Acta Technica *62* No. 2B/2017, 375–384

Design and application of inventory management system for manufacturing enterprises

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Abstract. The application of manufacturing enterprise inventory management system is of great significance to the development of manufacturing enterprises in modern times. In order to improve the technology and theory of the system, in this paper, firstly, the relevant data and theories of the system design were summarized, secondly, a simple warehouse management system was constructed by relying on the database technology and the system was applied to a manufacturing enterprise. The results show that the inventory management system can effectively reduce the production cost of the enterprise while improving the production efficiency of the enterprise. The research aims to provide some theoretical basis and reference for the development of China's manufacturing enterprises.

Key words. Manufacturing enterprise; inventory; management system.

1. Introduction

With the development of the times, the world's economic level has obtained greatly improvement and progress and various industries have been a certain impetus, so that a greater degree of comprehensive strength has been achieved. In this trend, various companies begin to attach great attention on their various development links, so as to provide some protection for higher and faster development of the industry. As one of the important parts of the development of whole industry, the inventory has a very important impact on the related costs of the industry development and the profitability of the later stage. Today, the management of inventory has gradually produced a huge role in promoting the development of various industries. Traditional inventory management is more to operate by relying on the manual records, which suffers a greater degree of influence of subjective factors, and there is a negative impact for the inventory accuracy records and the effectiveness of the final assessment. With the development of the times, the current computer technology has a more advanced development trend, as one of the most influential innovative

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technologies in the world today, the driving force of the computer technology for the development of various industries is beyond doubt, then, because the technology has excellent sharing and data collection and many other advantages, it can be more organically combine with the industry. Nowadays, the technology begins to be gradually applied to the inventory management of manufacturing enterprises, moreover, a certain convenience and accuracy are provided for the manufacturing enterprises' inventory management, which makes the enterprise have a greater degree of development and its comprehensive strength greatly improved. Based on relevant theory and technology development of the design and application of the inventory management system in China's manufacturing enterprises, this study compared and analyzed its advantages. The purpose of this paper is to provide a scientific basis and reference for the further improvement of related technologies and theories in China.

2. State of the art

With the development of the times, now, the world's various industries have suffered a certain impetus and positive impact under the background of the rapid development of the world economic level. As one of the key pillar industries in the rapid development of the current economic level [1], the development of manufacturing enterprises is of paramount importance for the progress of the world economy [2]. Inventory management is an important part of its normal operation and comprehensive strength promotion in the manufacturing industry. Many research scholars believe that in a manufacturing industry, only further understanding the inventory can people face up to the status of the development of the industry, and the current product production of the whole industry development can be further analyzed, then, the future product production and resource requirements can be further determined and certain theoretical and data support can be provided based on the relevant analysis. Therefore, many manufacturing companies begin to regard the inventory management as an important part and link of the development of enterprises [3]. At present, the development of the computer industry has a very important role for a variety of enterprises; in the manufacturing enterprises' inventory management process, the inventory management results can be more reliable by using the advantages of the technology and the obtained relevant data [4]. And only to have a more systematic inventory management system, a theoretical support and basis can be provided for the development of the industry ultimately, meanwhile, more technical support can be provided for the promotion of the overall strength of the entire manufacturing industry and the development of the national economic level.

3. Methodology

With the development of the times, the theme of world development is now peace and development. In this big trend of development, the world's economic level has been greatly improved, and the economic level has been unprecedented development.

As an important industry in the development of the times, the manufacturing industry has a very important practical significance for the development of the world [5]. The development of the manufacturing industry makes more products produced, which brings a very important impact for people's production and life demands in modern times, furthermore, people's lives also get a great convenience, then, some effective development is brought for people's colorful life while people's living standards are also constantly improved. In this large trend of development, China's manufacturing industry has also been a greater degree of progress. Especially since the reform and opening up, as China's manufacturing industry has brought great impetus to the improvement of China's economic level, China has gradually become an important manufacturing industry in today's world, and the products produced by related industries in China have begun to be further sold to other countries, so that the comprehensive level of China's manufacturing industry has been greatly improved (Figure 1). Then, many discordant phenomena are further exposed while massive products produced in China bring great impetus to the national economic level [6]. For example, because of the decision-making errors of the management layer in related industries, many industries have decision-making mistakes on the status of a product in the production of related products, which causes that the production of the product is more, the supply exceeds the demand and serious product backlog [7]. This series of uncoordinated phenomena has caused a certain degree of waste for the resources of related products in China, and has had a negative impact on the development of China's manufacturing industry [8]. With the progressive deterioration of related issues, China has begun to gradually pay attention to manufacturing enterprise inventory management. It is extremely necessary for an enterprise to attach great attention to the inventory management, only to timely check the inventory, the actual condition of the main raw material in the stock can be discovered, and certain raw materials that need to be purchased are bought timely, so as to avoid the delay of enterprise's production [9]. In addition, according to analyze the inventory status of some products produced, the current situation of the production of the enterprise can be realized clearly, so that the shrink production is carried out for the products with large yield, so as to avoid the product backlog. While for some products with relatively small output and relatively large demands, the production scale of this part of the product can be expanded by adjusting relevant production links [10]. Therefore, the inventory management has extremely positive impact on the development of some of China's manufacturing enterprises. However, the relevant model of inventory management in China is still in a relatively traditional calculation, the inventory check and other links are more completed by relying on manual inventory, this mode has a certain degree of subjective factors, and also has certain restricted role for the development of inventory management [11]. With the development of computer technology in China, China begins to apply computer technology to the actual manufacturing enterprise inventory management system, and then, a certain degree of progress is obtained, moreover, China's inventory management technology and related theories also begin to be gradually improved and developed. This study analyzed the current status of the development of China's manufacturing enterprise inventory management system, so as to determine the advantages of this system

model for the development of China's manufacturing enterprises through the design of inventory management system for manufacturing enterprises. The purpose of this paper is to provide some theoretical support and reference for the development of inventory management system for manufacturing enterprises in China. The time evolution of gross output value of China's manufacturing enterprises is shown in Fig. 1.

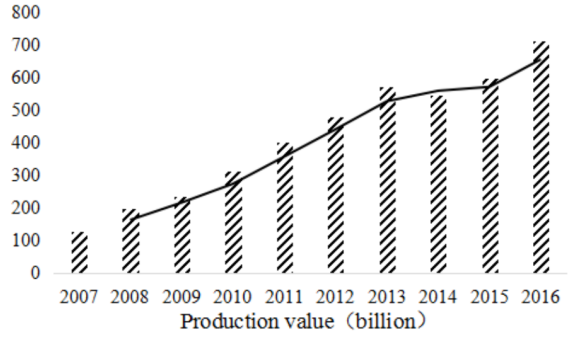


Fig. 1. Analysis of gross output value of China's manufacturing enterprises

Firstly, in this research, by reading and analyzing relevant data, the related design concept of manufacturing enterprise inventory management system was determined, and a certain theoretical foundation was laid for the further research on the basis of clarifying the relevant concept.

Then, based on ASP.NET technology, this paper constructed the related system of manufacturing enterprise inventory management. There are three layers in the main structural model. The first layer is the UI layer, its main role is the user use interface, which is mainly used to pass the user's request and submit it to the terminal, the composition structure is the client and the Web browser; the second layer is the business logic layer, this layer is mainly to use the user's related request to accept and make appropriate treatment, and then, the results are displayed to the user in the form of browsers, the main structure includes Web forms, XML Web services and component services; the third layer is the data layer, when the business logic processing layer is dealing with the request and the data processing is involved, the data processing service is provided and returned to the business logic layer, including ADO.NET and RDBMS. On the basis of the clear establishment of the relevant system, based on this system structure, some small and medium enterprises in China were adopted as the research objects to establish the database of the inventory management system; after the establishment of the database, the comparative analysis of the inventory management was conducted

4. Result analysis and discussion

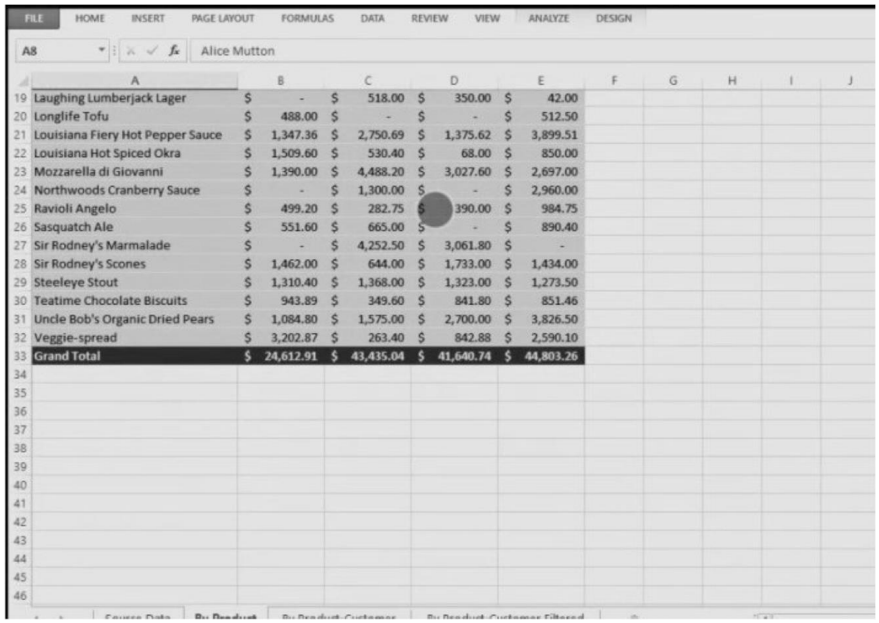
With the development of the times, manufacturing enterprises have gradually become one of the important support companies to promote the world's economic

development in modern times. In the manufacturing enterprises, as an important part of the development of enterprises, the importance of inventory for the development of the enterprise is no doubt (Fig. 2). After the reform and opening up, China's various industries have also made great progress, furthermore, the exchanges and cooperation between China and other countries in the world have also gradually increased. In this trend, China's manufacturing enterprises have obtained a great degree of improvement and progress [12]. The quantity of products in certain manufacturing industries in China is increasing constantly, which makes our country have a greater influence in the world, moreover, the economic level is also further improved [13]. With the development of manufacturing enterprises, many scholars in our country have begun to put forward to improve relevant theories and systems of inventory management in some enterprises. Only in this way, the future development direction of our country can be determined, and then, the waste of resources is further reduced while making our country specify a more explicit decision-making, so as to provide a certain theoretical basis for the sustainable development of the economy.

Fig. 2. Development of manufacturing enterprises

The traditional inventory management is mainly the simple and manual record way. With the development of the times, now, computer technology has brought a certain impetus for the development and progress of various industries. The combination of technology and other industries has made more industries begin to develop towards the direction of information technology. In this trend, China's manufacturing enterprise inventory management system has also been a positive impact [14]. Initially, due to the limitations of computer hardware and software facilities, China's manufacturing enterprise inventory management system development is relatively backward and the system's function is relatively simple. While with the continuous progress of China's science and technology, nowadays, China's computer network technology has been greatly improved, and the relevant database has been established, besides, China's innovative computer network technology has further eliminated the single and relatively backward computer network technology, and the inventory management system of China's manufacturing industry has also obtained a great degree of improvement and development [15] (Fig. 3). In today's era, the

advantages of manufacturing enterprise inventory management system are shown in Fig. 3, the system is mainly composed of five kinds of databases, and the main operation way of the database is shown in Table 1.



	A	B	C	D	E
19	Laughing Lumberjack Lager	$ -	$ 518.00	$ 350.00	$ 42.00
20	Longlife Tofu	$ 488.00	$ -	$ -	$ 512.50
21	Louisiana Fiery Hot Pepper Sauce	$ 1,347.36	$ 2,750.69	$ 1,375.62	$ 3,899.51
22	Louisiana Hot Spiced Okra	$ 1,509.60	$ 530.40	$ 68.00	$ 850.00
23	Mozzarella di Giovanni	$ 1,390.00	$ 4,488.20	$ 3,027.60	$ 2,697.00
24	Northwoods Cranberry Sauce	$ -	$ 1,300.00	$ -	$ 2,960.00
25	Ravioli Angelo	$ 499.20	$ 282.75	$ 390.00	$ 984.75
26	Sasquatch Ale	$ 551.60	$ 665.00	$ -	$ 890.40
27	Sir Rodney's Marmalade	$ -	$ 4,252.50	$ 3,061.80	$ -
28	Sir Rodney's Scones	$ 1,462.00	$ 644.00	$ 1,733.00	$ 1,434.00
29	Steeleye Stout	$ 1,310.40	$ 1,368.00	$ 1,323.00	$ 1,273.50
30	Teatime Chocolate Biscuits	$ 943.89	$ 349.60	$ 841.80	$ 851.46
31	Uncle Bob's Organic Dried Pears	$ 1,084.80	$ 1,575.00	$ 2,700.00	$ 3,826.50
32	Veggie-spread	$ 3,202.87	$ 263.40	$ 842.88	$ 2,590.10
33	Grand Total	$ 24,612.91	$ 43,435.04	$ 41,640.74	$ 44,803.26

Fig. 3. Development and application of enterprise inventory management system

On the basis of the extremely clear manufacturing enterprise inventory management system, this study took the discrete small and medium-sized enterprises in China as the example. Firstly, by reading relevant information, the characteristics and inventory requirements of small and medium-sized manufacturing enterprises in China were analyzed and summarized. The results are shown in Table 2. Then, according to the current development situation of discrete small and medium-sized manufacturing enterprises in China, and based on ASP.NET database technology, the warehouse and return data database of the small and medium-sized enterprises were constructed, as shown in Table 3.

The inventory system designed in this paper was applied to the inventory management process for a manufacturing enterprise in X Province in China, and then, the production costs and production benefits of the company in each quarter of 2016 were recorded and analyzed further. The results are shown in Figure 4. The results show that after the application of the stock system, the production cost of the enterprise in each quarter had a decreasing trend and the production efficiency was increasing. While with the extension of the application time, the downward trend of the production cost was large and the income of the production benefit increased constantly, then, the two indicators basically tended to a saturated state. This further indicates that the inventory management system of manufacturing enterprises has a very important positive influence and impetus to the development of

small and medium-sized manufacturing enterprises in our country, thus, the better and faster development of related manufacturing enterprises in the country can be achieved and the continuous improvement of the overall level of China's economy can be promoted through the further improvement of the system.

Table 1. Research on the theory and technology of inventory management system for manufacturing enterprises in China

Database and method	Composition	Brief description
ABC classification of the material inventory control	Class A material control	This kind of material is an indispensable material in the manufacturing process. The database mainly considers the operation cost at all aspects, such as procurement, transportation and shortage of the material, and then, further determines the best single purchase cost, thus reducing the cost as much as possible while ensuring the normal operation of the industry.
	Class B material control	The proportion of this type of the materials is between class A and class C materials, and only the general attention and protection are required in the inventory.
	Class C material control	Mostly are small materials, they have no close relationship with the industry and direct correlation, which can be purchased in large quantities.
B/S three-tier mechanism model	WEB browser, WEB server and database server	The system development, maintenance and upgrade and user aspects of the model are relatively simple, so they begin to gradually become the preferred database in the warehouse management system in China.
.Net platform framework	Language library, framework	Through the construction of the relevant code, the operation of the program can be further achieved.
ASP.NET technology	Microsoft.NET	The database often uses the code post method in the process of use, furthermore, during the calling process, the unordered compilation and program are updated, so the operation process is more high-speed, safe and powerful.
Microsoft SQL Server database	Microsoft SQL Server 2008	The database is a relatively mature and fully functional database in the inventory management system of China's manufacturing enterprises. The database is highly reliable, more efficient and intelligent.

5. Conclusion

With the development of the times, the manufacturing industry has gradually become an important support for the development of the world economy today, and the manufacturing enterprises have provided a great impetus and positive influence for the development of the world.

Table 2. Characteristics of discrete small and medium sized manufacturing enterprises in China and their special requirements of the inventory management

Research level	Illustration
Features	Production technology changes more
	Production technology changes more
	Cost control is difficult
Inventory management special needs	The practicality and miniaturization requirements of inventory management information system
	Reconfigurable requirements for inventory management systems
	Scalability requirements for inventory management systems
Inventory management link	Warehousing
	Storage
	Delivery of cargo from storage
Basic functions of inventory management system	Records of the varieties, specifications, leave the factory and other information of the storage goods
Inventory management users	General user
	Advanced user
Related business analysis	Warehousing business
	Business of delivering the cargo from storage
	Return business
	Inventory business

As an important part of the development of manufacturing enterprises, the management of inventory management link is conducive to reducing the cost of production and further increasing the benefits of business operations. However, the inventory management of China's traditional manufacturing enterprise is more dependent on the artificial form or a relatively simple computer operation program, so there are some restrictions on the management of inventory. Today, the efficient development of the computer industry provides certain technical support for the improvement of the manufacturing enterprise's database management system. In this research, through the analysis of the relevant database technology of the manufacturing en-

terprise inventory management system, a simple inventory management system was established. Through the practical application, the results show that the system has a positive effect on the reduction of the production cost and the improvement of the production efficiency of a small and medium-sized enterprise. The research aims to provide a theoretical basis for the development of China's manufacturing industry. However, due to the limitation of the author' level, a more comprehensive system construction is not understood, so there are some shortcomings in research results, while the results can still be used as a reference for the relevant industries.

Table 3. Return system of the warehouse constructed by ASP.NET database technology

Serial number	int	4	Not null	Primarykey
Product serial number	nvarchar	10	Not null	
Product code	nvarchar	20	Not null	
Product name	nvarchar	50	Not null	
Application user	nvarchar	20	null	
Application quantity	int	4	null	
Application time	datetime	8	Not null	
User confirmation	ntext	16	null	
Quantity confirmation	int	4	null	
Time confirmation	datetime	8	null	
Type of operation	nvarchar	20	Not null	
Examination and verification	nchar	4	Not null	
Remarks	ntext			

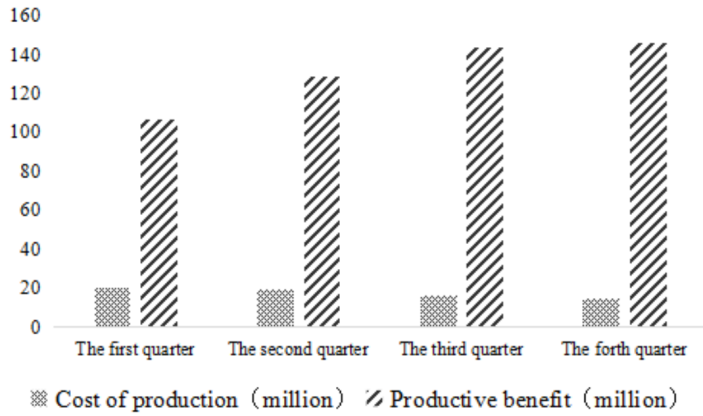


Fig. 4. Impact of the warehouse relative to an industry's production costs and benefits

References

[1] W. H. Wu, L. C. Fang, W. Y. Wang, M. C. Yu, H. Y. Kao: *An advanced CMII-based engineering change management framework: The integration of PLM and ERP perspectives.* International Journal of Production Research *52* (2014), No. 20, 6092 to 6109.

[2] B. Hamraz, N. H. M. Caldwell, D. C. Wynn, P. J. Clarkson: *Requirements-based development of an improved engineering change management method.* Journal of Engineering Design *24* (2013), No. 11, 765–793.

[3] N. Caldwell, B. Hamraz, T. W. Ridgman, P. J. Clarkson: *FBS Linkage ontology and technique to support engineering change management.* Research in engineering design *26* (2015), No. 1, 3–35.

[4] W. T. Thompson, F. Steier, W. Ostrenko: *Designing communication process for the design of an idea zone at a science center.* Journal of Applied Communication Research *42* (2014), No. 2, 208–226.

[5] L. W. Chang, S.Ṫ. Chen: *The impact of World Café on entrepreneurial strategic planning capability.* Journal of Business Research *68* (2015), No. 6, 1283–1290.

[6] J. Han, S. H. Lee, P. Nyamsuren: *An integrated engineering change management process model for a project-based manufacturing.* International Journal of Computer Integrated Manufacturing *28* (2015), No. 7, 745–752.

[7] K. R. Reddi, Y. B. Moon: *Modelling engineering change management in a new product development supply chain.* Journal of Production Research *51* (2013), No. 17, 5271 to 5291.

[8] G. Puente, O. Díaz, M. Azanza: *Refactoring affordances in corporate wikis: a case for the use of mind maps.* Enterprise Information Systems *9* (2015), No. 8, 785–834.

[9] H. Meier, R. Roy, G. Seliger: *Industrial product-service systems (IPS^2).* The International Journal of Advanced Manufacturing Technology *52* (2011), Nos. 9–12, 1175 to 1191.

[10] F. Tao, D. M. Zhao, Y. F. Hu, Z. Zhou: *Resource service composition and its optimal-selection based on particle swarm optimization in manufacturing grid system.* IEEE Transactions on Industrial Informatics *4*, (2008), No. 4, 315–327.

[11] X. Xu: *From cloud computing to cloud manufacturing.* Robotics and Computer-Integrated Manufacturing *28* (2012), No. 1, 75–86.

[12] D. H. Wu, M. J. Greer, D. W. Rosen, D. Schaefer: *Cloud manufacturing: Strategic vision and state-of-the-art.* Journal of Manufacturing Systems *32* (2013), No. 4, 564–579.

[13] D. H. Wu, J. L. Thames, D. W. Rosen, D. Schaefer: *Enhancing the product realization process with cloud-based design and manufacturing systems.* Journal of Computing and Information Science in Engineering *13* (2013), No. 4, paper 041004.

[14] K. Nagorny, A. W. Colombo, U. Schmidtmann: *A service and multi-agent-oriented manufacturing automation architecture: An IEC 62264 level 2 compliant implementation.* Computers in Industry *63* (2012), No. 8, 813–823.

[15] J. Y. Um, Y. C. Choi, I. Stroud: *Factory planning system considering energy-efficient process under cloud manufacturing.* Procedia CIRP *17* (2014), 553–558.

Received August 7, 2017