Application of Intelligent Manufacturing Technology in the Field of Ship Design and Manufacturing

Peiyu Wang*
Wuhan Institute of Shipbuilding Technology, Wuhan, Hubei, China, 430050

*Corresponding author e-mail: whwangpeiyu@wspc.edu.cn

Abstract. With the rapid development of information technology and its gradual penetration into the traditional manufacturing industry, modern industry has entered a period of intelligent manufacturing. In order to firmly grasp this brand-new development opportunity, various industries in our country are accelerating innovation and development, forming a number of brand-new industries and models. At this stage, the global shipping volume is increasing slowly and the endogenous power is lacking. The shipbuilding industry occupies a large proportion of my country’s traditional industries. It not only provides technical equipment for the development of marine resources and national defense construction, but is also an important channel for world trade, driving the development of many key industries, and it is a modern comprehensive industry with a huge industrial chain. Sex industry. The shipbuilding industry can drive the rapid development of the local economy and play an important role in promoting labor employment and ensuring the safety of coastal defense. In recent years, my country’s foreign trade has been growing at an alarming rate, which has provided better development opportunities to a certain extent. The industry has high international competitiveness.

Keywords: Intelligent Manufacturing, Field of Ship Design, Manufacturing

1. Introduction

With the advancement of the Internet era, intelligent manufacturing technology has been widely used in various fields. For the manufacturing industry, this technology has driven the industry to develop informatization, intelligence, and networking, and has greatly affected the industrial landscape. The impact of this technology has effectively optimized many of the drawbacks of traditional production methods. Among them, the shipbuilding industry has been greatly affected, and related technologies have played a major role in production, and their status has become more and more important. It can be seen that the shipbuilding industry has considerable development prospects, but it is still facing the stubborn illness of "big but not strong" [1]. The lack of high-end manufacturing capabilities has become an important constraint preventing my country from catching up with other countries. With the arrival of the big information tide, my country's shipbuilding industry is also facing major changes in manufacturing. Intelligent manufacturing technology may become an effective way to reverse the overall situation and get rid of the current predicament.
2. Current status of shipbuilding

2.1. The status quo of ship intelligent manufacturing technology
Since entering the "Thirteenth Five-Year Plan" period, the party and the country have been paying more and more attention to the maritime sector. In particular, the strategy of "One Belt, One Road" and "building a maritime power" has brought my country's urgent demands for the development of the marine economy to a whole new level. Under such an environment, the domestic shipbuilding industry has achieved remarkable development results, which are mainly reflected in the following aspects: The level of technological innovation has been further strengthened; The output and production capacity have been greatly improved; The supporting intelligence has been significant Breakthrough; The proportion of offshore engineering equipment in the international market has increased significantly; The industrial concentration has continued to increase. On the whole, the domestic shipbuilding industry has initially formed the concept of modern manufacturing. However, the problems that exist in the continuous development of the shipbuilding industry should also arouse great attention. In the market competition with high added value and high technology content, it is far behind the shipbuilding powers such as South Korea and Japan. In addition to the inadequate research and development of core technologies, the problems at the manufacturing end of ships and related facilities are also very important limiting factors that have led to the "big but not strong" shipbuilding industry in my country. With the accelerated development of the shipbuilding industry, digital technology has gradually been integrated into shipbuilding [2]. According to relevant data, the penetration rate of digital design tools in this industry far exceeds 80%, and the value of the intelligent manufacturing high-end equipment manufacturing industry accounts for more than 10% of the total equipment manufacturing industry. However, due to the late start of our country, it still lags behind the advanced manufacturing model in terms of information integration, the overall industry has a low degree of automation, most production links still rely on manual labor, and its technical level is unstable, leading to serious information transmission errors and information islands. It is one of the most important problems to be solved.

2.2. Existing problems of intelligent shipbuilding technology
With the wide application of intelligent manufacturing technology, my country's shipbuilding industry is facing new challenges. From the perspective of external factors, due to the relatively late development of domestic smart technology, industrial links are not yet complete, and the business environment is not mature enough, the research on key technologies of smart manufacturing is not deep enough, the quality of supporting products is low, and the core components are still Depends on imports from abroad. In addition, compared with other developed countries, my country is currently The overall level of intelligent manufacturing technology is low, and it is temporarily unable to integrate it into the development, design, manufacturing and service processes, and the overall degree of informationization is not high, and information islands often appear. Relevant data shows that the utilization rate of digital design tools in shipping and other fields is more than 85%; and the output value of industries such as high-speed rail transit, intelligent manufacturing, and ocean engineering account for more than 10%. Under the background of informatization and intelligentization of shipbuilding technology, the past extensive design and manufacturing forms of the shipbuilding industry have undergone earth-shaking changes [3]. In shipbuilding enterprises, information tools such as MES and ERP, industrial robots, new sensors, and intelligent control systems are widely used; however, they are compared with the world’s top-notch technologies in terms of information integration and interconnection among manufacturing processes. There are still obvious gaps in shipbuilding methods. On the whole, the current level of intelligence in domestic shipbuilding technology is relatively low, the problem of "information islands" still exists, and comprehensive integration, collaboration and innovation capabilities have not reached the corresponding height. Table 1 shows the extensive application of intelligent manufacturing technology in shipbuilding.
### Table 1. The extensive application of intelligent manufacturing technology in shipbuilding

| The utilization rate of ships and other fields | 85%     |
| The penetration rate of digital design tools  | 80%     |
| High-speed rail transit accounted             | 15%     |
| Industry value accounts of the total equipment manufacturing industry | 10%     |

### 3. Application of ship intelligent manufacturing technology

#### 3.1. Key technologies of ship intelligent manufacturing

In the development of modern manufacturing, artificial intelligence plays an irreplaceable role; advanced technologies such as intelligent robots, voice and image recognition, expert systems, and multi-information sensing have promoted the continuous enhancement of production efficiency. In the ship design link, process design and conceptual design are important manifestations of the creative thinking of most experts, and detailed analysis and judgment should be made. For the summary and analysis of experience, if it is done manually, it takes a lot of manpower and time. In the process of ship design, the use of expert systems can effectively free the design workers from the complicated work. From the perspective of ship intelligent design, manufacturing and operation, giving full play to the advantages of artificial intelligence deep learning can create a mature intelligent design, manufacturing, operation and management system, and continuously optimize the intelligent control mechanism from design, development to manufacturing. In a sense, intelligent manufacturing technology is actually a combination of manufacturing technology and artificial intelligence. Intelligent manufacturing in the current society is the in-depth application of traditional artificial intelligence in the manufacturing field, from the simple application of artificial intelligence to systematization. Use changes to build smart factories, and then achieve the goal of smart manufacturing. Radio frequency identification technology Radio frequency identification technology is a non-contact communication technology that uses radio signals to identify specific targets and obtain related data. It is used in shipbuilding with strong discreteness, denser personnel, and wider venues. The required parts are orders of magnitude higher. This technology is generally used in shipyard warehouses, mainly to carry in and out of various production materials, supply chain and asset management, and informatization a large number of parts and components, which is an indispensable step to realize intelligent shipbuilding [4].

#### 3.2. Internet of things, cloud computing, big data

The Internet of Things builds a "bridge" between the virtual environment and the real world, to a large extent, reduces the distance between objects and people in space, and brings great convenience to people's daily life and production. The Internet of Things technology helps to accelerate the transmission and processing of shipbuilding data, and promote the optimization of shipbuilding resource allocation. Cloud computing creates a reliable and safe environment for the processing and storage of data information, promotes data sharing among various manufacturing facilities, and provides efficient data support for ship design, manufacturing, and operation. Big data is a massive amount of data generated based on the Internet of Things. Big data relies on the advantages of cloud computing in data processing and storage to fully tap the hidden value of data. Analyze a large amount of data collected from the manufacturing process, facilities and ecological chain, so as to provide users with high-quality services. Shipbuilding usually needs to be divided into multiple stages, and the processing of steel plates at different stages requires different processing techniques. This process uses a wide variety of materials, parts, tools, and equipment. In order to ensure that the above items can be in place in time, avoid searching Material and delay manufacturing progress, real-time tracking management is very necessary [5]. On the other hand, the shipbuilding project is huge, and there are inevitably some hidden safety hazards in the manufacturing process, and the real-time positioning
system can accept information sources as soon as possible when an accident occurs, determine the location of the accident, and evacuate the construction personnel in time.

3.3. Virtual manufacturing technology
Shipbuilding is a very complex and systematic project. It is the same as the aircraft manufacturing industry. It has a large cost investment, and each link in the manufacturing process is highly correlated. Once a problem occurs, it will have a relatively large impact on the hull, resulting in a relatively large impact. Large cost loss, and virtual manufacturing technology can effectively reduce the probability of problems in the manufacturing process. Before the ship starts manufacturing, the staff can use virtual manufacturing technology to simulate the manufacturing of the plan in advance, determine the feasibility of the plan, and select a more economical plan under the premise of ensuring the production quality, and at the same time clarify the manufacturing process. The application of virtual manufacturing technology can effectively improve the flexibility of ship manufacturing, and can also deepen the staff's understanding of ship design and familiarity with the manufacturing process, thereby advancing the project progress and effectively reducing costs. Adopting virtual simulation technology, the entire supply chain division of labor and collaboration under virtual conditions have effectively changed the previous manufacturing method of "debugging, modification, and processing". With the support of virtual simulation technology, the entire manufacturing process is simulated, and the entire manufacturing process is simulated in advance. Predict, inspect and judge various performances to improve the efficiency of manufacturing and avoid rework in the later period due to insufficient initial design. In the shipbuilding industry, virtual models are created to predict the problems that may arise in products, instead of relying on prototypes to carry out repeated modifications, and promoting traditional manufacturing models to gradually get rid of the shackles of relying on experience, it can also enable people distributed in different regions and different positions. The staff work simultaneously within the same ship model to strengthen communication and interaction in all relevant aspects. For example, when designing a ship's engine room piping system, through virtual simulation technology, designers can "enter into it" to lay out the pipes, and at the same time, they can check whether there is interference in them. 3D models can be created for all piping, and any part can be intercepted on the computer. Observe and analyze it above, and then realize that the problem of unscientific internal pipeline layout can be effectively avoided in the design [6].

![Figure 1. Key technologies of intelligent ship manufacturing](image)

4. Development trend of ship intelligent manufacturing

4.1. Digital workshop
The surplus of low-level manufacturing capacity and the severe lack of high-level manufacturing capacity are the main reasons why China’s shipbuilding industry is "large but not strong". The application of intelligent manufacturing is gradually changing this phenomenon. The process before segmentation and segmentation uses 3C technology (communication technology, computer technology and control technology) and production management software to effectively manage the operation of a
certain production link, but it does not achieve the integration of the entire shipyard’s manufacturing island, So as to realize data sharing [7]. Intelligent manufacturing is to use machines to collect data while integrating human wisdom to achieve optimization goals. It can not only maximize the economic benefits of the enterprise, but also ensure the personal safety of the operators, so that the sustainable development of the industry can be realized.

4.2. Application of intelligent manufacturing technology in shipbuilding

At this stage, the application of smart manufacturing technology in the shipbuilding industry mainly includes smart design, smart operation, smart service, smart control, smart manufacturing, and cloud computing platforms. From the perspective of intelligent design, multi-level flexible design should be started from the demand side, and modularization should be adopted to improve the convenience of ship design. From the perspective of intelligent operation, the use of advanced technologies such as the Internet of Things and computers will continuously reduce the difficulty of shipbuilding management, and adopt modern methods to promote the intelligentization of shipbuilding and operations. From the perspective of intelligent services, it is mainly reflected in the information feedback and processing of the whole cycle of shipbuilding, which can control shipbuilding more quickly and conveniently. The perfect production control system can quickly locate and track the materials and equipment required in the manufacturing process, thereby saving the time for preparing materials and equipment, and realizing the monitoring and data analysis application of various product progress, thus shortening the production to a certain extent [8]. Cycle, effectively reducing transportation and management costs. According to relevant data, after an enterprise in my country has put into use a set of intelligent manufacturing execution system, its production efficiency has increased by about 60%, reducing the problems and problems in the manufacturing process. Improve the working environment and reduce the risk of safety accidents. It can be seen that the production control system is an important development direction of intelligent manufacturing in the shipbuilding industry.

From the perspective of intelligent maneuvering, in most situations of shipbuilding, problems in the manufacturing process can be detected in time without human operation, and can be corrected automatically. This greatly reduces labor costs and helps strengthen shipbuilding effectiveness. From the perspective of intelligent manufacturing, all modules can be pre-designed with the support of a computer [9]. The specific operation links only need to be operated according to the corresponding process. If an abnormal problem occurs, the machine itself will immediately make a judgment, and then proceed. Targeted correction. From the perspective of the cloud computing platform, it can efficiently collect and process all data, laying a data foundation for the above five types of "intelligence", thereby generating a systematic cycle. With the support of this system, the shortcomings of the existing shipbuilding model can be properly resolved, which will help greatly strengthen the intelligence and integration level of shipbuilding.

4.3. Research on the application of augmented reality technology in the field of shipbuilding

Augmented reality technology research is one of the key development directions of intelligent manufacturing in the shipbuilding industry. Specifically, it refers to the new technology of "seamless" integration of real world information and virtual world information [10,11], which is mainly manifested in design remote collaboration, process simulation, In terms of equipment assembly and maintenance, the enhancement of this technology can realize information sharing, which is conducive to the modification of design schemes. In addition, designers can use this technology to check whether the ship design is reasonable, avoiding the occurrence of project delays due to design problems found in the manufacturing process and having to stop production. It also reduces the company's human, material and financial expenditures to a large extent. In the context of rapid development of science and technology, diversified shipbuilding technologies will surely be formed. In my country's existing shipbuilding industry standard mechanisms, apart from information technology and a few database standards and 3D models in the application field, there are no standards for intelligent manufacturing.
and digital workshops. Based on the national intelligent manufacturing standard mechanism construction guidelines and the development trend of ship intelligent manufacturing technology, and on the premise of the existing ship industry standard mechanism, building an intelligent manufacturing standard mechanism related to high-tech ships and marine engineering equipment is a dynamic innovation and reform. It should first determine the "urgent, important, and mature" standards, complete the standard review, timely revision, etc., through the "snowball" form, from point to line, from line to surface, to further optimize ship intelligent manufacturing standard mechanism.

5. Conclusion
With the advancement of the information age, the global industrial manufacturing intelligence has become a general trend, and has reached a period of vigorous development in the past two years. The shipbuilding industry is one of its development key industries. Intelligent manufacturing technology can not only shorten the time while ensuring product quality. The construction period can effectively improve production efficiency, and it can also be controlled in time in the event of an accident to ensure the personal safety of staff and reduce business losses. In order to promote the intelligent development of the shipbuilding industry, looking for new technologies suitable for our country and constantly improving and improving existing technologies, establishing a sound ship intelligent manufacturing standard system is the most worthy of research and exploration at present. With the advent of the information age, the intelligentization of the world's manufacturing field has entered a stage of rapid development. Under the current market background, it is necessary to gradually improve the intelligence of shipbuilding to ensure that shipbuilding companies can be in the dominant position in the ever-increasing market competition. At present, intelligent shipbuilding has become the backbone of the strategic goal of achieving the "power of the ocean", providing a steady stream of power for the innovative development of the shipbuilding industry, and promoting the high-quality development of my country's shipbuilding industry.

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