

# Research on the Development Needs of Petroleum Machinery Postgraduate Industry

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**Abstract:** The number of domestic graduate students has reached a significant level in recent years. With a large number of graduates entering the job market, the competition for jobs has become intense. The relatively small number of available jobs has led to a rather severe employment situation. When we conduct an in-depth investigation into the latest development trends of the petroleum machinery industry, we find that the industry is constantly evolving. New technologies are being introduced, and there is a growing demand for advanced machinery in the oil and gas sector. This indicates a promising future for the industry. However, the industry also faces certain challenges. There are issues such as intense competition within the industry, and the need for highly specialized skills. Despite these challenges, the market demand for petroleum machinery remains substantial. Graduate students majoring in petroleum machinery have a unique advantage in this context. Their in-depth knowledge and practical skills enable them to meet the industry's demands. As a result, they are likely to have a strong presence in the future employment market, enjoying competitive advantages that will help them stand out in the job-hunting process.

**Keywords:** Petroleum Machinery; Graduate Students; Employment

## 1. Introduction

Nowadays, the petroleum machinery specialty is a crucial part of the energy field. It holds significant importance in the development of the national economy and energy security. With the global energy structure continuously evolving and technological innovation advancing at a rapid pace, the demand for professional talent in the petroleum machinery industry is on the rise. This not only brings

new opportunities but also presents challenges for graduate employment [1]. The petroleum machinery industry is witnessing a transformation. New technologies are emerging, such as advanced drilling and extraction techniques, and the use of high-tech equipment in oil refineries. These changes require a workforce with specialized knowledge and skills. For instance, the development of more efficient and environmentally friendly machinery demands that graduate students are well-versed in engineering and technology. This paper aims to study the demand of industry development for graduate students majoring in petroleum machinery. By analyzing the current employment situation, it can provide valuable insights into how graduate students can better meet the industry's needs. This will help in the training of graduate students, enabling them to be more competitive in the job market. Moreover, it also promotes the interaction between professional talents and industry development, ensuring a sustainable and prosperous future for both the students and the industry.

## 2. The Latest Development Trend of Petroleum Machinery Industry

The petroleum machinery industry is at the core of the global energy industry and has close connections with oil and gas exploration, mining, transportation, and processing. With the increasing demand for energy in the world and the deepening of oil and gas resource development, the industry has been constantly innovating in technology and improving performance. The latest development trends in the petroleum machinery industry are reflected in the following aspects.

### 2.1 Automation and Intelligence

In today's era, with the relentless march of

technology, the petroleum machinery industry is undergoing a profound transformation, steering resolutely towards automation and intelligence [2,3]. The integration of advanced control systems and cutting-edge robot technology has become a game-changer, significantly enhancing operational efficiency and fortifying safety measures. Looking ahead, the industry will place even greater emphasis on sustainability and intelligent upgrades [4]. By leveraging the power of artificial intelligence and harnessing the potential of big data analysis, it will achieve intelligent operation and maintenance, as well as optimal equipment scheduling. This will not only boost resource utilization efficiency but also enhance operational flexibility, paving the way for a more efficient and sustainable future in petroleum machinery.

### **2.2 Deep-Sea and Polar Mining Technology**

In the current context of an ever-expanding global energy appetite, the petroleum machinery industry has been thrust into the spotlight, compelled to pioneer and innovate. To satiate the surging demand for energy on a global scale, it is now fervently exploring and delving into mining technologies suitable for extreme environments such as the deep sea and the polar regions. [5] These uncharted territories present formidable challenges, yet they also hold the promise of vast untapped oil and gas resources. By venturing into these extreme frontiers, the industry is not only broadening the geographical expanse of resource development but also pushing the boundaries of technological capabilities. This bold exploration is set to redefine the future landscape of the petroleum machinery industry, opening up new avenues for growth and resource acquisition.

### **2.3 International Market Expansion**

In recent years, China's petroleum machinery industry has been experiencing remarkable growth. While maintaining a stable position in the domestic market, it has been vigorously expanding its footprint in the international arena. With the increasing globalization of the industry, domestic enterprises are acutely aware of the importance of enhancing their international competitiveness. This entails continuous improvement in product quality, technological innovation, and after-sales

services. Moreover, they are focusing on strengthening brand building to establish a recognizable and reliable image in the global market. By actively seeking and expanding overseas sales channels, these enterprises are better poised to meet the diverse needs and intense competition of the international market, aiming to carve out a larger share and contribute to the overall development of the global petroleum machinery industry.

### **2.4 Policy Support**

In the contemporary era, the national government has placed an utmost emphasis on energy security matters, given their critical implications for national stability and economic prosperity. In response, a comprehensive series of far-reaching policies have been introduced and implemented to actively support and bolster oil exploration and development initiatives [6,7]. These policies, with their clear directives and incentives, have not only created a conducive environment but also opened up a vast and expansive space for the development of the petroleum machinery market.

### **2.5 Market Competition Pattern**

In the petroleum machinery industry, a diversified market competition pattern has been formed, with state-owned enterprises, foreign-funded enterprises, and private enterprises all playing their roles. State-owned enterprises, boasting a long history and abundant industrial resources, firmly occupy an important position. Their extensive experience and solid foundation enable them to undertake major projects and contribute significantly to the industry's stability and development. Foreign-funded enterprises, on the other hand, are renowned for their advanced technology and high-quality products, often introducing cutting-edge manufacturing processes and innovative designs. Meanwhile, private enterprises have been making remarkable progress, rapidly enhancing their technical level and product quality through continuous efforts in research and development and learning from advanced models. This vibrant competition among different types of enterprises drives the overall innovation and progress of the petroleum machinery industry, bringing more choices and better services to customers.

## **2.6 Technological Innovation**

The petroleum and petrochemical equipment industry is playing a crucial role in propelling the high-quality development of the entire sector through continuous technological innovation. In recent years, as the global energy demand has been on the rise and the exploration and development of oil and gas resources have been further intensified, the petroleum machinery field has witnessed remarkable accomplishments. Technological innovation has led to the introduction of more advanced manufacturing techniques, intelligent control systems, and enhanced materials, which have significantly improved the performance and efficiency of the machinery. This not only meets the growing demands of the industry but also contributes to reducing production costs and environmental impacts. Moreover, it has enhanced the competitiveness of domestic petroleum machinery in the international market, opening up new opportunities for the sustainable growth of the industry.

## **2.7 Green and Low-Carbon Development**

The petroleum machinery industry has been making remarkable strides in recent times. It is not only actively embracing clean energy sources such as solar and wind power for its operations but also integrating advanced recycling technologies. This dual approach helps in substantially reducing carbon emissions and minimizing the waste of precious resources during the production and operation processes. By doing so, it is effectively enhancing the overall environmental image of the industry. Moreover, in line with the country's call for green innovation and high-quality development, the industry is taking proactive steps. It is optimizing its capacity structure to ensure more efficient utilization of energy resources and accelerating the shift towards green and low-carbon development models [8,9]. This concerted effort is paving the way for a more sustainable and environmentally friendly future for the petroleum machinery industry.

These trends show that the petroleum machinery industry is constantly adapting to and leading the transformation of the energy industry through technological innovation,

market expansion and policy support. High-quality development in the new era and the development of strategic industries in local regions require the support of high-quality professionals. As an important part of the energy industry, with the growth of global energy demand and technological progress, the demand for professionals with relevant skills and knowledge will be more urgent in the future.

## **3. Employment Challenges of Graduate Students Majoring in Petroleum Machinery**

At present, the industry is developing towards automation, intelligence and environmental protection [10]. However, the high cost of equipment, the challenges of complex terrain and extreme environment, and the control of environmental impact are the problems faced by the industry. At the same time, graduate students majoring in petroleum machinery also face many challenges in the job market.

### **3.1 Industry Competition**

With the technological progress and intensified market competition in the petroleum machinery industry, higher requirements have been put forward for the professional skills and innovation ability of graduate students. At the same time, the number of graduate students employed has increased, but there are relatively few positions available. Graduate students need to have a solid theoretical foundation and practical abilities in order to stand out in the fierce market competition.

### **3.2 Technology Updates Quickly**

The petroleum machinery industry is characterized by its rapid technological updates. [11] New materials, advanced manufacturing processes, and intelligent control systems are continuously emerging, revolutionizing the way the industry operates. In such a dynamic environment, graduate students find themselves at the forefront of the need to adapt. They must constantly engage in learning new technologies to keep pace with the ever-evolving demands of the industry. This necessitates that they possess the ability for continuous learning and self-renewal. They should actively seek out the latest research findings, participate in professional training, and collaborate with industry experts. By doing so, they can enhance their knowledge

and skills, ensuring that they are well-equipped to contribute effectively to the development of the petroleum machinery industry and stay competitive in the job market.

### **3.3 The Employment Direction is Relatively Concentrated**

The employment direction of graduate students majoring in petroleum machinery is clearly concentrated in the petroleum and chemical industry and related industries. This narrow focus has resulted in a relatively limited range of employment choices. For example, a large proportion of graduates tend to target positions in large oil companies or petrochemical plants. However, these industries are highly susceptible to external factors. The fluctuation of international oil prices will directly affect a company's profitability and investment decisions. In addition, changes in the macroeconomic situation, such as recession or slowdown, may further exacerbate the instability of the job market. This situation poses a challenge for graduates majoring in petroleum machinery to ensure stable and long-term employment, as they must cope with the uncertainty brought by these volatile economic conditions.

### **3.4 Gap between Starting Salary and Expectation**

Although the employment rate of graduate students majoring in petroleum machinery is relatively high, the change of salary level and job demand is also a problem that they need to pay attention to. Some reports show that there is a certain gap between the starting salary and the expected salary of postgraduates majoring in petroleum machinery, especially among doctoral students. For example, the graduate employment rate of China University of Petroleum (Beijing) and China University of Petroleum (East China) is above 97 %, but the salary level and job demand may fluctuate.

### **3.5 Gender Issues**

In certain areas of petroleum engineering and mechanical engineering, the nature of specific jobs and work settings demands physical labor and presence in less-than-ideal locations. For example, on oil field sites or offshore platforms, workers are exposed to harsh weather conditions, rugged terrains, and potentially hazardous environments. Given

these circumstances, some employers, perhaps influenced by traditional gender biases or concerns about the physical demands, show a preference for male graduates. This inclination unfortunately places female graduates at a disadvantage, as they often encounter additional hurdles in securing employment. Despite possessing equal or even superior academic qualifications and skills, they may struggle to break through this gendered barrier, facing more skepticism and having fewer opportunities presented to them in these male-dominated fields.

### **3.6 The Choice between Further Education and Employment**

For graduate students majoring in petroleum machinery, the decision between pursuing a doctoral degree and opting for direct employment is a crucial one. On one hand, choosing to read for a PhD offers the chance to significantly enhance academic prowess and research capabilities. It allows students to delve deep into their field of study, contribute to the academic community, and potentially open doors to more specialized and high-level career opportunities in the future. However, this path inevitably postpones their entry into the job market, during which time they might miss out on practical work experience and the immediate financial rewards. On the other hand, direct employment enables them to quickly gain valuable hands-on experience and start earning an income. But by doing so, they may forgo the opportunity to further expand their theoretical knowledge and engage in in-depth research, which could limit their long-term career progression in certain academic or highly specialized research-oriented positions.

### **3.7 International Employment Trends**

In the current era of globalization, with the continuous opening and integration of the global market, graduate students in the petroleum machinery industry are faced with new challenges and opportunities. They not only need to possess a solid foundation in professional knowledge but also must cultivate an international perspective. This means being aware of the latest trends, technologies, and market demands from around the world. Additionally, cross-cultural communication skills have become essential. They need to be able to effectively communicate and

collaborate with international partners, understand different cultural backgrounds and business etiquettes, and adapt to diverse working environments. Only by equipping themselves with these capabilities can they better meet the complex needs and fierce competition of the international market, enhance their personal competitiveness, and contribute to the international development of the petroleum machinery industry.

In general, graduate students majoring in petroleum machinery are facing many challenges in the job market. The requirements for professional skills are higher, and there is a gap between the starting salary and the expected salary. Graduate students need to constantly improve their professional skills and comprehensive quality to adapt to the changing job market.

#### **4. Market Demand for Graduate Students Majoring in Petroleum Machinery**

According to statistics from the Ministry of Education, the number of graduates is expected to reach 11.58 million in 2025, while the number of graduate students is expected to exceed 5 million. The increase in employment and the decrease in jobs mean that competition will be more intense. In recent years, petroleum machinery has been affected by various factors such as technology and policy, and the market prospect and demand have continued to increase.

The employment direction of petroleum machinery specialty mainly includes oil and gas exploration, drilling, production and processing. Graduates can be engaged in design, research, construction and management in oil companies, petrochemical industry and related enterprises. These positions not only require graduates to possess solid professional knowledge, but also require them to have practical operational skills and problem-solving abilities.

In terms of employment situation, state-owned enterprises in the petroleum machinery industry have a long history, strong R&D strength and more industry resources. Foreign-funded enterprises have strong R&D technology and high-quality products, but the price is high, mainly high-end products. In the subdivision field of petroleum drilling engineering equipment and technical service, the technical level and product quality of

private enterprises have been improved rapidly. Sinopec Petroleum Machinery Co., Ltd. is one of the key enterprises in this industry in China. Its leading products such as drill bits and downhole tools are at the international advanced level.

Specifically, the employment direction of graduate students majoring in petroleum machinery mainly includes the following aspects:

**Petroleum-related private enterprises:** Graduates can enter the R & D, design, production and other departments of energy companies such as oil and natural gas, and engage in technology and management related to petroleum machinery. For example, Sichuan Honghua Petroleum Equipment Co., Ltd., Nanyang Erji Petroleum Equipment Co., Ltd., Dongying Changming Petroleum Machinery Co., Ltd., Yantai Jerry Petroleum Equipment Technology Co., Ltd., Shandong Kerui Petroleum Equipment Co., Ltd., Tonghua Petrochemical Machinery Manufacturing Co., Ltd., Dezhou United Petroleum Machinery Co., Ltd.

**Large state-owned enterprises:** Many graduates choose to enter the country's large state-owned enterprises, such as PetroChina, Sinopec and CNOOC, to engage in technology and management related to petroleum equipment. PetroChina's units are mainly distributed in the north of Qinling-Huaihe River, Sinopec's units are mainly distributed in the south of Qinling-Huaihe River, and CNOOC's units are mainly distributed in coastal cities and seas. The units of state-owned enterprises can be divided into several major sectors, such as oilfield branch companies, refining and chemical enterprises, engineering and technical service companies, equipment manufacturing enterprises, scientific research units and so on. The optional positions for postgraduates majoring in petroleum machinery mainly include mechanical automation, safety production management, equipment research and development, gas storage and transportation, etc. In the 2025 campus recruitment, PetroChina, Sinopec and CNOOC provided a variety of positions for petroleum machinery graduate students, such as mechanical automation posts, equipment manufacturing posts, equipment instrumentation posts, etc., showing the industry's demand for mechanical

professionals. In addition, PetroChina plans to recruit more than 11,000 fresh graduates in campus recruitment in 2025, indicating that the oil industry 's demand for high-quality talent remains strong.

Foreign oil companies: some of the more outstanding graduate students will also choose some foreign oil companies, such as Schlumberger, Baker Hughes, BP, Halliburton, Wiedford, Royal Dutch Shell Group, ConocoPhillips, ExxonMobil, Total Oil, Chevron, Eni, Saudi Aramco, Gazprom, Lukil, Chevron, Repsol and so on.

In addition to working in enterprises, some graduates will also choose to enter colleges and universities to engage in teaching or enter scientific research institutions to engage in scientific research. Some excellent graduates will choose to continue to study for a doctorate or study abroad to improve their academic and research capabilities.

The salary level of graduate students majoring in petroleum machinery also has certain competitiveness in the industry. The starting salary of graduate students after graduation can reach about 7000 yuan.

To sum up, the graduates of petroleum machinery major have high competitiveness in the job market, not only because of the large demand for talents in the industry, but also because the salary level and career development prospects of the industry are more optimistic. At the same time, the development trend of the industry also provides more development opportunities and challenges for professionals.

## 5. Conclusion

As an important basic and pillar industry of the country, the oil industry has been experiencing a significant transformation in recent years. The global economic and policy environment has spurred new development trends and employment opportunities. Despite the challenges posed by environmental policies and market volatility, the oil industry remains dynamic and full of potential. It has been steadily evolving, with new technologies emerging, such as advanced drilling and extraction techniques, and the development of more efficient oil refining processes. For graduate students majoring in petroleum machinery, their employment advantages are quite notable. The demand for high - skilled

talents in the oil industry, especially in the areas of oilfield services and oil and gas equipment manufacturing, is substantial. These students with specialized knowledge and skills are highly sought after by employers. The oil industry, though facing numerous challenges, has a promising future. It offers a wide range of employment opportunities, from research and development to production and maintenance. With the support of technology and policy, the industry's employment prospects and career development are indeed worth looking forward to. As the industry continues to grow and adapt, graduate students in petroleum machinery can expect to play an important role in shaping its future and reaping the benefits of a rewarding career.

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