

Comparison for the Characteristics of the OA, MRP, and ERP Systems

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Abstract. Information systems play varied roles in businesses and in the growth of businesses as a result of advancements in computer technology. On the comparison of MRP and ERP and the development process, certain scholars have offered their perspectives. There are, however, few researches that compare the traits of OA, MRP, and ERP in detail. In this paper, the features of office automation systems, material demand planning systems, and manufacturing resource planning systems are contrasted and discussed along with their historical development, present state, and various system goals. This study provides a summary of the OA, MRP, and ERP systems. The three MRP development stages are outlined, along with the distinctions between the relevant environment, production process, capacity needs, fundamental parts of e-commerce activities, management modules, and other characteristics. Enterprise managers can effectively improve the office and production efficiency of enterprises by analyzing, designing, implementing, and combining management knowledge of different systems. These results shed light on guiding further exploration of understanding the comparison of three system characteristics.

Keywords: Information system; OA system; MRP&ERP system.

1. Introduction

For all levels of management at the company, the information system is a system that delivers suitable information based on internal and external data through formal procedures. When computers were first used in trade in the early 1950s, enterprise systems had their basic framework in place. The management information system was introduced in the 1960s to take the place of the conventional EDP bookkeeping system. The first generation of OA office systems, which mostly dealt with single affairs, was introduced in the late 1970s. It quickly developed and had embryonic functions in the middle of the 1980s. Early in the 1990s, OA progressed broadly. Process OA is the name of this level. After 1990, speech, image, audio, and video technologies were better integrated into office automation systems to produce more sophisticated office automation [1]. Office automation systems in China have evolved from being used in government offices to being used in businesses. As Internet and information technology have advanced, the OA systems have become collaborative offices that use Internet and Intranet technology to remove resource constraints and enable the sharing of information, business, and resources.

Soon when MRP first debuted in the 1960s, people began to understand and accept it. Four stages of development have been completed thus far: basic MRP, closed-loop MRP, MRPII, and ERP. The production system in the 1960s was centered on inventory control and how to efficiently manage a vast number of suppliers. The initial program automates manual processes including bookkeeping, invoice generation, and inventory control throughout this time. also rearranging [2]. Basic MRP was first primarily utilized for order management and inventory control. The backdrop is the mass production industry's low-cost competition. At that time, businesses were primarily concerned with how to manufacture the intended products on schedule in order to combat inventory shortages and backlogs. In the 1970s, businesses sought to maximize profit while requiring the least amount of capital outlay. As a result, the MRP system must promptly examine the financial situation and integrate it with the production/operations system. Hence, a closed MRP with a feedback function is displayed [3].

Computer technology is primarily used in modern office automation, important programs include Word, Excel, PowerPoint, and others. The usage of office software has made office work

considerably more precise and efficient. Office automation computer technology includes the use of network technology, multimedia, word processing, data processing, and other information processing technologies [4]. Online services (Internet of Things) have lately been included into office automation systems to improve functionality and user convenience [5]. The extension of internet connectivity into physical items and ordinary objects is known as the "Internet of Things" (IOT). According to Köksal and Tekinerdogan, the Internet of Things (IoT) technology has transformed industrial processes and been used to a number of commercial and governmental tasks [6]. According to Ayaz et al., Elijah et al., and Zhang, industries including manufacturing, healthcare, communications, and agriculture have helped to reduce inefficiencies and improve performance across all markets [7].

In the material demand planning (MRP) system, Alireza et al. offer a systematic technique to minimize overall cost and stress based on the right batch strategy. The model is run using the system dynamics (SD) approach by assigning various situations in accordance with the safety stock and batch adjustment strategy [8]. In their study, Mohamad Jihan Shofa and Wahyu Oktri Widyarto evaluated and contrasted the efficacy of MRP and DDMRP (Demand-Driven MRP) in terms of the system's inventory efficiency, highlighting the advantages of the latter. DDMRP attempts to link the availability of resources and materials with the state of the object by using a bill of materials (BOMs). By assessing and contrasting the lead time level and inventory level performance of DDMRP and MRP, it eliminates the disparity [9]. Based on the ERP life cycle framework, the classification method, and the content analysis of Esteves and Bohooks, Mahmood Ali and Lloyd Miller undertook a systematic evaluation of the ERP installation literature with a focus on big enterprise organizations. This review provided practitioners a base from which to plan their implementation and lower the risk of failure. It gave researchers and practitioners direction, enabling them to have a thorough understanding of published research work and its conclusions, which improves understanding of ERP implementation and may be used to address operational challenges during the implementation process [10]. ERP is a new model built on the original, often known as cloud based ERP or SaaS ERP, given the successful history of cloud computing and the increasing pressure on enterprises to comply with specific customer expectations in increasingly competitive business environment. By utilizing the advantages of cloud computing, it provides a fresh, flexible method for hosting and using ERP systems. The user's browser can be used to access the cloud-based ERP system. Additionally, businesses just need to pay to access a computing environment via the Internet; they are not required to pay to establish a computer environment.

The purpose of this study is to contrast and evaluate the traits of the three systems. It begins by outlining the fundamental ideas, goals, benefits, and drawbacks of the OA, MRP, and ERP systems, respectively. Second, it contrasts many parts of the three systems' characteristics, follows with an explanation of their shortcomings and potential for growth, and then comes the paper's conclusion.

2. OA system

OA is the abbreviation of office automation. It is a novel way of working that utilizes the internet to connect modern offices and computer technologies [11]. It uses network information platform technology and software for enterprise collaborative office and internal management. To be specific it carries out efficient information management for materials and files involved in administrative office, realizes information disclosure and resource sharing, and makes office management standardized, efficient and automated.

2.1 Fundamental principle

System engineering serves as the theoretical underpinning for office automation, which is a comprehensive application of computer and communication technology to fulfill various office tasks. By merging internal and external data from businesses and employing scientific mathematical models, OA serves as a guide and foundation for executives' decision-making. Middle-level managers' work quality and deployment efficiency can be improved by using the data information recorded in various

business links provided by the platform information exchange function. Through system synergy, all departments can collaborate and handle matters on the basis of information sharing, thus regular employees of the business can monitor and control the business process.

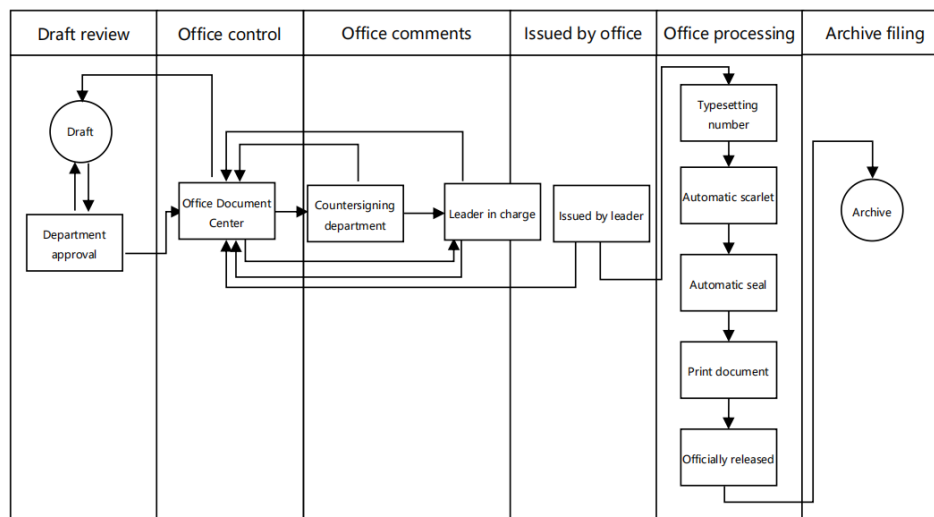


Fig. 1 document management flow chart of OA system.

2.2 Task objective

The enterprise relies on the platform to realize various functions such as document management, as showed in Fig. 1, personnel management, meeting management, attendance management, e-mail management, document receiving management, document sending management, etc., helping the enterprise to plan its daily work system, promoting communication and cooperation among employees, and monitoring business by leaders.

2.3 Strengths and weaknesses

2.3.1 Strengths

The OA system can realize communication and approval without being limited by time and region. Communication and file transmission are time-effective. For emergency work, automatic supervision and reminders can be set according to the time limit, which greatly improves work efficiency. As an online network office platform, OA system can solve all kinds of inconveniences brought by paper-based office. It replaces the previous paper-based office in business application and approval, document upload, file retention, etc. in daily office of enterprises, reducing paper costs and labor costs. Each department in it realizes the sharing of information resources, so that employees can timely understand the latest information inside and outside the enterprise. Through the internal database retrieval function of the system, it is easy to quickly find the required documents and information, and realize the creation, storage, retrieval, sharing and archiving of informatization documents and materials, so as to carry out targeted follow-up and approval in the later period [12].

2.3.2 Weaknesses

For large businesses, creating a full OA system necessitates needs a lot of labor, material resources, and financial resources. The internal operations of the office system change along with the company's strategy, which increases the cost to run and maintain the office system. A sophisticated system for human-computer interaction is the OA system. Malicious attacks may target each individual link [13].

3. MRP system

Material Resource Planning (MRP) is a way of planning for linked resources that not only regulates inventory but also assures output. As illustrated in Fig.2, it follows the master production plan in the system for production planning and management. As actual production conditions change frequently, the fundamental MRP plan may be constrained by supply capacity or transportation capacity and cannot ensure the prompt availability of resources. To compensate for the deficiencies of the basic material demand plan, the closed-loop material demand plan was developed. A business formulates a production plan and a master production plan based on its development requirements and market expectations, respectively. MRP assesses the capacity and load of critical resources to guarantee that the master production plan and material demand plan's capacity needs are met. It combines planning, implementation, and feedback [14]. Oliver presented a novel concept for a comprehensive enterprise management system, manufacturing resources planning, in 1977. MRP II stands for manufacturing resource planning in order to distinguish it from material resource planning (MRP).

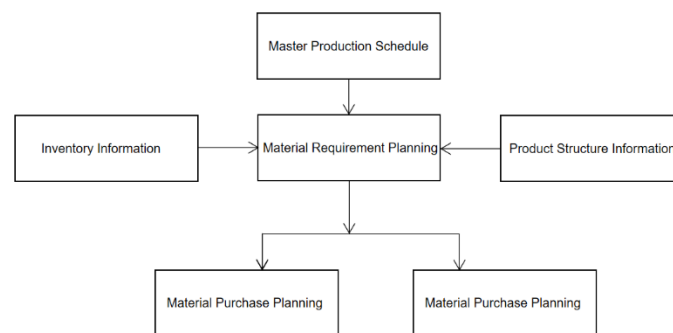


Fig. 2 simplified MRP logic flow chart.

3.1 Fundamental principle

The fundamental idea of MRP is to compute the detailed demand plan of relevant materials based on the master production plan, product composition, and inventory data of relevant materials, and to provide processing plan or buy plan recommendations. Through mastering the production cost and capital operation process, MRP II adjusts the business sales and production and manufacturing plans of the enterprise. It converts resource requirements, such as facilities, equipment, personnel and materials, into financial demands, and transform production output into monetary conditions [15].

3.2 Task objective

The purpose of MRP is to satisfy the objectives of the master production plan outlined in the product plan by providing the correct components at the appropriate time. MRP II relies on basic data such as bill of materials and process routes, as well as information flow management such as customer information and supplier information, as its working concept. It includes business planning, sales planning, production planning, resource demand planning, master production plan, material demand plan, rough / fine capacity demand plan, procurement management, and workshop management as the main lines of logistics. In addition, cost management, AP management and AR management, and general ledger management are served as the main lines of capital flow.

3.3 Strengths and weaknesses

3.3.1 Strengths

Basic MRP system offers numerous potential benefits for manufacturing enterprises, including helping manufacturing managers reduce stock inventories and related transportation costs, tracking the quantity needed for safety inventory, selecting the batch of orders that will be the most cost-effective, allocating of manufacturing activities among various products, and making future capacity

plans [16]. Taking the latest start and finish times as the time benchmark, it maximizes the flexibility of resources, with periods referring to the conclusion of the term.

3.3.2 Weaknesses

As for basic MRP system, the disadvantages are given as follows:

The system itself cannot control and master the MPS plan at the source;

It is difficult to ensure the implementation of relevant procurement plans because the procurement process is not involved;

Workshop operation is not involved. Workshop is the key object of material supply and control.

Even for closed loop MRP, it still has defects: focusing on logistics, but not involving capital flow; lack of information on capital flow will adversely affect the optimality, reliability and feasibility of production plans.

4. ERP system

ERP is a complete and systematic management platform based on information technology, employing sophisticated enterprise management concepts, inheriting all company resource information, and providing organizations with decision-making, planning, control, and business performance evaluation [14]. It refers to multi-module software used to manage and administer a vast array of operations that benefit factories and other businesses. As exhibited in Fig. 3, ERP may aid in data gathering, archiving, parts procurement, product planning, inventory management, and consumer service [17].

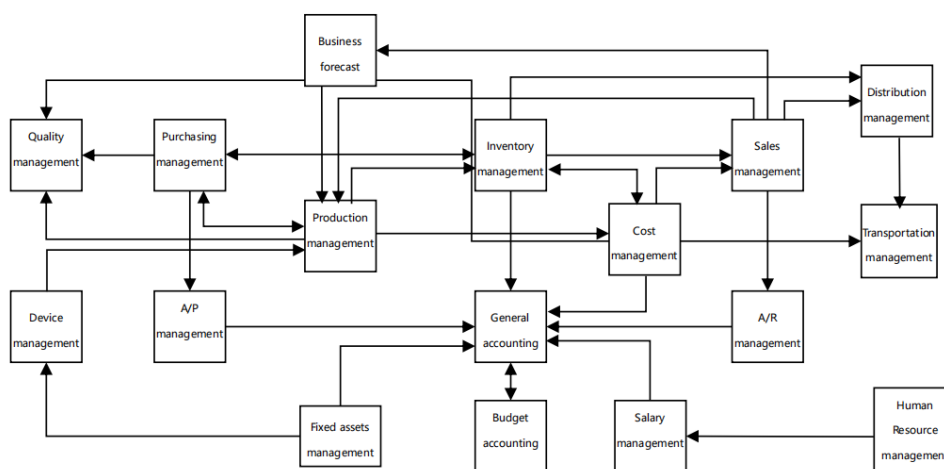


Fig. 3 A sketch of the ERP.

4.1 Fundamental principle

The principle of ERP is to build a single data repository including all the business data gathered by the company while conducting business operations, including financial information, production data, people management data, and any other data [18]. Internet/Intranet/Extranet, electronic commerce, and electronic data interchange are supported by C/S architecture and distributed data processing technologies [14].

4.2 Task objective

The primary objective of the system is to connect business operations inside the enterprise and across functional and technological barriers by enhancing workflow, standardizing business practices, and acquiring the most up-to-date real-time data [19].

4.3 Strengths and weaknesses

4.3.1 Strengths

The benefits of implementing ERP systems include better planning and management of production, human and material resources, inventories and physical resources, as well as monitoring and regulating financial performance for goods, clients, business lines, and geographical areas [20]. In addition, it is of critical importance to advancing the holistic growth of enterprise logistics, money flow, and information flow. Moreover, it has the features of standardization, quantification, and precision of corporate processes, organizational structures, and management styles, which increase output and operational effectiveness.

4.3.2 Weaknesses

The stereotyped, standardized, and rigorous structural management promoted by classic ERP faces a major challenge in the competitive context of rapid development where the organization, business, and management of firms are frequently in a state of change. Less than 30% of ERP implementations in China are successful, and these successful implementations tend to be in large businesses rather than small and medium-sized ones. The cost of setting up a full ERP system, including the price of the hardware system, the software system, and the cost of the human resources, is considerable at first. The application software server, database server, software and database backup system, storage system, etc. are all included in the hardware cost as its main component.

5. Comparison

In terms of system functions, OA focuses on the collaborative management of enterprise administrative affairs, such as document management, information management, process approval, etc. through analysis, processing, transmission, storage and maintenance of various information for system management, cumbersome office documents and a large number of documents can be systematically and uniformly managed through computer equipment and networks [4]. MRP can effectively make plans and manage materials in production. ERP, as an integrated cross functional software, has the function of financial cost control in the company's manufacturing, distribution, human resources and business process reengineering, and uses transaction data for decision support and business analysis [21].

As for the object of use and the applicable environment, the OA system is applicable to enterprises and government affairs units to achieve internal affairs coordination and management; MRP and ERP are applicable to manufacturing enterprises involving production and processing.

Regarding to the production process and capacity requirements, basic MRP needs to consider product structure information and inventory information. The premise of production is that all plans are feasible and achievable, but the actual production conditions are constantly changing. Therefore, it is often difficult to make assumptions. Closed loop MRP adds a planning and control link to the basic MRP, and proposes a demand plan for capacity, that is, production is carried out under the condition that the master production plan and the material demand plan are feasible.

For the basic elements of e-commerce activities, MRP mainly focuses on logistics and has relatively perfect control over production plans. However, the input of raw materials and the output of products are accompanied by the flow of capital, which plays a particularly important role in the production and operation of enterprises. On the basis of focusing on the core of logistics, MRP II adds the management of capital flow and information flow, and adjusts and controls the production and operation planning of enterprises by mastering the production cost and capital operation process.

With regard to management module, MRP II focuses on the management and control of human, talent and material resources of enterprises, while ERP integrates the management of customer needs, internal manufacturing activities of enterprises and manufacturing resources of suppliers to form a complete supply chain, adds transportation management and warehouse management, multi factory management, quality management, laboratory management, equipment maintenance and spare parts

management, etc., and expands the management of customer needs, supplier resources Internal manufacturing activities of enterprises are integrated into a more complete supply chain.

From the perspective of business scope and information sharing, MRP II supports the production operation and information exchange of local enterprises. Nevertheless, as businesses continue to grow in size, numerous groups and factories now demand unified deployment, and the entire supply chain now requires information management [14], which goes beyond the business scope of MRP II. ERP supports cross regional and transnational coordinated production, and realizes integrated management of information in the whole supply chain.

In terms of transaction control, the implementation of MRPII lies in post event and in-process processing. ERP has higher simulation function and decision support ability, and pays attention to the enterprise's previous event analysis and real-time control ability.

6. Limitations and Future outlooks

6.1 Limitations

6.1.1 OA System

As for OA, it needs to spend a lot of money to operate and maintain. In the face of changing company development strategies, it constantly adjusts the functions and contents of the office platform. In addition, Information security and privacy issues: office automation systems provide convenience for the internal information transmission of enterprises, but also bring security risks to enterprise information and data, especially the security of important computer files and intangible assets. Therefore, enterprises must pay more attention to information security management issues. Some enterprises have insufficient awareness of network virus prevention, lack of professional information security management personnel, and computer viruses from outside will lead to the leakage or destruction of users' work information [22]. Moreover, the office automation management system is not perfect. With the increasingly complex business processes of enterprises and the linear growth of massive information, for some enterprises, more often than not, OA systems only provide a function of information release and viewing. Besides to daily office work, large enterprises also have personnel, customer, finance, sales and other management requirements. The establishment of various information systems by enterprises can rarely be coordinated, and enterprises often face the problem of having to work on different application platforms The trouble of switching between databases is that some office automation systems can not play the role of "integration".

6.1.2 MRP System

MRP can only manage information and data in inventory production and other aspects, which is limited to the tracking of small supply chain information, and there is no data mining and analysis. Moreover, MRP only manages the information of the business system of the enterprise, and does not take into account the operation system of the enterprise. With regard to MRP II, the expansion of enterprise competition requires strengthening management in all aspects of the enterprise, and requires integrated management of the enterprise's overall resources rather than just manufacturing resources, which MRP cannot meet. MRPII cannot address the issue that information management needs extend across the whole supply chain. As the trend of information globalization continues, firms must increase information interchange and sharing. Competition and cooperation among enterprises are becoming more and more international. It is far from enough to limit information exchange between local enterprises.

6.1.3 ERP System

As for ERP system, implementation is laborious. An ERP system's deployment might take three to five years in a large firm. This period is lengthy and requires a significant investment of both time and money in a corporate environment that is always changing. There are many different versions and types of ERP system. Different manufacturers have their own characteristics and emphases, and

module settings are also different. If the software does not meet the characteristics of the enterprise and the requirements of internal control management, the effect of internal control may be affected [23]. Small and medium-sized enterprises have low ERP implementation intensity, unsatisfactory implementation and low practicability

6.2 Future outlooks

The intelligent OA system of the office system must assist users in performing some basic intelligence (BI, Business Intelligence) analysis, providing decision support, knowledge mining, business intelligence, and other services, moving the office system, migrating different PC functions to mobile software, realizing instant messaging, and enabling business processing to be done whenever and wherever. In order to provide more effective integration solutions for MRP and ERP systems, develop to more small and medium-sized firms, evaluate all types of manufacturing systems in-depth, and examine the guiding principles of related production management theories and the key to success. The development of ERP will eventually extend beyond manufacturing to other sectors, include information integration across all business operations, and broaden the extent of information integration [24].

7. Conclusion

With the rapid development of computer Internet, whether enterprises can reasonably design and use information systems has become the core index to measure the modern management of enterprises. In this context, this paper conducts a comprehensive investigation on the development history and current situation of office automation system, material demand planning system and manufacturing resource planning system, compares and combs the different characteristics of the three systems in combination with the principles, task objectives, advantages and disadvantages of different systems. In detail, this study summarizes the functions, applicable environments, production processes, capacity requirements, basic components of e-commerce activities, and functions of OA, MRP and ERP systems Differences in management module, business scope, transaction control, etc.

Nevertheless, it should be noted that there isn't enough study or analysis on the most recent three types of systems in this study, and both the content and research have hysteresis. In the future, the intelligent systems based on computer technology will be more and more widely used and valued as traditional enterprises increasingly deal with the situation of digital transformation and the ongoing change and development of implementation strategies for non-traditional enterprises. Overall, these results offer a guideline for managers in comprehending these three systems, which are intimately tied to the organization. It can also assist managers in making reasonable use of computer technology to assess, develop, implement, and operate the system in conjunction with management expertise.

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