Study on the Application of CRS in China Hotel Chain: the Analysis based on System Functional Factors

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Abstract

Based on relative research literature reviews about the development and functions of foreign hotel CRS, combining with the basic situation of China hotel industry and according to the clients' functional requirements to CRS, the functional factor model of CRS in the application of China hotel group is explored in the article. The research methods mainly include literature review, interviews, questionnaires and other empirical analysis methods. Through the empirical analysis, the hypothesis model is analyzed and modified, and the key functional factors of CRS are obtained. The CRS functional model of hotel group is established in the article, and this model has been proved to be effective in the CRS construction of Nanjing JInling Group.

Keywords: Hotel group, Hotel chain, Central reservation system (CRS), Model, Functional factors

1. Introduction

At the beginning of 1960s, to simplify the ticket reservation procedure, the airline company successfully developed the electronic reservation system which could directly manage the stock, associate with the agent, and implement scheduled flight inquiry and reservation operation by the agent's reservation system terminal (Gill, 1998). In 1965, Kemmons Wison first introduced the reservation system into the holiday hotel and called it the central reservation system (CRS), and the hotel accommodation industry had first used the CRS to implement the distribution and reservation. Up to the late of 1980s, the occurrence of the seamless connection technology promoted the mutual development of the hotel reservation system and the air reservation system, and realized the real-time confirmation for the reservation demands between the air reservation system and the hotel CRS and between the hotel group and the member hotels, and it could offer up-to-date room price and room supply status real time, and realize the mutual reservation operation among systems (Vallen, 2002). By the interface of the CRS, the chain hotel can centrally control its room list the room price list, give more individualized promote services, realize one-to-one relationship promotion, and better serve for clients and agents by inquiring clients' historical records (Dimitrios Buhalis, 2003). Up to the 1990s, the occurrence of internet accelerated the development of the hotel CRS, and clients could avoid all middle procedures and directly reserve the room. The travel agency and clients can directly interview the CRS of the group to acquire detailed materials of the hotel including the rentable situation and reserve and confirm the room immediately. At present, some famous national hotel groups all have successfully applied CRS, such as the HOLIDEX reservation system of the Bass Hotels, the GLOBAL II reservation system of the Inter Continental Hotels Group, the ACCOR reservation system of the ACCOR Group, the HILTRON CRS and the HILSTAR reservation system in April of 1999 of the Hilton (Dimitrios Buhalis, 2003). This kind of CRS generally can connect with the global distribution system (GDS) to fully utilize the strong function of GDS and the high popularization rate of the travel agent terminal.

With the popularization of internet and the development of E-business, the functional research of CRS has extended to the client management and the income management (Sigala, 2001). In the environment of internet, to acquire the maximization of client value, the hotel CRS must integrate the income database, the client database and the product database (Sigala, 2001). Especially, the occurrence of website added the function of on-line distribution for the hotel CRS, and as the service window of CRS, the website has been adopted by most hotels. Starkov (2005) had made a survey in his research, and the result showed that 53%~54% of the on-line distribution belonged to direct electronic distribution, and half of the on-line distribution at least came from the reservation system (including website) established by the hotel itself. After the E-business based on internet occurred, the application of the hotel CRS was further developed, and in Nyheim (2003)'s research, he thought that the hotel CRS must adapt the development of the E-business, integrate CRS with the income management, the reception system, the banquet and distribution system to make them implement real-time data exchange, seamless stock management and single-page stock (all systems could see same data at the same time), and fulfill the demands of hotel E-business data exchange and business processing. Except for that, the CRS based on networking possesses the functions such as individualized service and sales promotion, and especially as the window of CRS, the website needs to pay attention to the character of client-oriented website service, not the benefit-oriented service, because the client-oriented website can acquire abundant content

supports such as effective reservation, dummy room, interactive route map and figured interface (Lanz & Shapiro, 2004).

At present, many international hotel groups have completely integrated CRS with the internet world, because the tourism or the reservation about the tourism is one of largest commercial applications of internet (Leong, 2003). Only in US, the income of tourism reservation had increased from 46 billion dollars in 2003 to 54 billion dollars in 2004, and this number is predicted to be 91 billion dollars or one third of the total tourism consumption in 2009, and the reservation of the hotel group CRS system occupied quite big proportion (McGann, 2005). In China, up to the late of 2007, there were 13583 state grade hotels, and the collectivized rate of hotel had exceeded 17%, and in recent years, the hotel collectivization is increasing, but only a few Chinese hotel groups have CRM. Though the management staffs of the hotels have realized the function of CRS in the management, but there is no one mature CRS in China up to now. The China hotel industry in the collectivized development is competing with the internal hotel groups with mature CRS for the client source market, and the market extension is seriously threatened. Therefore, the scale extension of Chinese hotel group needs the enhancement of technology, and the establishment of CRS has been the current urgent task, which will impact the development of the whole Chinese tourism industry.

2. Literature interview and model hypothesis

CRS belongs to the category of the information system, and it is based on the network environment. From 1965 to now, the range and processing function of CRS are continually being perfected. According to the Anthony Model, the information system should include three layers such as the strategic planning, the tactical decision and the business decision, and consider the function of the interior information flow of the enterprise (Chen, Shuqin, 2006). Same with general enterprise information system, CRS needs to consider the administrative levels and ensure the maneuverability of various management layers to hotel CRS when the system is constructed. Connor (2003) pointed out that CRS had changed the balance among hotel, clients and agent with the continual development of the technology. At present, the functions of hotel CRS are continually perfected, especially in the interactive function with the individual travelers. In fact, the balance of hotel and agent is embodied in various system functions, and those developing on-line agents make the hotels to face very complex distribution channel and the threat of the sales price control (sales management), but CRS can make the hotel to control the room stock and the sales price of the room (Peterson & Merino, 2003). Middleton & Clarke (2001) also pointed out that because there was no a distribution channel to dominate the future market at present, the hotel groups needed to design their own CRS and distribution channels to combine the applications and enter into the bigger market and form the hotel group reservation ability. Lexhagen & Nysveen (2001) surveyed the tourism reservation and increment service, and found that the tourism industry had only offered part reservation services and limited on-line market increment services, and the traditional tourism agents could offer more increment services than the air industry and the hotel industry in the on-line market. That is mainly because that both clients and hotels lack in trust each other, and the inefficient reservations often happen, which indicates that the hotel should pay attention to the client management in the on-line reservation system and cultivate mutual business trusts. Park & Kim (2003) pointed out that the hotel CRS needed to collect, analyze and use three kinds of client information, i.e. the basic information of clients (such as individual and trading data), the information needed by clients (such as product information, service information and organizational information), and the information offered by clients (such as clients' opinions, clients' complaints and clients' advices), which also showed the importance of CRS to the client management.

Chinese scholars' study about CRS just started, and the content mainly includes the functions of CRS. Huang Xiagui (2005) thought that the CRS of domestic hotel group needed to study the client-oriented marketing mode of foreign chain hotels, and give emphasis to utilize the client creation rule of "client impression occupation rate- client market occupation rate- client heart occupation rate", and use the CRS to establish the interactive marketing network to accumulate large numbers of loyal client group. CRS is a large integrated system, and the hotel needs certain supports of investments and technologies to establish the CRS. Therefore, following difficulties are faced by Chinese hotel groups to develop CRS. The first one is the obstacle of a huge sum of money; the second one is the unbalance of the degree to recognize and accept CRS; the third one is the limitation of the market consumption behaviors; the fourth one is the limitations of the technical support and the management level; the fifth one is the tangle of the networking sales benefit and the sixth one is the harmony and communication between network and hotels (Chen Xiaowen, 2005). Yang Mingkui (2006) though that the main functions of CRS were mainly embodied in following aspects, (1) the room reservation in the interior of the group, and all reservations could be acquired by the interaction between the engine and the interfaces of various member hotels, (2) the system interface with GDS, and it could implement data exchange on the layer of system engine and ensure closer connection between CRS and GDS, (3) Web self-help reservation terminal, and guests of the hotel could reserve the room, inquire the information, modify the order form and inquire the accumulated points by the website of the group. Gu Huimin (2001) pointed out that the hotel group could control the composing, flux and flow of the client source by CRS to adjust various price combinations, implement the income management, and realize the maximization of the group benefit. Wang Haomin (2005) divided CRS functions into the

client management module, the client history management module, the room and room price management module, the reservation management module, the report management module and the data synchronic module when he studied the frame structure of CRS.

The literature review shows that for the research of CRS function, many scholars had studied the sales management, the client management, the group reservation and the self-help reservation surrounding CRS. In the introduction of foreign research articles about CRS, because the application of CRS was universal and the functions of CRS are perfect, these articles mainly emphasized the method of reservation, the new technology application of online website, and the features and management researches of online clients, and paid more attention to the quantitative analysis and research to CRS. In China, most researches about CRS belonged to exploring researches such as the applicable research of the reservation system, the research of the influencing factors to establish CRS, and the research of the construction of the CRS framework, and most of them are qualitative analysis, and few of them studied the construction of the CRS functional structure construction. As viewed from the hotel manager, the hotel group should treat the CRS strategy as the distribution center, and regard the CRS as the distribution system or an operation entity (Gale, 2006).

Though the review and summarization of these articles, the hypothesis model to describe the CRS functional factors can be established, and the final CRS functional factors model can be confirmed through certain empirical and quantitative analysis. The CRS of domestic hotel group is a comprehensive system project and an integrated system, and the domestic CRS has not been confirmed in the functional structure, and the functional factors and structured model of CRS should be systematically studied to explore the CRS functional model fitting for the application in Chinese hotel enterprises. So the following hypothesis of the CRS functional model (seen in Figure 1) is proposed in the article.

3. Research method

There are few research articles about the theoretical construction of CRS in China, and most of them belong to the qualitatively exploring study of framework, and there is not one article to adopt the survey data to empirically analyze the CRS functional model. To explore the functional model of hotel CRS, the empirical method design is adopted in the article. Based on the CRS hypothesis model in literature review, put out questionnaires to the hotel groups and their member hotels for acquiring data, and adopt the social science statistical software bag of SPSS to implement data factor analysis and the variance analysis for the effective collected questionnaires, and validate and perfect the hypothesis model, and quantitatively demonstrate the model from the qualitative research.

3.1 Variable definition and structure dimensions

Aiming at the hypothesis model, the interviews and surveys are implemented, and the interview objects mainly are domestic hotel groups and suppliers of hotel software such as Shanghai Jinjiang Corporation, Nanjing Jinling Group, New Century Tourism Group, Shanghai Thayer Interactive Corporation and Hangzhou West Lake Software Corporation. By the interviews, the first-hand materials needed to establish the CRS functional demands were formed, and aiming at 5 dimensions of the hypothesis model, the initial variables of each dimension were defined as seen in Table 1.

3.2 Samples and questionnaires

Because the analysis objects in the article are the CRS functional factors of hotel groups which are direct and main users of CRS, so the questionnaires is designed for the whole hotel groups. The survey range of the questionnaire mainly includes Zhejiang, Shanghai, Nanjing, Beijing and Guangzhou, and the amount of questionnaire was 180, and 132 of them were returned, and 120 of them were effective. The returned questionnaires from groups mainly came from Jinjiang Group, Motel Hotel Group, Jinling Group, Huangshan Tourism Group, and there were 67 group questionnaires, and other 53 questionnaires came from the member hotels in the groups.

There are 40 questions designed in the questionnaire, and the 7-scale system is adopted to count the points by the positive direction. "7" denotes "very important/ agree very much", and "1" denotes "very unimportant/ disagree very much". Then the statistical analysis method is used to process the data and obtain the analysis result.

4. Analysis of empirical result

4.1 Empirical factor analysis

The principal component analysis method and the maximum variance rotation method were adopted to confirm the variable structure of the CRS functional factors, and the former 40 variables in 5 dimensions were inducted as 34 variables in 8 dimensions. And the factor loads of the items including "V13 Privacy guarantee, V32 Member reservation, V2 Reservation modification, V36 Message platform, V38 Client sharing and V11 Self-help confirmation" in each principal component had not exceeded 0.5, so these indexes were eliminated, and the factor analysis was performed again. The loads of 34 variables in the second analysis all exceeded 0.5, which indicated that the CRS functional factor possessed certain layer feature in the structure. For the credibility, the coefficient of α was adopted to measure the coherence degree, and except for the coefficient of the system management factor (0.676), the coefficients of other factors all exceeded 0.7 (about 0.8). Because the study in the article belonged to the exploring study, so the credibility

of these factors could be accepted, which indicated that the structure of CRS functional variables organized in the article was good. The result of the factor analysis is seen in Table 2.

The naming of CRS functional factors after factor analysis is seen in Table 3.

To test the rationality of the factor analysis, the variances of various factors were further analyzed. The character roots of 8 selected dimensional factors could explain 71.312% of the total variance, so the factor structure of the CRS functional factors could be obtained. To further prove the validity of the factor structure and whether the factor structure has the statistical meanings or whether it happens occasionally, the relative variance analysis such as the variance analysis of various factors with investigated persons' ages, learning levels and duties and the variance analysis of various factors with the star grade and the development of CRS of the hotel where the investigated persons lived in was performed. By the analysis, there were not significant differences between these factors and these investigated persons, so the hypothesis model and the factor structure proposed in the article have certain rationality.

4.2 Explanation of CRS functional factor model

The main difference between the result of the empirical analysis and the hypothesis model established in the article lies in three new factors, i.e. the channel management factor, the member management factor and the system integration factor. The generation of the channel management factor just validated the management demand of the domestic hotel group to the distribution channels. In the interviews, also all objects mentioned the management of the distribution channels. With the occurrence of more new distribution channels, the hotel chain specially set up a department to contact with these channels, so the hotel chain would be a whole (Wang Yonghua, 2004, P15). The generation of the member management factor also has its practical background. The development of the membership card has been popularized in domestic hotel groups, and many hotels which were interviewed thought that the membership management was the main measure for the difference service. The member clients' any consumption in the hotel group could be accumulated by the form of point, and these points could be exchanged with air mileages, so the membership management has been the effective approach to cultivate loyal clients for the hotel group. The system integration factor is the technical measure for the group to really actualize the "network marketing" and eliminate the "information island". At present, various information systems of the hotel group still in the state that each does things in its own way, and large numbers of information can not be shared, and the headquarters can not effectively acquire the management situation of various member hotels, and the information feedbacks are always in the lagged state. The solution of these problems needs the functional factor of system integration. In addition, if the system lacks in the feature of integration, not only the business flow will be blocked, the client data will be repetitive, inconsistent and false (Sigala, 2003). Therefore, the generation of the channel management factor, the member management factor and the system integration factor can be explained reasonably. For the group reservation in the hypothesis model, some variables are divided into the system integration factor by the factor analysis, and the residual various are renamed as the reservation tracing factor after analyzing, and the content of the reservation tracing is the content of the reservation management of hotel group in fact. Finally, perform further regression analysis to 8 confirmed factors, and various factors can gradually enter into the regression equation, so these 8 factors are the functional factors composing the CRS. If the exterior factors of the system establishment, the functional model of CRS (seen in Figure 2) can be obtained.

According to these 8 functional factors analyzed in the article, the hotel group CRS is established, and the hotel group can acquire following service functions in the management of reservation business to enhance the market competitive ability of the hotel.

(1) Offering real-time reservation and fulfilling clients' requirements for smart services. By CRS, the hotel can offer the products which the clients need in the shortest time, and acquire clients' feedbacks for the products and services in time to improve the products and services of the hotel.

(2) Offering self-help services and on-line communication to clients and enhancing clients' satisfaction degree. Clients can inquire information, collect relation information about the hotel in the short time and implement safe and real-time self-help reservation by the reservation website of the hotel group.

(3) Realizing real seamless connection in the interior of the group and exerting the function of the group resources. CRS will realize the networking and computerization of the hotel group, and really connect various departments and various member hotels which are in the "information island" at present.

(4) Quickly connecting international and domestic channels and realizing the function of channel management. The current electric distribution channel still needs off-line telephone or fax to confirm, but the group can establish more close and opening cooperation with the exterior network reservation centers (such as the global distribution system, C-trip, E-long and other tourism webs) by CRS, and realize the supervision and management to the distribution channels.

(5) Realizing effective client evaluation and digging clients' potential values. By the records and analysis of the client materials, CRS could offer interactive client relationship management in the whole process, strengthen the association

between hotels and clients, attract clients' attention to the products and services of the hotel, dig clients' demands, and provide the "possibility" to the "individualized" service and the "one-to-one" marketing for the hotel.

5. Model test and advices

5.1 The CRS functional model of the Nanjing Jinling Group

Nanjing Jinling Group is the hotel management group based on the Nanjing Jinling Restaurant. In the age of economic globalization, facing the powerful competition of international hotel groups, Jinling Group not only saw the forming and continually development of the new market, but confirmed the road of the collectivized development in 2003. And the group had realized that the collectivized development should depend on the modern science and technology, especially the information communication technology to large extent. At present, the group corporation takes the hotel chain management as the core business.

Depending on the self-management and the management output, Nanjing Jinling Group had realized the extension and growth, and developed to be the large-sized hotel chain enterprise with Chinese representative character and international level. In the top 300 world hotel groups of 2006 in "Hotels", Jinling Group ranked the 154th, and it had ranked the 5th of "the top 20 national brands in the Chinese hotel industry" for three years (Statistics Report of China Hotel Group Corporations of 2006). At present, Jinling Hotel Group has two brands including the "Jinling" Chain Hotel and the "JinYiCun" Chain Hotel, and up to June of 2009, it had managed over 50 hotels, and it is one of Chinese largest 30 hotels in 2009, and its hotels are distributed in Jiangsu, Anhui, Zhejiang, Sichuan and He'nan.

As the group grows continually and the management radius is longer and longer, and group begins to face following problems.

(1) The communication cost is higher and higher and the client management is more and more difficult. The group can not supervise and manage the subordinate hotels in time, and the management of the products lacks in strict supervision in advance.

(2) The management information of the group is more and more complex and dispersive, and the client information is hard to be collected and utilized. The headquarters of the group lacks in the data (especially the room management) which can exactly reflect the management status of the group and can not depend on statistical data to make strategic decisions in time.

(3) The subordinate hotels are in the state that each does things in its own way. The products of the hotels can not be reserved each other, and various hotels only push the sale promotion for their own products and services, and the uniform marketing strategy of the group is deficient, which will influence the extension of the brand.

To solve these problems, in Feb of 2004, Nanjing Jinling Group consigned a 5-year-planning with high jumping-off point, i.e. the "Total Strategic Planning of the Informationization Construction" to IBM. In the planning report, IBM put forward using the informationization measures to solve the management problems of Jinling. By comparing with foreign hotels, the management layer of Jinling Group found that there was large difference between Jinling and foreign hotels in informationization. So the Jinling Hotel Group begun to walk on the road of informationization. In the March of the same year, Jinling Group established the strategic cooperative partner relationship with the Huangzhou West Lake Software Corporation to develop the CRS of hotel group together, and in the March of 2005, the first CRS in Chinese hotel group was formally delivered, and in 2008, the second edition of the Jinling Group CRS was normally delivered. The CRS of Jinling Group mainly includes central reservation, regular program, group marketing and on-line self-help, and the functional model is seen in Figure 3.

(1) The function of central reservation. It includes the reservation of reservation center, the network reservation, the member reservation, the commission management and the client history management. CRS directly connects with all member hotels and can check various kinds of information of member hotels, such as the client file, the room resource, the restaurant resource and the meeting room resource. And it corresponds with the managements such as the system integration and reservation tracing of the CRS functional factor model.

(2) The function of regular program. It includes the client management and distribution, and it can help the hotel group to establish various client data systems and sales plans, and enhance the service quality and fulfill clients' individualized demands. It corresponds with the member management and sales management of the CRS functional factor model, and it also includes many functions such as point encouragement, point consumption, and storage consumption.

(3) The function of group marketing. It could analyze the management data by grasping the real-time resource, offer the marketing content for managers, realize the total marketing of the corporation networking, achieve client value and dig management and sales analysis. It corresponds with the client management and channel management (marketing) of the CRS functional factor model.

(4) The function of on-line self-help. It can realize the self-help reservation by the website and the window, and it mainly includes the room reservation, the order form inquiry, the room state inquiry, the client consumption, the

accumulated point inquiry, the modification of client material information, and the client communication and complaint. These functions are similar with the factor of self-help reservation of the CRS functional factor model.

(5) The exterior interface mainly realizes the connections of CRS with the exterior parts such as GDS, IDS, self website, distributor and technology.

The CRS functional model of Jinling Group mainly considers three factors, i.e. the group itself, the distribution channel, and the client management, which are basically consistent with the establishment idea of the functional factor model. So the CRS functional factor model in the article could be basically validated in the CRS model of Jinling Group. At present, the third edition of Jinling Group CRS is being planned, and it is hoped to bring competitive advantage for Jinling Group, which is the main reason that Jinling Group can say "no" to the middleman of networking reservation.

5.2 Advices for the establishment of CRS

The CRS functional factor model in the article is just an ideal framework, and in the practice of the hotel management, the establishment and implementation of CRS will be a long-term project which needs the continual investments and supports of manpower, materials and capitals. Because the capitals that many hotel groups invest to the construction of CRS are limited in certain time and the factors such as the sales management and the client management are gradually deepening in the system implementation, so the establishment of the system is a gradually perfecting process. When the CRS is established, the restrictions of current information system should be considered, so the hotel group should make the analysis of investment benefit, reasonably distribute limited capitals, plan the construction as a whole, implement various functional factors step by step, and gradually perfect the system.

5.2.1 Planning as a whole and giving priority to important aspects

In the interviews, some hotels had not implemented planning and prediction well when using CRS, and they only strived for the direction with more and better functions and technologies. However, in the actual development, because of the limitations of capital, time, technology, manpower and materials, the hotel group can not actualize all functional factors once, so the development time of CRS will be delayed, the charge will exceed the budget and some functions will not be practical. Therefore, when the hotel group establishes CRS, it needs a whole planning, and selects part important functional factors to come true first according to its practical situation. Nanjing Jinling Group is the best example, and it first made the planning with large costs, and gradually implemented the planning.

5.2.2 Considering users and optimizing the combinations

The development of CRS should first considers the combinations of various functional variables in the functional factors, and the hotel group needs to optimize and combine these factors and functional variables, and establish the CRS which can fulfill the actual demand of the hotel group. Because of the differences in the division of the organizational structure of various groups and the concrete responsibilities, the division of CRS functional model of various hotel groups should be made according to the actual functions and task objects of the organization. The strategies of various groups to the clients and agents should be different, and the combinations and selections of the functions should be implemented according to the actual situation.

5.2.3 Perfecting CRS continually and step by step

The construction of CRS should not pursue large and complete scale, because the clients' demands are changing continually. The client relationship management should be a long-term strategy for the hotel group, and it needs abundant and complete client materials and should deeply dig customers' demands. The implementation of the client management function needs the supports of all employees. Therefore, the hotel group should fully dig the exterior demands of the group to decide which functions these functional factors should possess and continually perfect CRS based on original demands. With the continual development of CRS, the hotel group should more clearly cognize the demands of CRS functions. According to the principle of "step by step", the CRS functions should be continually perfected. The continual updating of foreign hotel group CRS also indicated the importance of this point. In the case of the article, the second development of Jinling Group to CRS just showed the necessity that the CRS functions should be developed step by step.

From foreign examples, the contribution of CRS to the sustainable develop of hotel group is very obvious. At present, Chinese hotel industry is in the stage of large development, and though the research in the article mainly emphasizes the study of functional factors of CRS, but the continuous study can consider the development mechanism of hotel group CRS to seek the universal rules of CRS development, and offer constructive advices for the development of the hotel group CRS in China.

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Table 1. Definitions of CRS functional variables

Function dimension	Items in the function dimension	Item for short	Item code
Group reservation	Reserve the room real time according to client's requirements and confirm it right now	Real-time reservation	V1
	Modify the reservation according to actual situation	Reservation modification	V2
	Inquire why the reservation has not been completed	Reservation tracing	V3
	All room resources in the group can be reserved	Centralized reservation	V4
	Display all reserved room prices and room quantity in the group	Centralized stock	V5
	Seamless connection between PMS and CRS	PMS direct connection	V6
	Members can reserve the room each other	Members reservation	V7
Self-help reservation	Simple and convenient information search	information search	V8
	Clients can inquire real-time room price and useable room on line	Self-help inquiry	V9
	Clients can reserve the room on line	Self-help reservation	V10
	Self-help reservation can be confirmed	Self-help confirmation	V11
	Function of safe on-line payment	On-line payment	V12
	Function of privacy guarantee	Privacy guarantee	V13
	Obtain reservation help on line	On-line communication	V14
	Self-help manage basic information (such as order inquiry, modification and cancel)	Self-help management	V15
	Self-help historical status	Self-help history	V16
Sales management	Diversiform room price settings (classification according to room type and reservation object)	Room price management	V17
	Flexibly set up usable room reservation	Stock management	V18
	Various reservation statistical reports	Statistical reports	V19
	Reservation data analysis and prediction	Analysis and prediction	V20
	Sales promotion plan of reservation	Reservation promotion	V21
	Sales management of various reservation sources	Reservation sources	V22
	The group headquarters controls various distribution channels	Channel centralization	V23
	Agent reservation system and CRS seamless connection	Agent connection	V24
	Agents can follow their clients' reservations	Channel tracing	V25
	Diversity of commission management	Commission management	V26
	Analysis and prediction of channel reservation data	Channel analysis	V27
	Seamless connection between GDS and hotel CRS	GDS connection	V28
System management	System settings (such as personnel permission setting, system parameter setting)	System settings	V29
	System maintenance (to ensuring the normal running of the system)	System maintenance	V30
Client management	Client record management (such as new, inquiry and modifying)	Client record	V31
	Member reservation management (such as new, inquiry and modifying)	Member reservation	V32
	Member point accumulation management (such as point accumulation calculation and change)	Member point accumulation	V33
	Membership card management (such as issuance and loss reporting)	Membership card	V34
	Clients' opinions management (complaint and advices)	Clients' opinions	V35
	Client message platform (directly send messages to appointed clients at the same time)	Message platform	V36
	Analysis and prediction of client historical reservation	Client management	V37
	Client resource sharing in the group	Client sharing	V38
	Unit agreement file management (such as new, inquiry and modifying)	Agreement file	V39
	Analysis and prediction of unit agreement reservation data	Agreement analysis	V40

Table 2. Analysis result of hotel chain CRS key functional factors

Functional variable	Factor load							
	1	2	3	4	5	6	7	8
V8 Information search	0.739	0.044	0.172	0.150	-0.127	0.071	0.087	0.033
V9 Self-help inquiry	0.831	0.127	0.170	0.182	0.128	0.031	-0.031	0.040
V10 Self-help reservation	0.739	0.127	0.262	0.177	0.171	0.108	0.059	0.034
V12 On-line payment	0.604	-0.079	-0.023	-0.168	-0.057	-0.065	0.370	0.253
V14 On-line communication	0.732	0.127	0.108	0.223	0.091	-0.039	-0.029	0.002
V15 Self-help management	0.716	0.296	0.083	0.093	0.069	-0.048	0.058	0.162
V16 Self-help history	0.876	0.135	0.134	0.095	0.094	-0.020	0.157	0.075
V4 Centralized reservation	0.249	0.770	0.159	0.108	0.118	0.080	-0.117	0.003
V5 Centralized stock	0.281	0.682	0.210	0.125	0.097	0.059	0.038	0.107
V6 PMS Direct connection	0.076	0.588	0.162	0.218	0.094	0.201	-0.082	0.010
V23 Channel centralization	0.079	0.606	0.154	-0.050	0.228	-0.122	0.414	0.082
V24 Agent connection	0.150	0.725	0.133	0.348	0.196	-0.054	0.131	0.191
V28 GDS connection	0.001	0.651	0.141	0.283	0.027	-0.031	0.312	-0.080
V17 Room price management	0.010	0.342	0.719	0.182	0.026	0.051	0.117	0.115
V18 Stock management	0.326	0.066	0.795	0.091	0.148	0.011	0.039	0.173
V19 Statistical reports	0.243	0.234	0.715	0.126	0.182	-0.027	0.122	0.025
V20 Analysis and prediction	0.213	-0.041	0.783	0.184	0.099	0.018	0.035	-0.019
V21 Reservation promotion	0.281	0.253	0.524	0.160	0.285	-0.138	0.308	0.054
V22 Reservation sources	0.034	0.382	0.681	0.168	0.034	0.030	0.083	0.003
V31 Client record	0.229	0.406	0.144	0.639	0.121	-0.229	0.105	0.092
V35 Clients' opinions	0.153	0.062	0.099	0.796	0.089	0.105	0.090	0.048
V37 Client management	0.305	0.291	0.171	0.726	0.076	-0.049	0.098	0.156
V39 Agreement file	0.165	0.208	0.258	0.681	0.096	0.068	0.176	0.182
V40 Agreement analysis	0.084	0.315	0.304	0.726	0.171	0.103	0.102	0.232
V25 Channel tracing	0.053	0.148	0.093	0.236	0.788	0.125	-0.114	0.036
V26 Commission management	0.048	0.226	0.258	-0.003	0.818	-0.074	0.052	0.091
V27 Channel analysis	0.129	0.093	0.092	0.120	0.787	-0.096	0.207	-0.071
V1 Real-time reservation	0.167	-0.173	0.001	0.241	0.077	0.711	0.248	-0.117
V3 Reservation tracing	-0.002	0.104	-0.048	-0.195	0.024	0.832	0.016	0.098
V7 Members reservation	-0.101	0.180	0.088	0.122	-0.175	0.722	-0.280	0.043
V33 Member point accumulation	0.187	0.179	0.248	0.429	0.063	0.046	0.705	0.137
V34 Membership card	0.230	0.148	0.307	0.409	0.093	0.008	0.714	0.022
V29 System settings	0.205	-0.055	0.151	0.298	0.021	-0.008	-0.013	0.732
V30 System maintenance	0.119	0.202	0.047	0.142	0.021	0.058	0.113	0.832

Table 3. Naming of CRS functional factors after factor analysis

Factor		Coefficient of a	Variable combination
F1	Self-help reservation	0.887	V8 Information search V9 Self-help inquiry V10 Self-help reservation V12 On-line payment V14 On-line communication V15 Self-help management V16 Self-help history
F2	System integration	0.850	V4 Centralized reservation V5 Centralized stock V6 PMS direct connection V23 Channel centralization V24 Agent connection V28 GDS connection
F3	Sales management	0.877	V17 Room price management V18 Stock management V19 Statistical reports V20 Analysis and prediction V21 Reservation promotion V22 Reservation sources
F4	Client management	0.896	V31 Client record V35 Clients' opinions V37 Client management V39 Agreement file V40 Agreement analysis
F5	Channel management	0.751	V25 Channel tracing V26 Commission management V27 Channel analysis
F6	Reservation tracing	0.855	V1 Real-time reservation V3 Reservation tracing V7 Member reservation
F7	Member management	0.926	V33 Member point accumulation V34 Membership card
F8	System management	0.676	V29 System settings V30 System maintenance
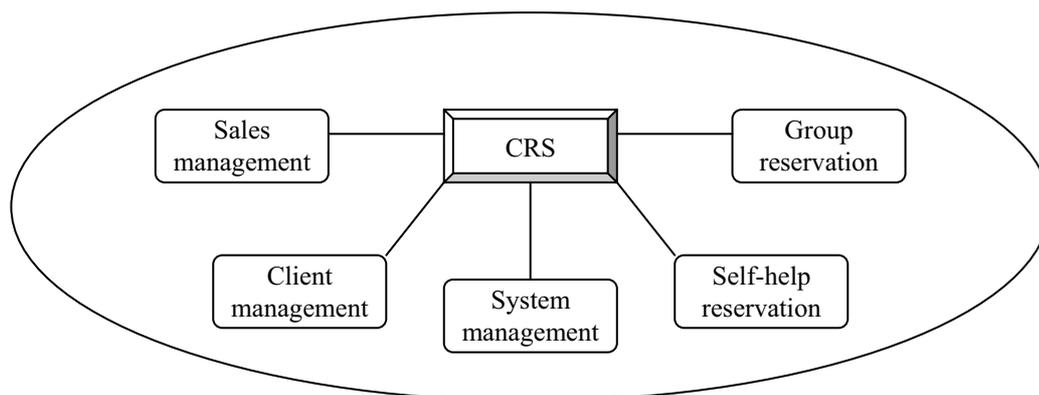
Figure 1. CRS Functional Factor Hypothesis Model
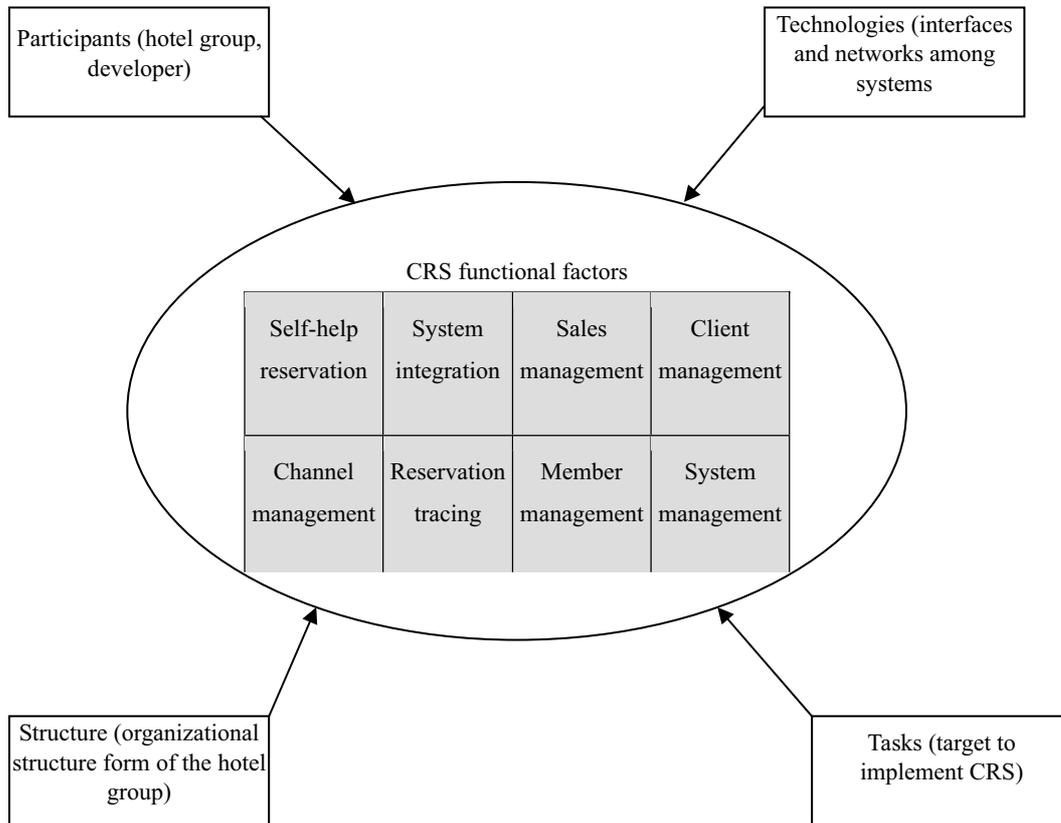
Figure 2. Hotel CRS Functional Factor Model
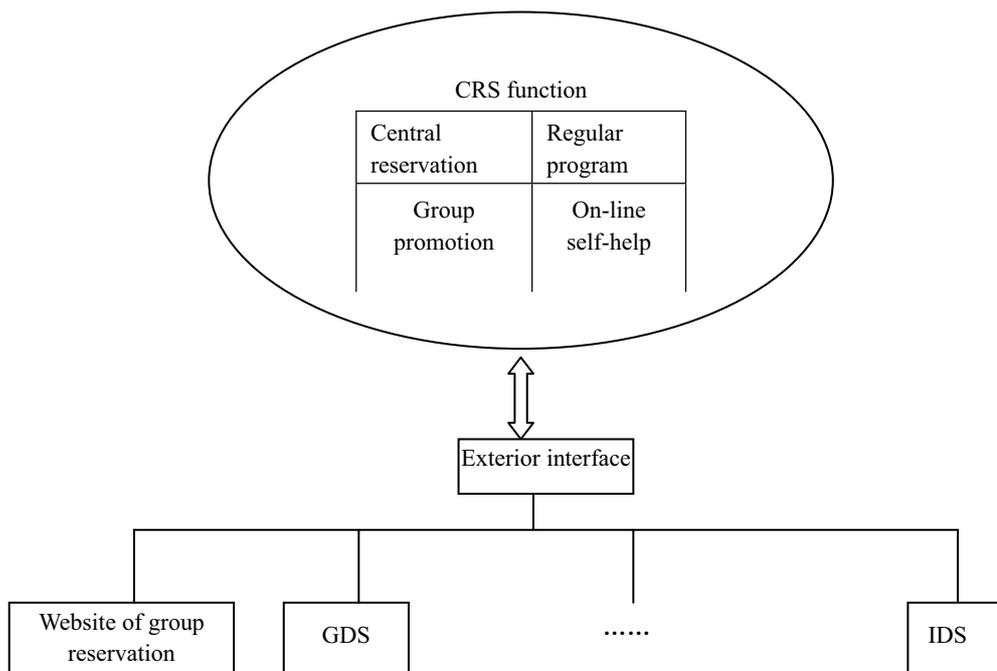
Figure 3. CRS Functional Model of Nanjing Jinling Group