on government-allocated resources; secondly, balance cost and income by modifying the accounting policies on fixed assets depreciation and financing interest; and lastly, maximize economy of scope by enhancing synergy between different business segments and sub-businesses of the same segment in the enterprise. In practice, these methods are carried out in Shenzhen Metro with innovative methods that comprise “metro plus property”, “member plus fund” and “entity plus virtual”. This study concludes that the advantages of quasi-

marketing include the optimization of resources and the success in overcoming the financial restraints in metro enterprises. Through the high applicability in Shenzhen Metro, it is shown that this quasi-market principle-based profit model could enable metro enterprises to achieve self-development and sustainability.

Keywords Metro · Quasi-market · Profit model · Cost and benefit · Economy of scale · Economy of scope · Self-development sustainability

1 Introduction

Urban rail transit¹ is featured with large transport capacity, reduced air pollution, guaranteed safety and comfort. Thus, it has gradually become the lead in urban traffic and the most preferential means of transportation in major cities; especially in countries where the traffic congestion during rush hour greatly prolong travel time and where the metro network has an expansive residential and commercial scope. The urban rail transit construction started early in cities of foreign countries such as London in UK, New York in USA, Moscow in Russia, and Tokyo in Japan. These cities have formed comparatively complete network of rail transit in the last century. The belated rail transit construction in Mainland China began from the middle of the last century and was due to limitations in the level of technology and economic strength; by the turn of the century, it had encountered explosive growth. Up to the

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¹ Urban rail transit includes varied types such as metro (or subway), light rail, maglev, tram, suburban rail, etc. Metro, an important type of urban rail transit, has the typical and representative features and functions. This paper makes discussion hereafter on metro that represents urban rail transit.

end of 2014, a total of 101 urban rail transit lines in 22 cities were completed and put into operation in Mainland China, with a total traveling length of 3155, 2438 km which are used for the metro line, taking up 77.3%² of total length.

As the key mode of urban rail transit, metro has the features of huge investments and remarkable social benefits, yet with unsound direct economic benefit. On the one hand, metro serves as an important part of the public transport service that operates with the aim of maximizing social benefits. On the other hand, the price of metro tickets with respect to public welfare not only causes the deficit to most metro enterprises in the world, but also leads to the lack of investment motivations from either private or public capital. Furthermore, most metros are supported by governments in way of cash investments and resource compensations during the construction of the projects and subsidized for losses by governments once they are completed and put into operation. Consequently, governments are usually encumbered by the increasing severity of the public financial burden.

In order to spur new socioeconomic growth, the priority in promoting sustainable and smart mobility transport is common in many countries such as USA, Canada, China, and most European countries. As a result, the need for new technology and innovations continues to surge. Likewise, the investments on improving public transport indicate that metro enterprises need to generate adequate profit to continue providing positive growth and externalities. Hence, there is an absolute need to promote studies on metro enterprise profit model. Few studies in other countries have developed metro profit models, this study fills the gap by presenting the comprehensive and coherent profit model performed in Shenzhen Metro. In this study, the actual process of optimizing and integrating various resources while utilizing unique metro characteristics aims to promote the potential of metro enterprises in creating positive internal gains in complementary to the positive externalities. Based on quasi-marketing, this research urges positive economic and financial performance in the metro industry without compromising the universality and accessibility of metro ridership. This study promotes companies to self-generate adequate revenue and realize sustainable development for both the construction and operation of metro.

Mu et al. [1] depicted that the evolution of public–private partnership (PPP) which included the former centralized sector, rise of PPP, fall of PPP to optimal equilibrium in the future. This is a process that includes setbacks and challenges due to the interactions and decisions made between formal and informal actors under the political,

cultural, and institutional contexts. A renewed process with the ability to seek a new equilibrium in public needs and financial sustainability is necessary. Thus, the quasi-market principle provides the process of an optimal balance between centric management and PPP in future infrastructure development. Groenleer et al. [2] stated the need for a more collaborative and decentralized decision-making process without compromising the aggregate resource allocation for societal prosperity and technological innovations of transport infrastructures. Ke et al. [3] indicated the importance of considering factors of the private involvement such as financial variables, risk allocation, efficiency, and coordinating with the public factors like government fiscal commitment, public accountability and policy and regulations. Marthur and Smith [4] proposed three methods to stabilize revenue yield which include the standardization of land development, transparency in policies and future development, and sharing of gross annual revenue and property sale proceeds. Therefore, this paper provides a quasi-market framework of the designing process based on the comprehensive consideration of the influencing factors.

Quasi-markets consist of competition between profit and nonprofit organizations for consumers on the supply side; whereas agents distribute the purchased services to users in terms of need on the demand side. In turn, quasi-markets are more efficient and effective than public provisions while ensuring more equity, accessibility, and stability than conventional markets. The explored and established metro enterprise profit model based on quasi-marketing not only aims to generate the direct economic benefits, but also to effectuate the spillover effects of social and economic benefits through partial internalization of gains. However, the latter cannot be realized by metro enterprises themselves. To solve this problem, government shall make related supporting policies and allocate certain resources to metro projects. The metro enterprise can then make market-based operations on the resources in order to generate and collect external value-added benefits. Thus, this study emphasizes on the practices of “quasi-marketing”. Quasi-markets resemble conventional markets but are organizationally planned and supervised to fulfill the task of efficient public choice. Thus, the profit model below is elaborated based on the “quasi-marketing” principle.

This study first provides literature reviews of previous studies on metro profit models. Then the general principles of designing profit models are examined. Thereafter, this paper presents the specific and integrated design ideas and scheme of the profit model. The following sections include a case study of Shenzhen Metro and final summary and outlook.

² Source: 2014 Profile of Metro Routes in China, Newsletter Express (The 1st issue January 23, 2015) of China Association of Metros.

2 Reviews of Related Literatures

The rapid development of the metro industry in the twentieth century impelled scholars and professionals to study the profit-generating process in metro enterprises.

Some scholars affirm that the main reason of difficulty in profit earning from metro sector is from the fact that the agents in the transaction cannot profit from the positive externalities. Thus, how to obtain returns for the positive externalities has become the core focus in building profit models. Two feasible methods proposed by Miao et al. [5] include government subsidies and authorization of property development rights to rail transit enterprises. The “metro operation + benefit return” profit model was put forward by Zhang et al. [6] where the former represented operation on metro lines and ancillary resources and the latter includes return of value-added benefit from real estate properties along the metro line. The development benefits from this model are increased by Zhang et al. [7] through cooperation with a real estate developer brand. Liu [8] identified three fundamental aspects, i.e., overall control of property operations along rail transit lines, interactive land development combined with construction of rail stations, and integrated connections with conventional bus transport. Likewise, Xue et al. [9] proposed that the integrated approach for profit models promotes benign development in urban rail transit. Song et al. [10] formed a later compensation mode for existing lines that is mainly subsidized by government and supplemented with property development, whereas an advanced compensation mode for new line projects includes integrated development on land resources and planned resources. Cooperation and a new approach between the informal and formal actors are crucial to generate profit in order to continue increasing the aggregate benefits of society.

Some scholars have delivered reviews on how to use Hong Kong’s metro profit model. Of which, Xu [11] systematically analyzed the content of “rail + property” from components of the profit model, namely profit growth point, profit object, profit measures and profit barrier, and asserted that the key to success of Hong Kong “rail + property” profit model lies in the institutional assurance behind the pattern. Shi [12] considered that the application such as “rail + property”, added value to property, self-pricing and introduced market mechanism by Mass Transit Railway of HK has some referential significance to other cities with urban rail transit projects.

Some scholars study the metro enterprise profit model from the perspective of cost and benefit. Liu et al. [13] believes that the unbalanced relationship between cost and benefit restricts the development of rail transit transportation, resulting in a gradual formulation of the profit model

of which must consist of comprehensive, integrative development and market operations of rail transit and lands. Qin [14] stated the views of “increasing revenue and reducing expenditure” to realize metro profit, wherein, “increasing revenue” is mainly reflected in ticket revenue, resource development revenue, land development earnings, and governmental financial subsidies; “reducing expenditure” is mainly shown with control on the estimated costs of project and incorporation of scientific financing plans and management mode. The relationship between cost and benefit in the metro sector was found to need further research in order to improve the ability of generating adequate profit. Some scholar discussed on enhancing profitability of metro enterprises by exploring and utilizing metro passenger flow values, optimization of resource allocations and resource systems. Wang [15] thinks that building an integrated resource optimization system creates a variety of profitable businesses. This system is directed through developing indigenous resources, using derived resources based on the abundant resources of rail transit and high passenger flow. Yuan [16] made specific analysis on the profitability of various metro resources including land, commerce, advertisement and property.

Moreover, some scholar addressed the environmental co-benefits, cost-benefit, financing strategies, social impact of metro system and transit-oriented development (TOD) pattern. Doll et al. [17] proved that directing and encouraging new commercial and residential developments along the metro corridors and lines attracts more riders from private modes to public transportation systems and increases ridership. Maria [18] performed an ex-post cost-benefit analysis in which their land-use simulations suggested that the benefits of land use are much more significant when considering metro construction. Zheng [19] found that the financing sustainability is largely influenced by the leasing revenue from local lands and the sole other feasible option is to collect additional property taxes to replace the lost revenue from land leasing and real estate transaction taxes and fees. Kamruzzaman et al. [20] performed an evaluation on prospective transit-oriented development (TOD) sites through the selection of built environmental indicators in Brisbane. It was found that cluster type is critical for TOD success and sustainable development of transit, and TOD is supposed to develop TOD profiles and performance matrices [20]. Nasri et al. [21] found that residents living in transit-oriented development (TOD) areas are more motivated to use sustainable transportation modes. By analyzing the changes in the traveled vehicle miles of the residents and considering the fact that TOD areas possess good transit accessibility, efficient transit services as well as high density and multi-purpose development, the trend of driving less is evident [21]. Xu et al. [22] has done an empirical research on the

interaction between rail transit and commercial property value in Wuhan, and found that the value-added areas are defined within the 400 m radius of road network distance from Metro stations, and the 0–100 m circle increase nearly 16% in value, the outer three circles increase about 8%. Sun et al. [23] proposed a social welfare maximization model to identify the relationship between the government and operator in the transit subsidization and regulation problem, it found that the cost of public funds will affect the design of public transit subsidization and regulation policies, and no subsidization for operation costs should be given when the cost of public funds exceeds the critical shadow price of the financial constraint.

In conclusion, scholars or enterprise professionals in foreign countries have made few studies on metro enterprise profit model, more have analyzed strategies or effects of rail transit. Among existing domestic research, we found many articles discussing reasons for deficit in metro enterprises and the profit-generating process from different perspectives by Chinese scholars and enterprise professionals, which served as a foundation for building profit model as well as for further studies. Yet most of them put forward some ideas or specific implementation measures based on a sole aspect or single theory, without presenting whole framework of and a logical coherence to metro enterprise profit model. Hence, on the basis of the above literature research and combining the metro industry's attributes, this article offers an in-depth exploration on the mechanism theories and implemental methods to build all-inclusive metro profit model. The extensive and comprehensive systematic study strives to contribute to the sound development of metro systems.

3 General Principles in Designing Enterprise Profit Models

3.1 Concepts of the Profit Model

Profit, namely the profit gained by the enterprise, is the positive surplus after deducting the total cost from the total income obtained by the enterprise. Profit may comprise of accounting profit and economic profit. The difference lies in the fact that the economic profit shall deduct the opportunity cost from the capital, but the accounting profit shall not [24]. In consideration of quasi-public products and quasi-public attributes of metro enterprises, the study will discuss the formulation of enterprise profit model in terms of accounting profit.

Through research of numerous literatures, we find that Wei Wei's (Associate Professor of Peking University HSBC School of Business) study and Zhu Wuxiang's (Professor of Tsinghua University School of Economics

and Management) study are unique [25]. The six-element business model and profit model theory proposed by Wei Zhu is more suitable for actual operations of the enterprise. Moreover, Wei Zhu's study is highly helpful and useful for the enterprise or the founder to solve various problems. Therefore, it has attracted much attention from the investment firms and enterprises, and has been prominently accepted by all circles. Below, we will discuss the enterprise profit model based on the basic framework of Wei-Zhu's theory.

The profit model consists of sources and measures of income and expenses in the premise that the enterprise revenue exceeds the expenditure. The income and expenses sources refer to benefit-related sides, products or services (business), resource capabilities, etc., which revenues are from (which costs are paid to); the measures of income and expenses refer to the way in which income and expenses are directed, whether the enterprise's income and expenses are fixed, remained or divided. The profit model can be designed by different pricing methods through combining the sources and measures of income and expenses.

The profit model is mainly related to transaction pricing, but the profit model is not equal to high or low pricing, and it possesses richer connotations, specifically summarized as the following [26]:

- (1) Orientation: How to reflect the value flow direction, i.e. from which benefit-related sides revenues are obtained, to which benefit-related sides costs are paid, which costs are undertaken by other benefit-related sides, etc.;
- (2) Qualitative: The pricing way of income and expenses is pricing according to time, usage amount or value quantity;
- (3) Quantification: Different quantifications in the same qualitative property are RMB 3 Yuan/hour or RMB 20 Yuan/day if by time-based pricing;
- (4) Timing: The same revenue is collected by stages or one time, in advance or postponed, and different collection times will bring out different cash flow structures, thus affecting the enterprise's value.

3.2 Basic Principles of Profit Model Design

The design of enterprise profit model shall comply with the following four basic principles:

- (1) Principles of system

The profit model is one of the elements that constitute the business model. The enterprise profit model must be designed in consideration of being incorporated into the scope of enterprise business model; the relationship between all elements of the profit model and major systems

as well as all its elements of the business model shall be unified and coordinated, so that the whole system becomes complete and well-balanced. Meanwhile, overall consideration shall be taken because the source and measures of income and expenses reflect the enterprise profit model from certain aspects.

(2) Principles of profitability

Profit seeking is a natural impetus of business activities in an enterprise. Any expenditure of an enterprise must be based on certain returns. Accordingly, the profit model is a tool for the enterprise to seek and maximize the benefits. Therefore, when designing profit models, the overall adaptability of the combined sources and measures of income and expenses shall be considered; in the aim to maximize the surplus after the resource consumption cost is deducted from the enterprise revenue, thus achieving more increase in value.

(3) Principles of relevance

Profit models vary greatly in different enterprises, in different industries and also differ in different enterprises in the same industry. Furthermore, even when profit models are the same, the income and expenses structures may be different due to the diverse resource capability endowments of different enterprises. Profit model designing must comply with the actual conditions of the enterprise. Indeed, trends in the profit model will not be monotonous, and with the change of enterprise environment, the profit model must be flexibly adjusted in time in order to guarantee the relevance and effectiveness of the profit model.

(4) Principles of dynamic environment

Enterprises are developing constantly in the ever-changing economic environment. Profit model design must not only serve for the current but also future production operation of enterprises. By considering various factors of change during enterprise profit model designing, certain allowance for flexibility shall be reserved for possible internal and external changes or future influential trends. As a result, the enterprise can make rapid and effective adjustments based on the present profit model. A dynamic and versatile approach incites a more active and flexible adaptability of market change in enterprises.

3.3 General Steps in Profit Model Designing

A slight change often produces a significant impact in the actual profit-generating process. The analyzed principles serve as guidance during the designing of the enterprise profit model due to the varied environment and conditions of which metro enterprises must consider. Therefore, numerous variable factors that can impact the operation in combination with the connotation of the profit model are

considered in the designing stage. Based on the economic environment of the studied enterprise, emphasis shall be put on the key resource capability of Shenzhen Metro and analysis shall be made on the sources and measures of income and expenses from the perspective of benefit-related sides.

(1) Study of the Economic Environment

The current state and development tendencies of macro economy will directly or indirectly influence the enterprise profit. A good economic environment can promote smooth enterprise transaction activities and improve the outlook and development of the enterprise. The industrial environment and regional economic development are also the factors of which the enterprise must consider during profit model designing, while specific analysis must be carried out in combination with the actual conditions.

(2) Analysis of the Symbiosis Body

Symbiosis body refers to the integration of the focused enterprise's business model and its benefit-related sides' business models [27]. In view of Wei-Zhu's introduction and explanation on symbiosis body, from the view of symbiosis body, enterprise profit model design must not only concern the benefit-related sides of the enterprise, but also the benefit-related sides' stakeholders. The enterprises shall be put into the symbiosis body, and the boundary of the profit model shall be expanded; overall consideration shall be given to the enterprise's position, its level of importance in the symbiosis body, resource capability for use, income and expenses measures and way for selection, etc. Comparison shall be made with the benefit-related sides' revenue and cost in the symbiosis body, in order to seek optimal path for profit model, improve the operating efficiency of the enterprise and create more values for the enterprise.

(3) Analysis of the Resource Capability

The resource capability is a fundamental factor of influencing the enterprise's source of income and expenses. Resources refer to all human resources, material resources and financial resources, etc., of which the enterprise owns or controls. The capability refers to the subjective consciousness or quality embodied through completing some activity or task based on the human capital, and it directly influences the enterprise efficiency. Specifically, it refers to the resource conversion capability of the enterprise.

Positions of various resource capabilities in the enterprise are unequal, and resource capabilities required for the operation of different profit models are not identical. Therefore, the main resource capabilities involved in the process of obtaining revenues and paying the costs need to be known; in other words, the resource capability plays a crucial role. As long as resource capabilities from different

benefit-related sides, different times and regions, particularly the key resources and core capabilities are known, and the match with the profit model is promoted, the profit model can be built effectively.

(4) Analyzing benefit-related sides

Divided into the internal and the external parts, different benefit-related sides form a mutually beneficial unique business value system by interconnecting and taking what they need in their transaction activities under a commercial mode. Only when the revenue and costs are known to belong to the specific benefit-related side, can the potential value of the parties be then fully tapped, achieving the effect of increasing revenue and reducing expenditure.

Wei Zhu considers the profit model from the perspective of benefit-related sides and sets an analytic matrix with two aspects, namely, the source of revenue and cost payment. The profit model matrix diagram drawn by Wei Zhu extends the range of benefit-related sides to the third-party partners and customers. In other words, the revenue can be gained from the third-party customers in addition to the direct customers, and the costs can be paid by the third-party partners apart from the enterprises and the variable costs can even be zero. As a result, the more complex the transaction structure becomes, the greater the innovation degree of profit model will be. Of course, it does not mean that more benefit-related sides will generate more profits. In fact, how to rationally utilize the resource capability of benefit-related sides to form stable, benign and continuous interaction among benefit-related sides should be the top priority in profit model design.

(5) Designing way of income and expenses

The measures taken in directing the way income and expenses are formed can affect the enterprises' revenue and cash flow structure. Due to different natures of various partners, the same enterprise can design different measures and ways of income and expenses for various benefit-related sides or even for the same benefit-related sides.

(6) Drawing profit model diagram

The analysis of the economic environment of enterprises of Fig. 1 illustrates the source and way of income and expenses of the profit model from the perspective of benefit-related sides and resources capacity. Through optimum combination of the sources and ways of income and expenses, we can gain a better profit model.

Fig. 1 Design concept diagram of profit model

4 Design Ideas and Scheme of Metro Enterprise Profit Model

As an important part of the public transport system of urban infrastructures, the metro undertakes the social function of public transport services, and possesses a particularity that differs from general businesses. To design the metro enterprise profit model, the industry's attributes of metro enterprise and the specialty of its business system need to be studied and considered, under the guidance of general design principles of enterprise profit model.

4.1 Attributes of the Metro Enterprise Industry

4.1.1 Quasi-public Product and Positive Externality

According to whether the products are exclusive or competitive, they can be divided into private and public products [28]. However, there are some products that are similar to public products in nature but not in full compliance with their standards. They have exclusive and non-exclusive, competitive and non-competitive features. These products are known as quasi-public products. Metro is such a product.

As a kind of quasi-public product, the non-exclusiveness of metro lies in the fact that it is a means of public transport; it does not have the attribute of stopping people from taking it. As well, its non-competitiveness is reflected in that a certain passenger riding it will not impact others' utility under the premise that the metro car is not too crowded, with the marginal cost resultant by increased passengers being zero. A certain degree of competitiveness and exclusiveness is embodied in that the passengers who pay certain amount of fares can enjoy the metro service in the paid area at stations and onboard the train, and when

the passenger flow has exceeded the maximum level, a part of the users are kept outside of metro service.

The quasi-public attribute of metro has led to the general loss felt by the vast majority of metro enterprises. However, local governments are still actively promoting metro construction, because its construction and operation can generate tremendous social and economic benefits, namely, the positive externality.

The academic meaning of externality refers to that the independent variable of the utility function of a certain economic entity includes the behavior of others and the entity does not provide reward to or claim for compensation from them [29]. In simple terms, externality means that the behavior of one entity produces a beneficial or adverse impact outside the entity and such an impact is not charged or paid for. Generally, an externality occurs when a transaction results in a beneficial or harmful effect to a third party who was not involved. If the impact is beneficial, it is called positive externality. To be specific, the positive externality of metro project refers to the economic behavior of metro enterprise of which near-metro property owners, real estate developers and other third parties gain benefits or reduced costs though they do not directly take part in the metro construction, and the metro enterprise itself cannot get any return.

To solve the aforesaid problems and maximize social welfare, the government needs to intervene. The government can empower metro enterprises the right to develop the land along the line through certain policy arrangements or subsidizing metro service product with positive externality to make the positive externality internalized. Thus, the benefits experienced by third parties can also be gained within the internal parties of the transaction as an internalization of aggregate gains.

4.1.2 Heavy Assets and Low Profit

Enterprises fall into two categories based on their asset structure and nature of their business, namely, light asset and heavy asset enterprises. Compared with light asset enterprises, heavy asset ones have huge amount of owned fixed assets like workshops, equipment and a huge scale of properties like land and housing properties. The features of heavy asset metro enterprises are relatively prominent.

Due to the heavy asset feature, metro enterprises face high fixed costs. Firstly, a massive amount of depreciation expenses is generated after initial operation due to the huge amount of fixed assets. Secondly, a large amount of fixed assets means that the cost of purchasing those fixed assets will be extremely high and after the metro is put into service, a lot of financial expenses will occur. Thirdly, huge spending is needed for the maintenance, upgrading and

redevelopment of these assets after a certain period of operation.

The goal to cover the huge expenses and fixed cost of metro enterprises is challenging, because metro aims to serve the public and so the price of metro fare is set by the government for public welfare. Meanwhile, immense social and economic benefits generated by metro construction and operation fail to be reaped by metro enterprises the low-profit feature of metro enterprises.

4.1.3 Economies of Scale and Scope

The economies of scale of metro enterprises can be shown by the reduced cost and increasing profit with the expanding presence of networks of metro lines and the exponential growth of passengers. It includes:

- (1) The economies of cost. The fixed asset of metro enterprise is relatively professional and to cover the cost they rely on the number of passengers. With the ever-expanding network of metro lines and the exponential growth of passengers, metro enterprises can not only decrease fixed cost significantly but also share resources.
- (2) The economies of revenue. Along with the expansion of networked metro lines and the increase of passenger flow, the commercial value of peripheral resources will be improved.
- (3) The economies of management. As the scale of metro enterprises is expanding, management efficiency can be enhanced by detailed labor division or networked management. Metro enterprises are able to conduct low-cost financing by economic strength and solid development foundation.

The economies of scope of metro enterprises can be explained by the economic benefits gained through the increase of profits or cost-savings by business segments. It includes:

- (1) For metro construction, optimizing metro construction and design to save the upfront cost of construction, the cost of postoperation as well as add the revenue generated by passengers flow and increase the value of high-end commercial properties.
- (2) For accounting and financing, it refers to the proper combination and innovation of financing methods, which will reduce the overall cost of financing, save the cost of construction (the capitalization of financing interest during the construction period), lower the financing expenses and adjust the depreciations of fixed assets.
- (3) For metro operation, it is able to generate the economies of scope by conducting the output of

operational management, undertaking maintenance of other projects and operational expertise training, etc.

- (4) For resources operation and property development, the former involves metro commercials, metro communications, metro shops, metro cultural industry and metro e-commerce. The latter refers to property development, property operation and management. By further developing and expanding the potential of both areas, the economies of scope can be explored and the economic benefits can be maximized.

4.2 Particularity of Metro Enterprise Profit Model Design

Based on the analysis of metro enterprises, design of metro enterprise profit model should take into account the issues of to whom to return the positive externality and how to balance cost–benefit and how to fully excavate the benefits of economies of scope.

4.2.1 Returns for the Positive Externalities

Early in 1883, foreign scholars made research and exploration to deal with externality. They thought the externality could be resolved through government imposed “Pigovian Tax” [30] or through private deals using “Coase’s Theory of Property” [31]. Based on the current national conditions, if proper policies can be rolled out to help metro enterprises to gain some land development and operational rights along a metro line, there will be no problem in the realization of metro capital projects. The ways of returning positive externalities to metro enterprises include:

- (1) For alleviated traffic congestion due to the operation of metro, a certain amount of fees should be charged to road users apart from pedestrians and public transportation users and return it to metro enterprises. For example, based on the level of fuel consumption, an extra amount of fees should be charged per unit of fuel consumption.
- (2) For the value added to the developed properties after the metro operation, property users or owners are suggested to be charged a certain amount of fees based on the principle of shorter distance with higher tax and a certain proportion of the fees will be paid to metro enterprises. For example, calculate the fees based on the standard area of property and extra fees should be charged per unit of area.
- (3) For the value added to properties and sold land after the metro operation, land value increment tax is suggested to be charged when real estate transfer

based on the principle of shorter distance with higher tax and a certain proportion will be paid to metro enterprises.

- (4) For the unsold land, along with the increase of the land value after the construction of metro, government should issue some supportive policies to authorize metro enterprises the right to develop the land along the metro line.

4.2.2 Balancing Cost and Benefit

Under the quasi-market operation conditions, the key to solving the imbalance of cost benefits of the metro enterprises is the reasonable apportion of asset depreciation and finance interest to make it not only objectively and truly reflect the financial conditions and business performances of metro enterprises, but also truly reflect the special economic nature of the metro project.

In terms of the asset depreciation, in order to better reflect the relationship between the revenue realization and asset use, the accrual of depreciation can be performed on the basis of “value quantity” by using the principle of “work quantity” for Ref. [32]. The basic formula is as follows:

Amount of depreciation of assets = original value of fixed assets $\times$ (1 – net residual value) $\times$ value quantity of the current period/expected total value quantity

Herein, the value quantity of the current period and the expected total value quantity are respectively the actual revenues from metro operation, ancillary resources’ operation and property development of the current period and the expected total revenue of the project’s life cycle.

In terms of financing interest, it is essentially the expenditure paid in advance by the metro enterprise for the government to perform the investment in quasi-public product; in the quasi-market operational mode, a certain amount of development resources shall be granted by the government in compensation, and the reasonable apportion shall be performed on the basis of value quantity of property development [32]. Its fundamental formula is:

Interest amortization amount = total interest amount to pay $\times$ value of property development quantity in the current period/total value of anticipated property development quantity.

Thus, before the revenue is generated by the property development, the fund-raising interest is taken as the receivable account; after the revenue is generated by the property development, the apportion is made on the basis of value quantity to reflect the economic essence of the fund-raising interest for quasi-public product.

4.2.3 Utilizing Economy of Scope

The quasi-market principle enables the metro enterprise to generate a variety of services and products and has the characteristics of the economy of scope. The resulting cost advantages are greater than the economy of scale since metro enterprises are limited as the increase in its size and speed of operation depends on the investment [33]. By means of diversified operation, the surplus resources can be made to fully utilize and realize the sharing of resources between different business units and the exploration and use of the effects of economy of scope. The architectural structure of the metro project possesses complexity and particularity, and to explore the effects of the economy of scope by the metro enterprise, it should be considered along with the market demand and factor endowment, the fields that match its own core competence and key resources shall be selected for business development and diversified operation. In this way, the effects of increasing incomes while cutting down expense can be fully realized. The economy of scope that can be explored by the metro enterprise includes:

- (1) In terms of fund-raising and finance, apart from the traditional means, innovation of fund-raising tools and financing channels shall be further explored, and the direct financing strength shall be intensified; meanwhile, the passenger flow is a resource in itself and shall be in full use to develop metro members, and the members' deposits shall be centralized to invest in the metro construction and the property development project;
- (2) In terms of metro operation, training business and consultation services can be further expanded, like operational technology training, metro operational management consultation, etc.
- (3) In terms of resource development, apart from continuing the improvement of the existing four categories of core services, namely commercial operation, advertisement and media, telecommunication information, cultural expansion, revenues from metro passageway link right, commercial voice broadcasting advertisement fee, metro WIFI, etc., can be utilized;
- (4) In terms of property development, apart from the commercial housing development, property operation, property lease and property management, more environmental-friendly, green and energy-saving high-quality property projects can be made with the goal of building the metro property brand.

4.3 Main Contents of Metro Enterprise Profit Model

The business system diagram of the symbiosis body of which metro enterprises are in is drawn as shown in Fig. 2.

From Fig. 2, it is found that in addition to the main operations, the metro enterprises can make full usage of the land development right endowed by the government as well as the abundant passenger resources generated by metro operation to extend the business or excavate new business types. With regard to the obtained land development right, the metro enterprises can perform the property development business. The affluent passenger flow resources shall be utilized, and metro enterprises can expand new financing channels. At the same time, based on consumption characteristics of the internet era, the metro enterprises can develop metro virtual business to meet the passenger's needs for mobile needs and internet surfing experience. Therefore, the main content of metro enterprise profit model can be summarized as three aspects, "metro plus property", "member plus fund" and "entity plus virtual".

4.3.1 Metro plus Property

"Metro plus property" is an important part of metro enterprise profit model. In terms of metro, it can be divided into five business segments, namely planning and design, fund-raising and finance, metro construction, metro operation, ancillary resources operation. The optimization of one segment will help reduce the cost of another segment or increase the income.

- (1) The planning and design is the starting point of setting up the profit model for metro enterprises. The optimization of the planning and design will not only save construction and operation cost, but also increase the passenger flow at a later stage and produce quality ancillary resources and commercial property.
- (2) The fund-raising and finance will provide funds for metro construction and operation. Metro enterprises can fully utilize the government credit resources to study an appropriate financing combo to lower fund-raising cost. Because a metro project needs huge investment, an optimized financing scheme will save a considerable amount of costs.
- (3) Metro construction refers to the implementation of the plan and design schemes. As the owner, metro enterprises shall not only improve the cost management system and control the construction costs, but also strengthen the quality management, adhere to high standards and strict requirements, create

Fig. 2 Business system diagram of metro enterprise's symbiosis body

excellent metro projects, to save construction costs and reduce repairs and maintenance costs in the long-term.

- (4) Metro operation is the core business of metro enterprise. The operation will not only focus on growing the passenger transport income through increasing the passenger flow, but also on controlling and decreasing operational costs.
- (5) The ancillary resources are derivative output of metro investment and construction. The marginal cost yield rate of ancillary resource operation is extremely high. On one hand, through operation on the existing ancillary resources and development of new types of ancillary resources, the operating income will be increased; on the other hand, the operational costs shall be controlled and saved.

As for the property segment, the return of externality of metro project shall be realized mainly through the development on the land above metro and its underground space and on the lands along the metro line (referred to as metro property development). Different development modes will face different incomes and risks, and in practice, metro enterprises shall consider their specific conditions to make the prudent choice.

4.3.2 Member Plus Fund

In the “member plus fund” model, the “metro prepaid card” is used as the carrier. Card holders will be invited to become the members, and then with the reference of the internet financial mode of “Yu’e Bao” in China, the card functions will be extended for the investment and wealth management. The return on the investment will be higher than the bank’s time-deposit interest rate. Meanwhile, the card has the function for withdrawal of the demand deposit in order to encourage members to increase their deposit amount. Then, the capital deposit in the prepaid card will be put into the metro industry’s investment fund established by metro enterprises for the purposes of the metro construction, property development, purchases and self-holding of quality commercial property along the metro. Therefore, metro enterprises will raise low-cost capital fund and, through the investment in the quality projects, realize capital returns and added values while metro members will share a stable and comparatively high yield that will be undoubtedly a win-win result.

The current prepaid card has already been characterized by the financial consumption and small-amount payment, and in the future, it is determined to give more innovative

financial functions, such as investment and wealth management, third-party large-amount payment, etc.

When “member plus fund” model becomes mature, the member scope can be extended to the store owners, residents along the metro line as well as other parties enjoying the metro benefits. Therefore, the fund amount is continuously being expanded, the financial services such as metro e-commerce gets further developed, making the sound interactions between the metro members, industry’s investment fund, metro construction and property development, and promoting the long-term and sustainable development of metro enterprises.

4.3.3 Entity Plus Virtual

Metro as a public space in motion means that the mobile internet is naturally compatible with it. If metro enterprises provide WIFI signal throughout the metro space and then develop the third-party applications (known as metro APP), it will not only bring convenience to the passengers, taking into account the daily passenger ridership and the average travel time on metro, but also will create a more profitable space for metro enterprises.

As for the metro WIFI coverage, profit can be earned by managing the freely accessed homepage, namely to control push or application, introducing advertisement and sharing for data traffic. The methods of which the metro APP is utilized to obtain profits include:

- (1) The metro passengers can access and use the related functions of APP free of charge, including the metro train route, fare inquiries, station perimeter and other related operational services information. Further usage of additional functions requires certain fees, in forms of currency, credits, etc.
- (2) As the metro APP has a wide coverage, more advertisers, game developers and third-party application developers would be attracted to the advertising opportunity, and metro enterprises would gain revenue from advertisements and data traffic sharing.
- (3) Taking into account that current application program is gradually becoming the main battlefield for e-commerce enterprises, if metro enterprises can embed the e-commerce enterprise portal into the metro APP, metro enterprises can obtain, apart from the income from data traffic, the commission revenue in a proportion of the sales volume according to the principle of membership marketing.

In this way, through the optimal utilization of the virtual economy of “metro WIFI plus metro APP”, and combined with the metro entity economy, the value of internal and external resources can be maximized; the needs of different benefit-related sides can be met. This serves to prompt

metro enterprises to step onto a sound progress road through self-building and self-operation.

4.4 Implementation Conditions of Metro Enterprise Profit Model

Because of the quasi-public attribute of metro project, its social benefits will be far greater than the direct economic benefits. Thus, how to transfer the positive externality into internality as much as possible becomes the key to the setup of metro enterprise profit model. Based on the above analysis, the benefit return of the value added of land along the metro has become the effective way to set up the profit model.

The benefit return of the value added of land along the metro can be realized through proper policy arrangement by the government, which will give the land development along the metro right to metro enterprises and metro enterprises will carry out market development on lands along the metro. The quasi-market operation of the land along the line by metro enterprises requires the following three conditions:

- (1) State-owned land: only when the land is state-owned can the benefit return of the value added of land along the metro be feasible. In China, the land is owned by the state or collective, so according to the relevant laws and regulations, metro enterprises can obtain the land-use permit and authorization through bundle bidding of the land or increasing registered capital by the priced land value.
- (2) High prices of land and housing. Only when the land and housing prices are sufficiently high can the benefit return of the value added of land along the metro be sufficient enough to support the large-amount investment in metro construction and later operation. At present, not all the cities which have built metros have the available conditions. How these metro enterprises can select and allocate the appropriate land resources will depend on the actual situations of different cities.
- (3) Local market economy is relatively developed, and the disposable income of residents is relatively high. Only when the disposable income of local residents is sufficiently high can they afford the high prices of land and housing. At present, China’s first and second-tier cities have available conditions to set up a profit model through land development along metro lines.

Figure 3 shows the conceptual diagram of metro enterprise profit model.

The diagram provides the profit model framework under the quasi-market principle: the economic environment and

Fig. 3 Diagram of metro enterprise profit model

symbiosis which include industrial attributes, particularity of model and implementation conditions. These factors are critical in generating internal gains of positive externalities and in enhancing synergy between business and sub-business segments. Figure 3 also provides visibility to the core relationship of the two major internal categories that contribute to the main contents of the profit model: source of income and expenses and way of income and expenses. The main contents include three types of integrated enterprise operation when balancing cost and income: metro + property, member + funds, entity + virtual.

5 Case Study: Practice of Shenzhen Metro

5.1 Background of Shenzhen Metro

Shenzhen Metro Group Co., Ltd. assumes the main responsibility for construction and operation of the rail transit system. Its business scope includes preliminary research, design and construction of the metro project, as

well as metro operation, resource business operation, property development and management, finance and fund-raising in association with metro systems. Now it has formed the industrial chain which integrates the businesses in the metro systems, featuring “investment and fund-raising, construction, operation and resource management and property development”. As of the end of December 2014, the company had the registered capital of 24 billion RMB Yuan, the total assets of 182.4 billion RMB Yuan, the net assets of 84.1 billion RMB Yuan, the asset-liability ratio of 54% and 12,000 employees.

5.2 Current Business of Shenzhen Metro

In 2014, Shenzhen Metro realized the operating income of 3.365 billion RMB Yuan, the operating costs of 2.575 billion RMB Yuan, and the net profit of 439 million RMB Yuan. Currently Shenzhen Metro mainly adopts the “metro + property” profit model. In the following study, we briefly introduce about each business segment of Shenzhen Metro in 2014.

(1) Planning, design and route construction

At present, Shenzhen Metro operates No. 1, 2, 3 and 5 Lines. In accordance with the direct metro transportation income and expenses in 2014, the operations of No. 1, 3 and 5 lines make profits. However, No. 2 Metro Line, due to its unreasonable planning of the route at the preliminary stage, which resulted in some problems in line route which affects the later-stage passenger flow and the exploitation of ancillary resources, has become the only line that recorded loss in operation. It reflects that planning and design would directly affect the profitability of a metro enterprise. As for construction of metro systems, there are three lines: No. 7, 9 and 11 Lines previously under construction, a total of 107.28 km, with the total investment of 99.7 billion RMB Yuan. They started operation in 2016.

(2) Finance and fund-raising

In the aspect of finance, on the basis of balancing costs and benefits and by means of the research in the yield curve of the metro systems, Shenzhen Metro has put forward a suitable accounting arrangement method in accordance with the features of the metro industry and practical situation of Metro Group. In other words, the asset depreciation and financing interests are not included in the operating costs temporarily and will be dealt with in the subsequent property development. As a result, the enterprise has obtained the recognition and support from the municipal government and the municipal financial department. Thus, the method has effectively solved the problem of loss reflected in the financial statement of Shenzhen Metro and provided support for the diversified financing options.

In the aspect of financing, in order to disperse the financing risks and save the financing costs, Shenzhen Metro has broken the deadlock of merely relying on the credit financing of banks and actively researched and implemented the diversified financing strategy. It has made some innovation in the various financing tools and channels, and succeeded in attempts for the financing diversity such as financing lease, medium-term notes, corporate bonds, short-term financing bonds and cross-border RMB Yuan loans. In 2014, Shenzhen Metro acquired funds of 19.3 billion RMB Yuan through the market approach, saving financing interests of 180 million RMB Yuan, including the direct financing of 15.8 billion RMB Yuan, with the comprehensive financing costs at 5.46%, and the total indirect financing amount of 3.5 billion RMB Yuan.

(3) Metro Operation.

The accumulated average daily passenger volume of ridership in 2014 is recorded as 2,375,500, with the maximum daily ridership volume of 3,310,700. The punctuality rate, fulfillment of the operational diagram and the equipment

reliability index all exceeded 99%, thus fully realizing all kinds of planned service indexes in terms of safety and quality in the operation of the metro systems. In 2014, Shenzhen Metro realized the passenger transportation income of 2.215 billion RMB Yuan, approximately accounting for 66% of the total income. The cost of passenger transportation was 2.174 billion RMB Yuan and the annual balance of payments was 45.07 million RMB Yuan.

(4) Business operation on ancillary resources

In 2014, Shenzhen Metro achieved the operating income of resources of 410 million RMB Yuan, approximately accounting for 12% of the total income, with the operating costs of 33 million RMB Yuan and the net profit of 355 million RMB Yuan. The media culture resources generated a partial income of 245 million RMB Yuan, accounting for 60% of the total income of resources. The commercial resources affiliated with the metro stations generated 74 million RMB Yuan which represents 18% of the total income of resources. The telecom information resources yielded 87 million RMB Yuan, accounting for 21% of total income; whereas income of other resources accounted for 1% of total income from resources.

(5) Property development

In 2014, Shenzhen Metro generated an income of 78.71 million RMB Yuan in the property development segment, approximately accounting for 2.34% of the total income, the operating income of 11.88 million RMB Yuan, and the net profit of 30.55 million RMB Yuan. Due to the fact that the property development of the metro systems has just started, its income represented a low percentage of total income. Hence, the limit indicates that the relationship between the lengths of time is proportional to the generated income in property development. In accordance with the accounting principle, the sales from the property will not be considered as income until the houses have been occupied by the owners; nevertheless, the cash flow of the group has been evidently improved.

In accordance with the proposed accounting arrangement method for the financing interests, the amount of the financing interests which had been written-down or bought on credit was paid 121 million RMB Yuan, with the obtained benefit in the property development in 2014. This part is practically due to the contribution from the property development business to the overall financial status of Shenzhen Metro.

In a word, Shenzhen Metro has actively absorbed the positive externality on the land in the metro project under the profit model which features the main businesses of “metro plus property”. It fully utilized the value-added benefits of the land along the metro lines effectuated by the construction of the metro projects. It has extensively

conducted the secondary development of resources and obtained larger comprehensive economic benefits.

5.3 Profit Model of Shenzhen Metro Main Profit-Source Businesses

5.3.1 Business Operation on Ancillary Resources

Business operation on ancillary resources represents the important part of “metro” in the “metro plus property” profit model. It mainly consists of four categories of resources: media culture resources, commercial resources affiliated with metro stations, telecommunication information resources and other resources. Its main benefit-related sides are composed of the renting contractors.

(1) The media culture resource.

The advertisements at stations constitute the main operating resources. In 2014, it produced the operating income of 184 million RMB Yuan, accounting for 45% of the total income. Its main profit was obtained through the mode of “minimum guarantee rent plus sharing after over-fulfilling the quota”, its minimum guarantee rents has been increasing year by year. Then the electronic media are introduced while mainly gaining profits through the collection of fixed rental fees, which produced the operating income of 49 million RMB Yuan, accounting for 12% of the total income. The other media resources and profits through collecting fixed rental fees represented 3% of the total income.

(2) The commercial resources affiliated with metro stations.

The station banks are excellent commercial resources along the metro stations, with the leasing area of 1853.54 m². The shops in the halls of metro stations are scattered commercial resources along the metro lines, with the leasing area of 2356.79 m². These two kinds of subsidiary businesses reached the operating income of 20 million RMB Yuan respectively in 2014, accounting for 10% of the total income, both of which made profits by collecting fixed rents. The underground spatial industrial chain developed adjacent to the metro stations are varied in the area of property. Thus, the method of either incorporating the minimum guarantee rent plus sharing by over-fulfilling the quota or the collection of fixed rents are adopted to make profits in different sites.

(3) Telecom information resource type.

Currently, this category’s operating income is mostly from a systematic leasing of telecom equipment and generating profit through collecting fixed rents.

(4) Other resource business type.

It mainly includes making connecting walkways, leasing of temporary sites, and recycling and disposal of waste and old materials. This category of resources realized the operating income of 4.06 million RMB Yuan in 2014, only accounting for 1% of the total income, with making profit through the collection of fixed rents or lump-sum payment.

5.3.2 Property Development

Property development is an important part of the “property” in the “metro plus property” profit model. At the present stage, the contribution of property development is mainly reflected as undertaking to share out public-welfare fixed costs on depreciation and financing interest. In 2014, the paid share is 121 million RMB Yuan, and the future development profit will be more than the annual share amount and will be reflected as the financial results of the year under review.

Now Shenzhen Metro owns a total of 15 pieces of commercial land reserve, a total land area of 889,000 m². Permitted sale of constructed area is 3.74 million m², a total anticipated market value of 150 billion RMB Yuan. The land value is expected to reach 33.377 billion RMB Yuan. In 2014, Shenzhen Metro has achieved the development goal for newly commencing construction of 500,000 m², with the under-construction area of 1.2 million m².

Shenzhen Metro adopts the mode of “rolling development and rolling sale”. In 2014, the actually fulfilled sale target is 3 billion Yuan, exceeding by 50% of the plan. The annual fund return is 1.5 billion Yuan, exceeding by 20% of the plan. The commercial property income reached 70 million Yuan, and the contractual amounts collected is more than 98%. Besides, the sale of housing “FUTURE TIMES” opened in November 2014 led a housing purchase boom that the whole quantity of property was almost sold out on a single day, which greatly increased the reputation and brand awareness of Shenzhen Metro Property in the industry.

With regard to the low-rent housing, Shenzhen Metro has agent-constructed 1.2565 million m² of the low-rent housing in total volume-ratio inclusive area. Recently, the projects at QianHai and HengGang are under the completion acceptance and the finish rectification before hand-over; while the projects at TangLang and SheKou is under active and normal progress.

In regard to the development mode, Shenzhen Metro mainly uses five different modes, i.e. independent development mode, agent development and BT construction mode, protocol type cooperation and BT construction mode, protocol type cooperation construction mode and legal person type cooperation mode.

5.4 Profit Model of Shenzhen Metro Potential New Business

According to the mentioned discussions on metro enterprise profit model, apart from the existing “metro plus property” profit model, Shenzhen Metro can also generate profit growth points in the models of “member plus fund” and “entity plus virtual” to further expand the profit margin.

5.4.1 Metro Member Economy

In 2014, the maximum daily passenger ridership of Shenzhen Metro surged to 3 million and the quantity of active public transport card holders exceeded 6 million. In 2017, the daily average passenger ridership will reach about 5 million after the initial operations of Lines 7, 9 and 11. With such massive passenger flow and in consideration of the above-mentioned design idea of the “member plus fund” profit model, the resource of passenger flow can be developed and utilized through financial measures to resolve the problems of capital sources for metro construction. At present, Shenzhen Metro has started the exploration and research on the operation mechanism and system as how to use the carrier of “Shenzhen Tong” ticket card and encourage part of card holders to become metro members.

Under the guidance of the above-mentioned operation idea of “member plus fund”, Shenzhen Metro is actively working in the following two aspects: firstly, to expand the functions of “Shenzhen Tong” ticket card and enrich the types of service offered by “Shenzhen Tong” ticket card to increase the convenience and satisfaction of “Shenzhen Tong” ticket card users. Secondly, through lifting the upper limit of stored value of “Shenzhen Tong” ticket card to support and facilitate the members to use the expanded functions. To attract more ticket card holders to become the members, Shenzhen Metro, on one hand, can further raise the investment return rate within the acceptable range; on the other hand can divide the members in details, execute scientific and refined management of the members as per their different demands to fully dig out the potential values of the members. In this way, a metro construction fund is “invested by the people and used for their benefit”. The enterprise and the members are interactive on good will. This is quite helpful to development and progress of metro.

See Table 1 for the profit mode of metro member economy. Its benefit-related sides include member, manufacturer, government, financial institution, etc.

5.4.2 Metro Industry Investment Fund

Metro industry investment fund is mainly invested on metro projects and it is impossible to get a high investment return. According to the operational thought of the above-mentioned “member plus fund” profit model, the reliable capital source is the capital precipitation of metro members. Metro construction promotes the development of the relevant industries and produces many profitable projects. Shenzhen Metro can invest the fund to its main businesses or the highly profitable projects in its industrial chain such as development projects of the high-quality metro properties or can invest the fund for the development of ancillary resource projects taking its advantage of commercialized resource development on metro passenger flow, so as to provide fund investors the considerable and competitive fund return rate and attract more passengers to become metro members.

Considering that different members have different risk preferences and risk tolerances, in the aspect of fund operation, Shenzhen Metro can select the partial members with strong risk tolerance and invest their capitals to some fields with higher risks and earnings in the form of funds such as finance, e-commerce of Metro industry; for the members with general risk tolerance and expectation of stable earnings, Shenzhen Metro can select investment on the projects with steady earnings so as to meet the different demands of the investors.

Shenzhen Metro has completed the preliminary research on metro industry investment fund that is at active promotion stage to establish. The detailed organization form, fund type, fields of fund investment and withdrawal mechanism are yet to be further studied.

See Table 2 for profit mode of Metro industrial investment funds. Its benefit-related sides include fund holder, fund operation organization, government, client, etc.

5.4.3 Metro WIFI

Shenzhen Metro is currently undertaking the active research on the development of virtual businesses and WIFI with coverage expanding over 55 stations and more than 98 trains of Line 1 and 2. On July 30, 2014, WIFI services throughout the whole journey were installed and provided on Lines 1 and 2. When the passengers enter into the area covered by the Metro WIFI, they only need to search for WIFI hot spot, download the Metro APP and get the verification code in the form of game participation or follow a Micro Blog according to the hints. Passengers can get access to the internet once verified. Furthermore, free WIFI will soon be provided successively at Line 5 and Line 3 and the free WIFI of Shenzhen Metro will gradually cover the whole network.

Table 1 Profit model of metro member economy

Source of income and expenses	Incomes	Investment income, cost saving, etc
	Expenses	Investment return to the members and the relevant fees and taxes
Methods of income and expenses	Incomes	Take any method of either fixed or fixed + sharing or sharing for different services
	Expenses	Take any method of either fixed or sharing for different clients

Table 2 Profit model of metro industrial investment funds

Source of income and expenses	Incomes	Investment income, project earnings, cost saving, etc
	Expenses	Management cost, trustee fee, operation expense, liquidation expense, relevant fees and taxes, etc
Way of income and expenses	Incomes	Take any method of either fixed or fixed + sharing or sharing for different investment projects
	Expenses	Take any method of either fixed or sharing for different clients

The WIFI business of Shenzhen Metro will use a third-party's investment and operation mode. Value-added services will contribute to the later benefit earnings. Shenzhen Metro will not only provide free high-speed WIFI and various intranet service functions (such as push, query and location), but also provide the software download of dependence mobile ends of metro community so as to meet the dependence demands of travel, purchase of tickets, reminders, etc., in the metro community as well as other series of functions such as social networking, recommendations with local locations, group purchase, payment, exchange through mileage accumulation, donation of positive energy, on-line playing and game center.

For the profit model of metro WIFI, see Table 3. Its benefit-related sides include metro operator, passengers, cooperative manufacturers, advertiser agency, etc.

6 Summary and Outlook

Based on the quasi-market principle, this paper adopts a strategy from a general to specific perspective on the research and discussion of the design and establishment of the metro profit model. In contrast to other published papers which focus on a certain aspect or single theory

research on metro profit model, this study analyze the connotations and denotations of profit model and then interprets the impacts on its resulting design logic and mechanism. By generating internal gains of positive externalities, balancing cost and income, and maximizing economy of scope, the integrated approach produces a comprehensive profit model. The integration of the characteristics in the metro sector and the degree of specificity in the design and performance of metro enterprise profit model in its business system promotes a more comprehensive and systematic research relevant to actual metro operation in a constantly changing environment.

Quasi-markets assure the universality and quality of service while featuring the advantages of a conventional market. When the profit model is based on the quasi-market principle, the externalities experienced by third parties also become internal gains that can sustain the metro enterprise's inputs. To a great extent, the profit model formulation for metro enterprises is based on the comprehensive analysis of the attributes of metro enterprises within unique environments as well as profound studies on the utilization and integration of resources. The environment of Shenzhen Metro is considerably lenient to the authorization of land use and cohesive cooperation between various industries; whereas the scope of authority

Table 3 Profit model of metro WIFI

Source of income and expenses	Incomes	(1) WIFI coverage: information push, advertisement push, investment attraction; (2) Value-added services of Metro community: provide various value-added service such as advertise, member, donation, and payment, group purchase, surrounding recommendation and buying tickets through download of positive energy software
	Expenses	WIFI coverage, software development, O&M, relevant fees and taxes, etc
Way of income and expenses	Incomes	Take any method of either fixed or fixed + sharing or sharing for different services
	Expenses	Fixed

of other metro enterprises in the global community is less due to the present contractual arrangements of most public–private partnerships. Although the majority of metro enterprises are in deficit at present, this research carried out an empirical analysis on the real operation status and profit composition of Shenzhen Metro Co. Ltd. in 2014, and confirmed the feasibility and relativity of the profit model with the case study put forward by this paper, which provides an applicable reference and experience for metro enterprises around the world. This paper presents the process in forming a profit model which includes the analysis of metro attributes under a unique environment. The case study demonstrates the advantages of quasi-marketing in the optimization of resources while ensuring accessible provisions of metro service. Studies around the world have elaborated on the importance of technological innovations and thorough planning in shaping smart transportation. Scientists, governments and enterprises are united by the attempts to solve the various setbacks faced by the transport sector through new and universal endeavors. Although few studies explicitly model profit in metro, the current initiatives accentuate the need to generate present benefits in order to support future enhancements. This paper fills the gap by presenting the fundamental coherent steps for enterprises to form a unique metro profit model by the means of a comprehensive integration of socioeconomic scheme. The utilization of a quasi-market-based profit model aims to promote a resolution to fellow deficit challenges faced by the global metro community. Through the wide analytic spectrum of trends in the metro industry and initiatives from the case study, a new era of positive growth and sustainable development is initiated in the metro enterprises.

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