

Original Paper

Productivity Measure in Using Enterprise Resource Planning System in Selected Companies in Beijing, China

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Abstract

With the globalization of economic development and social development, the business environment of enterprises has changed. Only by continuously improving the digital level and management level of enterprises can they survive in the fierce global competition and develop. In this economic and social environment, enterprise managers need to implement Enterprise Resource Planning (ERP) system in order to better operate and manage enterprise business and improve enterprise operating profit. Its purpose is to standardize and restructure enterprise process, financial process, capital flow and information flow, and improve enterprise operation ability, profitability and growth ability. The implementation of ERP system will have an impact on the level of enterprise productivity. Therefore, taking manufacturing companies as the research object, it is of great significance to explore the impact of ERP system implementation on the level of enterprise productivity.

Taking the manufacturing companies selected in Beijing, China as the research object, this paper uses the method of combining theoretical analysis and empirical research to study the impact of ERP system on enterprise productivity and enterprise performance, so as to improve the industry's understanding of ERP system. This paper uses data statistics and empirical research methods to analyze the impact of ERP system on enterprise productivity and enterprise performance. Firstly, it introduces the background and significance of the research, and then reviews and combs the relevant literature at home and abroad on ERP system, enterprise performance and the impact of ERP system on enterprise performance; Based on management information system theory, business process reengineering theory and financial performance theory, financial performance is measured from three aspects: operation ability, profitability and growth ability. Reasonably select relevant indicators to build the index system. This paper selects the enterprise financial data of Beijing manufacturing company implementing ERP system from 2013 to 2015, and uses the data model to make an empirical analysis on the impact of manufacturing company implementing ERP system on enterprise productivity and enterprise

performance. It is found that in China, the implementation of ERP system by Beijing manufacturing company will have a certain impact on enterprise productivity and enterprise performance. Combined with the principle of ERP, this paper discusses the impact of ERP Implementation on enterprise performance. In the empirical research part, descriptive statistics and Wilcoxon paired rank sum test are used to verify the impact of ERP Implementation on enterprise performance.

The results show that the implementation of ERP system will improve the operation ability, profitability and growth ability of enterprises. Therefore, when preparing for the ERP system, enterprises must do a full feasibility and demand analysis to ensure the smooth implementation of the ERP system. Finally, this paper gives some suggestions on the impact of ERP Implementation on enterprise performance.

Keywords

Productivity, Enterprise Resource Planning (ERP), Performance

1. Introduction

With the continuous development of economic globalization, digitization and specialization, the continuous renewal of digital technology and the continuous shortening of product life cycle, the enterprise management breaks the national limitations. What the company needs to think about is how to allocate resources effectively when the enterprise's resources are scarce. Therefore, enterprises need to introduce ERP system to help enterprise managers operate and manage the company. ERP system originated in western developed countries and has been widely used in western developed countries. At present, the utilization rate of ERP system is that more than 85% of the world's top 500 enterprises have implemented ERP system management to manage enterprises. ERP system includes financial management, supply chain management, production management and other functional modules. Financial accounting, supply chain technology and production management in ERP system are widely used in enterprises. Its information technology and management technology have become one of the core competitiveness of enterprises. The management personnel of the company can check the operation and financial data of the enterprise by using the ERP system. Due to the complete transparency of financial data and information, the managers can grasp the enterprise operation data in time and make important decisions of the company based on the enterprise data. Therefore, the implementation of ERP system can promote enterprise information construction and improve enterprise management level.

Although ERP application plays an important role in the construction of enterprise informatization, the industry knows that the success rate of ERP implementation is low and the cost is high. There are many cases of enterprise implementation failure, and the performance and operation ability of enterprises have not been improved. In this case of low success rate, enterprises are afraid of information construction and dare not start ERP project, resulting in missing a good opportunity to improve enterprise information construction and enhance enterprise core competitiveness.

The construction and return on investment of ERP system is a long-term process. When enterprise

managers invest in the implementation of ERP system, its short-term impact can not be shown in the financial data; After the enterprise introduces ERP system, the enterprise has a loss instead; After the implementation of enterprise ERP, the improvement of enterprise performance may need to be realized through other indicators. Therefore, the impact of the implementation of ERP system on the company's performance will not begin to affect the company's performance until a few months or years later. The impact of ERP system on the company's performance is very important for the enterprise. Only when managers know the impact of ERP system on enterprise financial performance, can they constantly adjust the management mode of the enterprise, and the enterprise can operate and manage efficiently. Enterprise managers should consider whether the implementation of ERP can improve enterprise performance. Global scholars have begun to study the impact of ERP on enterprise performance. There are few studies on whether the implementation of ERP can improve enterprise performance in China, and there is no normative and systematic research. The case analysis has been unable to reflect the impact of ERP system on enterprise performance. It is very necessary to empirically analyze the impact of ERP system on financial performance.

2. Research Methodology

2.1 Research Design

Step 1: through the collation of the literature and relevant theories in Chapter 2, find the influencing factors of ERP system implementation on enterprise performance, select the financial data of manufacturing companies, and establish a data model. This paper holds that the factors affecting the financial performance of ERP system generally include: the product type of ERP, the scale of the enterprise, the growth of the company's main business income, and the online time of ERP system

Step 2: analyze enterprise performance with two evaluation methods: Accounting Indicators and capital market. The first is to use accounting indicators to measure enterprise performance. Such as the enterprise's operating capacity indicators (accounts receivable turnover rate, inventory turnover rate, inventory turnover rate, sales expense rate), profitability indicators (total asset net interest rate, cost profit rate) and growth indicators (operating profit growth rate), etc. The second is to use the capital market to reflect the financial performance. Based on the stock market return and stock price growth, the financial performance of enterprises is measured through the capital market. The reasons for my seven financial indicators are: first, financial indicators can reflect the financial performance of enterprises; Second, these data can be obtained from the company's public data

Step 3: make descriptive statistics on the enterprise performance before and after the implementation of ERP system, then use the paired sample t-test to analyze the changes of financial performance before and after the implementation of ERP system, then test the correlation of research variables, and finally construct the regression equation.

$$Y_{it} = \alpha_0 + \alpha_1 ERP_{it} + \alpha_2 SIZE_{it} + \alpha_3 FORM_{it} + \alpha_4 GROWTH_{it} + u_{it}$$

Among them, Y_{it} refers to the financial performance of sample I in year t, such as accounts receivable

turnover rate, net inventory turnover rate and other financial indicators, which is equal to the data of financial performance indicators in year t ; coefficient α_1 represents the influence coefficient of ERP system on y , $erpit$ represents whether sample I has implemented ERP system in year T . If the enterprise uses ERP system, the value is 1, otherwise, the value is 0; coefficient α_2 represents the influence coefficient of enterprise size on y , and $sizeit$ represents the company size of sample I in year T . This paper quantifies the company size and selects the total assets of the enterprise; coefficient α_3 represents the influence coefficient of the product software brand on y . $form$ It represents the type of ERP system implemented by sample I in the T year. If the ERP system software is developed abroad, the value is 0, if the ERP system software is developed domestically, the value is 1, and if the ERP system software is developed in other forms, the value is 2. coefficient α_4 represents the influence coefficient of the growth of main business income on y . $growthit$ represents the growth of main business income of sample I in year t , which is used to measure the growth of sample enterprises.

2.2 Sources of Data & Population of the Study

Enterprise managers will introduce ERP system according to the actual business needs of the enterprise. In the short term, the informatization construction of ERP system is an operating expenditure, which will produce management expenses and operating costs, which will affect the profitability of the enterprise. From a long-term perspective, ERP system will improve the operation efficiency and management level of the enterprise, improve the profitability of the enterprise, and make the enterprise have core competitiveness. Enterprise managers are optimistic about the future prospect of ERP system, and introduce ERP system for enterprise management. The implementation of ERP project is a major project of the enterprise that year. The project information will appear in the annual report and the official website of the listed company. We can search ERP and the company's annual report on the enterprise's official website through the search method of the Internet. ERP suppliers will also publicize the implementation of ERP projects as a successful case, so we can find the required ERP project information.

2.3 Data Gathering Procedure

This paper collects sample data through five steps:

First, select manufacturing companies as the research object. First of all, manufacturing industry is the foundation of China's economic development and national competitiveness. The high-quality development of manufacturing industry is related to the overall development of China's high-quality economy. Therefore, it is necessary to improve the development level of manufacturing listed companies, and the construction of enterprise informatization has become an important task of listed companies. Secondly, under the environment of economic globalization, China's manufacturing listed companies have fierce competition with domestic and foreign companies. Finally, the implementation of ERP system can promote enterprise information construction and improve enterprise management level.

Second, select the manufacturing listed companies in Beijing as the research object. First of all, listed

manufacturing enterprises operate well, fewer enterprises will withdraw from the market, and the financial information and ERP project information of most listed companies are open and transparent, which is easy to collect, sort out and study. Secondly, the ERP project implementation cycle of listed companies is long, which is divided into phase I, phase II and post project maintenance. The ERP project and financial data are open and transparent. Finally, leaders attach importance to and publicize the project implementation. In order to improve the popularity of products, ERP manufacturers publicize the project implementation of these large listed companies as successful cases.

Third, preliminary screening of manufacturing listed companies in Beijing. Firstly, find out the list of listed companies on the website, and select the manufacturing industry according to the research object of this paper. Secondly, if the enterprise implements ERP system, it determines the implementation time of ERP; If the enterprise does not implement ERP system, it will be eliminated. Finally, sort out the annual reports before and after the implementation of ERP system, and obtain the financial data of sample companies.

Fourth, filter out listed companies that do not meet the research object. This paper studies the impact of ERP system on financial performance. The impact of different types of ERP systems on financial performance eliminates the samples of ERP implementation time and product companies that cannot be found. Eliminate the company with incomplete financial data, the financial data before the implementation of ERP system and the financial data for three years after the implementation.

Fifth, determine the sample manufacturing enterprises in Beijing. This paper compares the enterprises that have implemented ERP system with the enterprises that have not implemented ERP system, and finally determines the sample of manufacturing listed companies. Firstly, the sample selected manufacturing enterprises to be listed from 2013 to 2015, so 484 manufacturing listed companies with ERP system implementation were determined. Excluding the listed companies with ERP online before 2013, it was impossible to compare the financial data. At the same time, excluding the listed companies with ERP online after 2018, it was impossible to obtain the financial data after 3 years. Finally, 509 manufacturing listed companies met the conditions, among them, 484 listed companies have implemented ERP system and 25 listed companies have not implemented ERP system. At first, 1052 manufacturing listed companies were collected from the website, of which 1027 manufacturing listed enterprises implemented ERP system and 25 manufacturing listed enterprises did not implement ERP system. Among the 1027 Manufacturing Listed Companies Implementing ERP system, 181 listed companies launched ERP before 2013 and 362 listed companies launched ERP after 2015, of which 177 enterprises use domestic software, 185 enterprises use foreign software and 10 use self-developed ERP software. The sample of empirical analysis in this paper is 484.

2.4 Statistical Treatment of Data

Table 1. The Performance Evaluation Indicators of Previous Generations Are Summarized Below

	Turnover rate of accounts receivable
Business operation capacity	Turnover rate of inventory
	Operating cost rate
Profitability of enterprises	Sales expense rate
	Net interest rate of total assets
	Cost and expense profit margin
Enterprise growth ability	Growth rate of operating profit

Table 2. Statistics of Financial Indicators in This Paper

Indicator type	Indicator name	Index code	Index formula
Operational capacity	Turnover rate of accounts receivable	ART	Operating income / average receivable balance×100%
		ART	
	Turnover rate of inventory	ITR ITR	Operating cost / average inventory occupancy×100%
	Operating cost rate	COS COS	Operating cost / revenue×100%
	Sales expense rate	ESR ESR	Sales expenses / operating income×100%
Profitability	Net interest rate of total assets	ROA ROA	Average net profit / total assets balance×100%
		PCR PCR	
Growth ability	Growth rate of operating profit	OPR OPR	Increase of operating profit in the current year / total operating profit of the previous year×100%

Table 3. Enterprise Sample

technological process	Sample situation	quantity
Sample population	Listed companies in manufacturing industry	1052
	Manufacturing Listed Companies Implementing ERP before 2013	181
Culling and screening	Manufacturing Listed Companies Implementing ERP in 2013-2015	484
	Manufacturing Listed Companies Implementing ERP after 2015	362
	Manufacturing listed companies without ERP implementation in 2013-2015	25
Final sample selection	Manufacturing Listed Companies Implementing ERP in 2013-2015	484
	Manufacturing listed companies without ERP implementation in 2013-2015	25

3. Result

This paper describes the financial data of 484 listed manufacturing companies in China, and describes the financial index data of the previous year, the implementation year and the following one to three years from the minimum, maximum, average, standard deviation and variation.

After the implementation of ERP system, the turnover rate of accounts receivable of listed manufacturing companies is the lowest, with an average of 11.5651 in the year before the implementation of ERP system and 1 in the first year after the implementation of ERP system 3.1826, the second year after the implementation of ERP system was 13.9714, and the third year after the implementation of ERP system was 13.3743. The average turnover rate of accounts receivable increased, indicating that ERP system has a positive impact on accounts receivable. The improvement of financial system module in ERP system affects enterprise collection.

After the implementation of ERP system, the inventory turnover rate of listed manufacturing companies is 5.1784560 in the first year after the implementation of ERP system, 5.30471 6 in the second year after the implementation of ERP system and 5.8989364 in the third year after the implementation of ERP system. The higher the average inventory turnover rate, the stronger the liquidity of the enterprise. The faster the capital turnover rate invested in inventory, the stronger the short-term repayment ability of the enterprise.

After the implementation of ERP system, the operating cost rate of listed manufacturing companies is 0.5% per year before the implementation of ERP system 7434244, 0.7460264 in the first year after the

implementation of ERP system, 0.72 18188 in the second year after the implementation of ERP system and 0.7262415 in the third year after the implementation of ERP system. After the enterprise ERP system went online, the operating cost rate decreased from the first year to the third year.

After the implementation of ERP system in manufacturing listed companies, the average annual value of sales expense rate before the implementation of ERP system is 0.5% 0794209, 0.0781490 in the first year after the implementation of ERP system, 0.07 44298 in the second year after the implementation of ERP system and 0.0732279 in the third year after the implementation of ERP system. The decrease of sales expense rate indicates that the sales management of supply chain can reduce other sales expenses in the process of selling goods.

After the implementation of ERP system, the net interest rate of total assets of listed manufacturing companies is the average value of the year before the implementation of ERP system 0.0321616, 0.0436607 in the first year after the implementation of ERP system, and 0.0436607 in the second year after the implementation of ERP system 0.0406576, 0.0478558 in the third year after the implementation of ERP system, indicating that the net interest rate of total assets of listed manufacturing companies has increased steadily after the implementation of ERP. The higher the level of enterprise operation and management, the lower the management cost, and the net interest rate of total assets is higher than the average level of society, indicating that the development of the enterprise is in the forefront of its peers.

After the implementation of ERP system, the cost profit margin of listed manufacturing companies is 0.0703579 a year before the implementation of ERP system, 0.0758756 in the first year after the implementation of ERP system and 0.0758756 in the second year after the implementation of ERP system 0.086783, 0.0883969 in the third year after the implementation of ERP system. After the launch of ERP, the operation capacity of the enterprise is improved and the inventory turnover rate is accelerated. The financial module of ERP system improves the work efficiency of the enterprise, which can reduce the production cost, reduce the management cost, sales cost and financial cost, and improve the economic benefit of the enterprise.

The growth rate of operating profit of listed manufacturing companies was 0.0341362 one year before the implementation of ERP system, -1.9566519 in the first year after the implementation of ERP system, 0.7056434 in the second year after the implementation of ERP system and 0.9021145 in the third year after the implementation of ERP system. The data show that the impact of ERP system on the growth ability of enterprises is not obvious in the short term and does not improve the growth ability of enterprises, but in the long run, the growth ability of enterprises has been improved.

To sum up, after the implementation of ERP system by listed manufacturing companies, the five indicators of accounts receivable turnover rate, inventory turnover rate, sales expenses, net profit rate of total assets and cost profit rate have a great impact and produce positive benefits. The operating cost rate decreases, and the operating cost rate increases slightly with the implementation of ERP, which shows that when enterprises implement ERP, purchasing ERP system is an important expense and

increases the operating cost of enterprises. Before implementing ERP, they should do a good job of feasibility analysis and demand analysis, consider the cost of ERP implementation and enterprise income, and choose ERP software products suitable for their own enterprises.

4. Discussion

Summary of Findings

In this paper, 484 manufacturing companies are selected in Beijing, China. Through the analysis of the financial data of enterprises, the following conclusions are drawn.

1. The launch of ERP system can improve the operation ability of enterprises.
2. The launch of ERP system can improve the profitability of enterprises.
3. There is a time lag in the growth ability of enterprises after they launch ERP system

Recommendations

1. Do a good job in feasibility and demand analysis
2. Do a good job in long-term planning and financial budget management
3. Select the appropriate enterprise resource system
4. Reorganize enterprise business processes
5. Enhance risk prevention awareness

5. Conclusion

1) The launch of ERP system can improve the operation ability of enterprises

ERP implementation can improve the operation ability of enterprises. ERP system integrates financial management, production operation management, logistics management, procurement management and sales management modules, which is more systematic and functional than a single system, and realizes the integrated operation of enterprises. It can not only integrate the scattered data of various departments, and all departments can access the data, but also ensure the accuracy and unity of enterprise data. Firstly, the financial module and general ledger module of ERP system manage the registration and review of enterprise financial vouchers, and finally form the three major statements of the enterprise. The accounts receivable module manages the normal arrears of customers due to the sale of goods, which can help the financial personnel recover the accounts receivable of the enterprise in time and reduce the occurrence of bad debts and bad debts. And can make the enterprise's financial plan and budget in advance to avoid improper operation, budget overrun and insufficient funds, and help the enterprise's managers make an effective capital budget.

Secondly, inventory management is the inventory control of the enterprise. The warehouse staff purchases and stores raw materials and sells goods out of the warehouse on the ERP system. Inventory personnel can query the inventory quantity of the enterprise. In case of insufficient goods, the enterprise shall timely remind the purchasing personnel to purchase and replenish the inventory. It can be seen that the supply chain module of ERP system improves the work efficiency of warehouse

managers.

Thirdly, ERP system is the information and data platform of the whole enterprise, and its advantage is that it can monitor data in real time. In the process of enterprise operation, all departments need to communicate in time, which can improve the coordination and cooperation between all departments, and manage and synchronize enterprise data in real time. After the scale of the enterprise reaches a certain level, the energy of managers is limited, and it is difficult to avoid mistakes when dealing with things. Through information technology, work efficiency can be improved and work errors can be reduced,

ERP system is a safe and efficient enterprise management tool.

2) The launch of ERP system can improve the profitability of enterprises

ERP implementation can improve the profitability of enterprises. Through ERP system, enterprises can help establish a complete information management platform and supervise the information flow and capital flow of enterprises. ERP system can be used to coordinate suppliers and sellers in the supply chain and manage them comprehensively.

Firstly, the supply chain module of ERP system includes sales management and procurement management. Purchase management can form purchase orders and purchase arrival documents according to purchase requisitions, and form documents efficiently, which greatly improves the processing speed of orders, ensures the correctness of the quantity and amount of purchase orders, and shortens the purchase time. The sales module can realize multiple shipments and issue a sales invoice only once, which greatly reduces the workload of sales.

Secondly, with the expansion of business scale, the traditional business model has been unable to adapt to the highly competitive business environment. The business reorganization of enterprises needs to change from the traditional business model to the information model to improve the operation and management level of enterprises. If an enterprise invests one unit of capital and can obtain greater income, the higher the profit margin of the enterprise. ERP system improves the profitability of enterprises, and the final performance is the improvement of enterprise performance.

Finally, for enterprises, ERP system can help enterprise managers find out the operation problems in the process of operation and management through information means, timely solve the problem of high operation cost, reduce enterprise operation cost, improve enterprise profitability and improve enterprise profit.

ERP system generally takes two years from project initiation to project implementation and then to project acceptance. Whether ERP implementation can improve the profitability of listed manufacturing companies requires at least one to two years to verify after ERP system goes online. After descriptive statistical analysis, it is concluded that ERP system can improve the profitability of enterprises.

3) There is a time lag in the growth ability of enterprises after they launch ERP system

Enterprise online ERP system can improve the growth ability of enterprises, but the impact of ERP system on growth ability is not obvious in the short term, and there is a certain lag. From a long-term

perspective, it can improve the growth ability of enterprises. Although the purchase of ERP system will increase the expenditure of the enterprise in the short term, it can improve the operation efficiency of the enterprise in the later stage.

First of all, enterprises have introduced ERP system to improve production efficiency. The operation and management of manufacturing companies need to adapt to the business process of ERP system. Therefore, the organizational change of manufacturing companies takes a certain time, and the business process change is difficult, and it also needs to bear the cost of purchasing the system. In the short term, the improvement of enterprise growth ability is not obvious. After the growth ability is launched in ERP, it may take 3-5 years to explore its impact.

Secondly, the information management of supply chain improves the operation ability and profitability of enterprises, and the growth ability of enterprises is improved. Enterprises need to introduce ERP system for business management. ERP system is a double-edged sword. If used properly, supply chain management can not only improve the work efficiency of procurement, sales and inventory managers, but also improve the management ability of enterprises, realize the data sharing of procurement, sales and inventory departments, comprehensively manage the business of supply chain and improve the operation efficiency of the company; If it is not used properly, the organizational structure of the enterprise will change, which will reduce the operation efficiency and increase the operation cost of the enterprise.

Finally, through descriptive statistical analysis, after the implementation of ERP system, the average growth rate of operating profit of manufacturing companies decreased in the first year after the implementation of ERP system, and increased in the second and third years after the implementation of ERP system. The data show that the impact of ERP system on the growth ability of enterprises is not obvious in the short term, and it does not improve the growth ability of enterprises in the short term.

It is a major task for the enterprise to launch the ERP system that year. In the early stage, it is necessary to conduct feasibility analysis and demand analysis, and make a good capital budget. It is necessary to invest human, material and capital to implement the ERP system; Change the enterprise organization according to the needs of the system during the implementation; After the completion of the project, it is necessary to arrange full-time personnel to maintain, operate and update the system.

To sum up, the impact of ERP system on enterprise growth ability cannot be significantly improved in the short term. Therefore, the impact of ERP system on the growth ability of enterprises is not obvious in the short term. When conducting empirical analysis, it is necessary to select a longer period of time to investigate the impact of ERP system on the growth ability of enterprises.

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