# New management system design: stressing on data statistics and analysis

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| ARTICLE INFO | ABSTRACT |
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| | The paper is to lay special emphasis on study to design new management system into current information management in order to expand a method such as a library management information system. Studying data resources on hand and a new system model for information service management have been formed and realized, and at the same time problems of the hidden dangers of data redundancy get solved. The new system is called as a post-information management and the current system called as a pre-information management system. Whole information management system (IMS) consists of two systems, PrIMS and PoIMS. PoIMS is main foundations of statistics and analysis data. We offer a post-information management system which focuses on design system at data statistics and analysis with formulas. It is applied the retrieval combined models under multi-restrictive conditions and theories to the lending book rates in a library with PoIMS.<br> |

## Introduction

Current information service management and information platforms have entered many areas of life, which promote the development of the information industry and raise levels of service. Applying management software in fierce competition has urged developers in domestic and abroad to emphasize their management conceptions converted. There are a series of information management system, such as Business Process Reengineering (BPR), Enterprise Resources Panning (ERP), Application Service Provider (ASP), Customer Relationship Management (CRM), Supply Chain Management (SCM), 4th Party Logistics (4PL) and so on. Enterprises can be formed through the integration of individual businesses via electronic commerce and the internet. This is a useful management system with many functions, which helps seize more business opportunities and makes reaction quicker and generates higher yields as far as it possible from investment. Any applying information management systems show a feature of new economy times. The library that is often called as a center for information and literature is one of the departments that adopted more early computers to record and catalogue books. It has achieved great success with information technology in the book management area.

Along information science developing, the library have to absorbed more and more works of information technology and management science, so library science has been an important branch of management discipline. Following the development of information science, the library has absorbed ever more works of information technology and information management and becomes an important branch of information management, too. From a view of commerce, networking management is to lower cost and raise efficiency. Departmental data analysis can be used to produce development plans. Enterprises does not require for management until production develops to a certain extent. That is emphasis on concentrate management of production and technology, processing management, advancing management for the general matter. Libraries in China began computerized

management in 1978 and were networked in 1994. The special product for library management appeared as commodity, which produces important results that drive library management modernization.

Computerized library management systems are still a kind of substitute for tradition or handwork mode and process as design aim and use functions to resolve problems of physical document management. Electronic resources management does not substitute physical document management. There were many definitions of terms and concepts that had not been adapted or had been too restricted for current management. Almost all the academic and public libraries in the nation have been using a specialized system for about forty years. In this system, bibliographical and reader data have been accumulated for many years, but the data have almost been not used or totally not used and reused. The system attached some statistics and provided retrieval and other functions for physical document management. Essentially, there is no management of data analysis (DA), which is not incorporated in the specialized systems either domestic or abroad. Some libraries in the nation identified the fault and imported data from the system into a spreadsheet, e. g. MS Office Excel, in order to enable to take statistical processing and other analytical tasks. Some data warehouse's utilized multi data layers which offer services for department heads as well comprehensive plan and decision makers. One of more serious technological problems is that with the increasing speed in data transmission, server processing has become overloaded resulting in slowing down of systems in main libraries. Some company technicians propose the technological solution of separating subsystems into dedicated servers, which one server is used for public retrieval and another used for bibliography and lending records. Due to some colleges merging into universities, the growing number of students and college districts, there are many scattered computers in reading rooms accessing to a center server. The curators adopted only one access to record information in order to reduce working computers.

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It has been no a practically adaptable system which is able to solve these problems until the present.

**Necessity of Using New System**

Present management systems have been confined to manage information resources of documents in the information service areas in libraries. It lacks service management system for document information in delivering process, including service requirement, service gradation, service manner, service evaluation etc. An intelligent middleware developed facilitated linear correlation discovery between attributes and attribute groups to integrated existing data management analysis software [1]. Software measurement was the raw data associated with various elements of the software process and product [2]. With made an effort to survey by authors the management and analysis of data were organized with the current knowledge in disaster situations [3]. These do not perform a system of data statistics and analysis up to now. New system had better be intellective and standardization management of information resources and evaluation for librarians. Librarians have will to develop information services continuously that were previously handwork restrained by software merchant design models and restricted by management system. This kind of software system designed only for managers is considered to control internal proceed in library, share data and have access to database in interlibrary, but there are few deeply functions or extensive services for readers in the system. Introducing new information services and management concepts add items into new system as patron services. Simultaneously, the new system, which comprises of two independent subsystem, runs themselves items and shares data each other in computer network and server group in order to obtain a final goal that is concerning expansion, improvement of the information service. Since the application of an automated system, library has been accumulated large amounts of data. In particular, bibliographic data are up to ten thousand or hundred thousand. A unique reader information base is a profitable idea for merchants who are able to identify readers' requirement and offer readers some solutions. Large amounts of data need to be processed in one server while the DA needs to be completed by another, but the current system cannot do this and data cannot be extracted to show satisfactory results. The results may improve diversified library management and stimulate librarian to work hard for patron solutions, because there is no enough fund to cause system not to run in two separate servers or the system own which had been faults. It is significant that new concepts of library management are melted into redesign other new system had got content of data statistics and analysis based on "Reader/Customer Relationship Management".

**Presentment of Post-information Management System**

Management information system (MIS) is to use the opinions and the methods of the system engineering, analyze whole internal regularity of management information, gain accurate, fast and complete information process in order to raise management level. Then an integrative MIS is a single system of all information process and storage in management organization, but the system is not of extensive reliability. The system is very difficult to develop, practice and maintain that a great deal of information in database associates uneasily with formal MIS. There was foresight: a function powerful, data type full, concise and convenient MIS should include whole business category. It appears at intellective, multimedia information, and does not imitate management system with the traditional document

management and its aim is of decrease manual labor. It is inevitable that such a system has poor security, bunch volume of data, redundancy data, burden server, low transmission rate, and cause analysis information to be difficult.

The current system is generally to set data and manage first as automation system, so we call "pre-information management" system (PrIMS). The new built system, we call "post-information management" system (PoIMS), supplements preceding one and parallel running, which they do not replace each other. It is impossible that a set of server does support to retrieve or query large amounts of data [4] [5]. If we do like that, the data could have a directly negative influence on daily management tasks made by librarians, and then it occurs to emerge serious issue. As a result of it should be run by separate servers system, which is the application area of the PoIMS. The PoIMS is on the basis of chief service to patrons on data in the PrIMS. This system will have a broad application prospect and give great economic benefit though present data, as resources use very small or do not reuse fairly in library that existent data must be used in future, which can not know potential value and negative effect of data. A whole information management system (IMS) is composed of PrIMS and PoIMS.

Presenting PoIMS seems that information system used in 50s of the 20th century to decrease paper particular account paper expense, and in 80s Decision Support System (DSS) and Executive Support System, (ESS) were presented [6], and in 90s Information Resources Management (IRM) was presented. Because the volumes of data are plenty increase, the proceeding capability of the server is constrained and the server is linked customer numbers over, as technology, the whole IMS should consist of two parts such as pre-information management system and post-information management system. The work process of PrIMS is that data input—data store—data organize—data retrieve—data transform information, and then one of PoIMS is that data transfer—data store—data order—data organize—data retrieve—data transform information. They just have their own different and important work points that the former through management yielded information stresses on information and the latter through using management information got a conclusion that stresses on information/data analysis.

**Basic Features of Post-information Management**

Information management has been accepted and used in extensive fields by people until it is not fully defined up to now. It first used in society management institute such as library and information center where data store and data order were limited to the system. After new management conceptions and running methods' thrusting out constantly, information has been treated as high value resources not to be deleted or lost rashly. The modern information system is a core of information processing system with computer. Information value is decided by a condition of information processing and communicating if it realizes fully. In order to collect promptly and manage fairly information, it is necessary to develop information system using, as full as it can, social information resources.

The PoIMS, which is hysteretic but has all kinds of statistics and analysis ability, can provide more extensive information service than current system because new one is recombination based on primary data and uses fully held data excluding image data. The definite numbers of data have been accumulated, which have brought server processing capability lower, however, some of data need to be deleted, removed to other server or copied in current MIS. It is necessary to remove data in

reserve for raise efficiency of server running but not using is unadvisable. The first-rate analysis system should separate some retrieval items and all statistic functions from original system and add new analysis functions to reach the satisfactory goal of information service management system.

**Basic Features:**

(1) There are relatively stable data resources these are an explicit period of time, and then dynamic data resources do not have in favor of a stable conclusion.

(2) Information/data analysis may be processing on plenty or sponge data and spend long running time and large computer resources.

(3) It is not suitable to run DA for original design of data tables or relation with data and need to integrate these data tables and data again.

(4) Real-time unified DA lacks certainly technical support between heterogeneous database management system and single one is more easy.

(5) There are not further DA functions between original data and regenerative data of management in the current system and special analysis system is required.

Providing PoIMS adapts library automatic management to require urgently and can fully use present data resources and decrease equipment to invest. It is a kind of extensive service through separating some part of data from a single system to raise efficiencies of issues solved. As far as information management theories it is only a kind of transitional form that fully applies the conceptions of Data Mining (DM), Data Warehouses (DW), Knowledge Discovery from Database (KDD) to perfect information management in library.
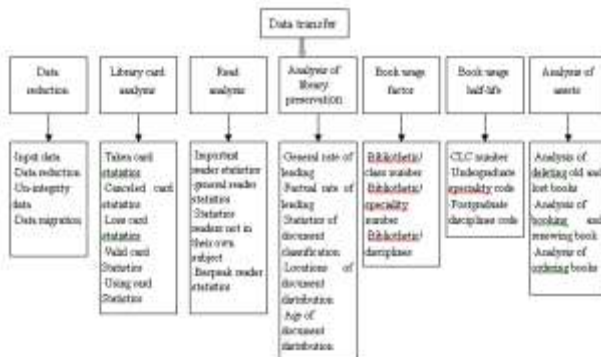
Fig1 is the part features of PoIMS.



**Fig1: part features of PoIMS**

**Main Differences from the Current System**

There is an essential difference of current management system in library from running MIS in enterprise and a great gap from solving practical problems in library information management.

**Transaction processing and information system**

There is same meaning and different treatment between transaction processing and information system. With deeply studying, the distinction of definite scopes between two of them expand. Therefore, functions of information system exceeded that of transaction processing, which people had not expected.

**Information management and management information**

Information management as a theory subject mainly studies information set for planning, organizing and controlling with information service including providing and using. Then management information uses equipment like computer to process data of only one apartment for concrete information. It attains to expect goal with planning, organizing and controlling

information and emphasizes to process information that comes from the enterprise relative internal management as the final goal to reduce cost.

**Management Information System and Information Management System**

Management information system wants to get precise, quick, overall information processing with viewpoints and methods of the system engineering to analyze and study synthetically internal regular of information on fully use value of information resources for raise managerial level. Library has information management as a chief object of management. The key functions of its system are relative internal work process with information of collecting, working, storing, retrieving, organizing etc and especially emphatic management of library information that is different from management system of enterprise. So we call the Information Management System (IMS) for practical and apply software program in library.

**Customer Relationship Management and Reader Relationship Management**

It is information of running layer such as Enterprise Resources Planning (ERP) and Customer Relationship Management (CRM) which are chief action to improve working process, ensure integrity and completion of fundamentally running action in management level of an enterprise for raise running efficiency. Enterprise management information must evolve from executive level to directing upper management level of decision-making, plan and control. CRM wants finally to realize the goal of customer obtained, reserved, devoted and benefited highly through significance communicating with customer whose action is comprehended and affected. Being customer's counselor will see satisfaction extent as the highest state. In library reader information is received through his borrowing and reading documents in definite time. Library storing information that is offered from Reader Relationship Management (RRM) built return to the reader. That is an important part to raise book utilization and improve book structure in library management. Using conceptions of enterprise management library can establish fair relationship with readers to be important link in facing an information period. Without a definite number of readers library would no be, nevertheless without a lot of readers library would not have existed

**Data Mining and DA**

Data Mining (DM), simply, is drawn or mined knowledge from large amounts of data. And it, a kind of intricate process, is also called Knowledge Discovery from Database (KDD) which is drawn formerly unknown, implicit and potential applying value or knowledge from a great many of databases. It is able to be found and taken knowledge through software tools. DA said here has special signification that patron obtains expected results by using retrieval language in stationary DA functions e. g. book usage factor [7] and book usage half-life [8] in system for regular, type clear and complete data. Between DM and DA on special signification there are different DA action that is more extensive application.

**Data Warehouses and Database Management System**

So far, the definition of Data Warehouses (DW) has not been unified. While, according to W.H.Inmon, DW father, generally accepted definition is that "DW is a purport management decision of process, orient-subject, integrate, temporal change, perdurable data sets". It stresses here that DW is a kind of system construction but not a product essentially, and is DBMS application of adopted itself. In present relational

database of DBMS can support many DW and meantime has functions of database integrate and DA. Though DBMS may achieve efficiently these functions of inputting data, retrieving data and maintaining data, it is not able to find connection and regulation in data and predict development trend in future in the current data. It is required technology and tools of intellective, automatic exchange data into information and knowledge.

There is, moreover, different comprehension for data and information:

• Data are facts without explanation or primitive expression while information is data explained or records, classified, organizational, relevant data within transfer signification.

• Data are raw and processed materials that describe what happened but can not construct or behave basic reliably. Some connections are found with analyzing for data and some meaning was afforded to them that formed the so-called information.

• It is knowledge that useful information is. Knowledge may be defined as a group of logical connections in information blocks, and such a relation is discovered through context or found by adjacent degree of process. Such the knowledge is formed through comprehending its model from information.

• Any reports are still data, as it should be paid an emphasis on the role of information and information definition broadened before these not to be absorbed or decided factors send management division.

• Data refer generally to property value that is a type of digit, text, language, voice, image and so on as a way of raw materials of information. Information, which is a kind of meaning data, has a relationship of raw and result with data, after the data have been refined, winnowed and analyzed. Information comes from data and reveals data character and intention. Information is valuable knowledge to make the policy and is also resource. It is able to make people engaged in effective management as a tool in economic and society action.

**Studying Main Points of New System**

Many applying DW tools such CRM are merely to transfer different data source to DM as a prophase tool of DA. DBMS is generally used to manage transferred data before it is not clearly defined DM. It is difficult to make real management because of data format and type discordance from different data source. Data of PoIMS come from certain data source and have coincident data format and type. After deleting repeat and unworkable data we can engage in DA and obtain meaningful results at preset analysis functions.

Application soft developed to combine DM tool with DW is part [9] but not entirely use in library. There are different IMS and data types in each library and these defects are difficult to implement in present system. Soft system for main service is developed separately based on present data and design idea of PoIMS that has not theory available or is in the absence of theory support. PoIMS has computer network, server performance, datum volume as fundament, moreover not only to resolve technology problems of computer and data table structure but also to resolve problems of soft system and data security. So first to resolve main points:

**(1) Tasting data transmission in network**

Since direct causes of setting the new system proceeded from large amounts of data it took more 30 seconds to operate back of database direct results. Where do bottlenecks come about? These are contingencies of network transmission,

processing competence of computer, application soft, storage mediums.

**(2) Tasting speed of retrieval large amounts of data for server performance**

What are large amounts of data? It means that a volume of data bring about running speed down apparently and that is said its phenomena of display results are apparently slow when user writes or reads data in normal orange of computer running and its definition is in the case of related performance of computer running. DA is first considered how solutes a problem of retrieval speed slowly for large amounts of data.

**(3) Tasting speed of retrieval large amounts of data for data tables**

What standards do the engineering designer divide data fields and data tables of information system in relational database? He considers whether large amounts of data give an impact between data tables.

**(4) Data transfer and DW built**

How is fashion DW built under data transfer which requires to be transferred and how many volumes of data give an impact on? How do some concepts of DM used combine with arrange data before data transfer? The former is to obtain results of DA by mending, deleting, adding manner for substandard data and the latter is only complex process to extract unknown, valuable mode or rule knowledge from a bulk of data.

**(5) Theory reliance and functions design**

PoIMS conceptions are exactly defined and PoIMS is now in the position and relationship with present system. PoIMS terms and definition are adapted to management system range. This is available for used data and reuse data. It is what practical contents have in RRM. What functions have in the system and how have to distribute?

**(6) Application soft realizing purpose**

What problems are able to solve in a set of PoIMS? These which of functions have existed and which have not adapted and which should or must have been offer theory reliance to adapt new developing system in future. They will be compatible between information stream and data stream in finally built new system. It attains to lend or return among each district library and realize sharing document resources through DA to solve usual problems of books and journals maldistribution.

**(7) Appling new theories**

Retrieval combined models under multi-restrictive conditions are an information retrieve theory that were built under

conditional probability. If $A_i = \prod\limits_{p=1}^{n} A_p) \bigcup\limits_{q=1}^{n} A_q$  ($i \geq p$, $q$ ; $p \neq q$), see (1):

$$P(B|(\prod\limits_{p=1}^{n} A_p) \curlyvee\limits_{q=1}^{n} A_q) = \frac{P((\prod\limits_{p=1}^{n} A_p \, I \, B) \curlyvee\limits_{q=1}^{n} A_q)}{P((\prod\limits_{p=1}^{n} A_p) \curlyvee\limits_{q=1}^{n} A_q)} \quad (1)$$

There are two kinds of lending book rates. Along with the large scale introduction of the computers and information processing to enhance the degree of automation, labor makes statistical data be easier and change the original manual. This is some statistical formulas which are often used at current library.

$$R_1 (\%) = \frac{A_f / t}{S_f / t} \times 100\% \quad (2)$$

In where R1 is a lending book rate on theory, Af is real frequency of lending books/time and Sf is standard frequency of lending books/time.

$$Sf = a \times b \times c \qquad (3)$$

a: defined number of lending books per reader
b: defined number of lending book times per year
c: number of the kind of readers
R1 (%) may be more than 100%.

$$R_2(\%) = \frac{\sum A_d / t}{S_d / t} \times 100\% \qquad (4)$$

In where R2 is a lending book rate of reality, Ad is factual number of lending book days/frequency and Sd is standard number of lending book days/frequency [10].

$$S_d = f \times h \times c \qquad (5)$$

f: defined number of lending books per reader
h: number of days per year(365)
c: number of the kind of readers
R2 (%) must be less than 100%. The theories applied in PoIMS had run very well through testing.

**(8) Appling new analysis formulas**
• Book usage half-life, see (6).

$$\ln x - \ln x_0 = -kt, \qquad \ln \frac{x}{x_0} = -kt \qquad (6)$$

$$x = x_0 e^{-kt} \qquad T_{\frac{1}{2}} = \frac{\ln 2}{k}$$

Where the k is the decay constant, the x0 is the maximum numbers of usage, and the $T_{1/2}$ is half-life. When the t = 0, the total amounts of checkout books is x0, c=ln x0.
• Book usage factor, see (7).

$$B = \frac{checkout \quad number \quad of \quad one \quad kind \quad books}{total \quad checkout \quad number \quad of \quad same \quad class \quad books} \qquad (7)$$

It is the rate of checkout amounts of books which a kind of books compares with different kinds in the same class of books into library in current year. The book usage factor may evaluate a kind of books via factor value.

**(9) Achievement of new management system**
It called as "literature resources statistics and analysis system" was developed By Nanjing of Book and Information Technology Co. Ltd. according to above design ideas and the analysis of data shown the calculation of book use factor for a university library, see Fig 2.



**Fig2: statistics and analysis management system**
**Conclusion**
The different research areas, in one word, at information process all used themselves terms. An enterprise management uses MIS while library should use information management system (IMS) which was also called automatic system few years

ago. Computer technology uses "query" as term through data sets classified to search corresponding character string and library staffs use retrieval language through retrieval words and phrases (subject term, free term) to finish information retrieval in retrieval item. A decision-maker in enterprise thinks sponge information is irregular at the present and needs utilizing DM implement for acquisitive knowledge. But an information administrator in library thinks document information is regular and librarian engages in standardization job of the machine readable catalogue (MARC) format for a long time, which librarian can obtain reliable result through using normal function of the information analysis. People think useful information is namely knowledge while librarian calls useful information as information resources. Interdisciplinary studies offer a vast development space for information technology and all sort of conceptions infiltrated and accepted arch other have information system applied availably in various areas.

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