

Lean Management Application in Vehicle Engine Manufacturing Enterprises

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Abstract: Lean Management mode implementation is a new way and direction for vehicle engine manufacturing firms to face intelligent transformation and upgrading development. However, with growing raw material and labor costs, domestic and worldwide rivalry, and other factors, the original vehicle engine firm production management mode faces numerous challenges to the development of enterprise efficiency. In the context of comprehensively implementing the national manufacturing strategy and promoting enterprise transformation and upgrading, this paper analyzes the status of production and operation management of Chinese vehicle engine manufacturing enterprises with Lean Management as the bottom line guarantee, summarizes the management dilemmas of its production and operation management system, evaluation system, human resources attention standard, and recommends future research.

1. Analysis of necessity: the importance of Lean Management

Chinese economic model has progressively created a new normal since 2015, and numerous industries are confronting new challenges. Due to the annual increase in raw material and labor prices, competition is increasing, and product earnings are severely constrained. In order to break through the existing issue and embrace the chance for this challenge, the Lean Management model is increasingly offered in this context in enterprise system management.

1.1 Conceptual Analysis of Lean Manufacturing Management

Lean Manufacturing Management was first presented in the United States at the Massachusetts Institute of Technology (MIT) as part of the International vehicle Initiative (IAI) research program. Lean production management not only reduces manufacturing costs, but it also enhances product quality and completeness. ^[1]This study defines lean management broadly, emphasizing the notion of putting people first and encouraging team organization and development. It ensures product quality by understanding clients well enough to make products that suit their expectations, following the concepts of right-time, right-quantity, and right-fit production, and implementing precise product development methods. Lean management seeks to eliminate material waste and lower manufacturing costs, with the ultimate goal of boosting customer satisfaction.

1.2 Factors for constructing Lean Management model for vehicle engine

Enterprises are currently dealing with a significant change in the external environment as a result of the market economy's rapid development, the global economy, and the integration of information networks into society. For the manufacturing sector, this presents both an opportunity and a challenge. Only by continuously optimizing the internal structure of the product and actively responding to market dynamics is it possible to take advantage of the product resource allocation, thus promoting the power and ability of the enterprise's sustainable development. These adjustments to the product structure and improved innovative enterprise management mechanisms will increase the enterprise's response speed to changes in the external environment. ^[2]Therefore, reforming and optimizing the production and operation management of vehicle engine manufacturing firms from the perspective of Lean Management is critical for further innovation in the mode of operation.

1.3 Lean management promotes the construction of enterprise lean culture

With the in-depth implementation of the lean management system, vehicle engine manufacturing enterprises will gradually form a corporate culture centered on "continuous improvement". For example, at the material level, the enterprise will use the 5 S on-site management method (organizing, reorganizing, sweeping, cleaning, quality etc.) to review the equipment management and also use the production concept of eliminating the three M's (Muda, Mura, Muri) to reduce non-value-added consumptive behaviors and shorten the operation time. (1) Crisis Awareness: Avoid wasteful behaviors in the manufacturing process of vehicle engines by taking the lean production idea of "zero defect" as the benchmark. (2) Problem Awareness: Cultivate the spirit of asking questions from the surface to the inside of the enterprise staff, explore the root causes of problems, and prevent similar problems from arising. (3) People-oriented consciousness: emphasize the concept of "people-oriented", attach importance to the cultivation of multi-disciplinary composite talents, and optimize the human resource management system. (4) Pursuit of excellence: In the pursuit of cost reduction and elimination of waste, we strictly control the quality of our products and vehiclers out the lean culture throughout the production and R&D processes. (5) Cumulative awareness: Enhance the "snowball" effect and form a continuous lean culture system. In this way, we can reasonably cope with the external environment, realize the coordination and profit sharing between upstream and downstream, pay attention to talents and operation management, and build the enterprise culture system under the perspective of lean management from the organizational dimension, functional dimension, management dimension, and time dimension.

2. Justification analysis: the role of Lean Management

2.1 Promote the team building work of vehicle engine enterprises

Lean manufacturing management is a management philosophy that seeks to maximize efficiency and eliminate waste, with the key being continuous improvement and learning. In vehicle engine manufacturing companies, Lean Management helps advance team-building efforts. First, Lean Management emphasizes the ability and knowledge enhancement of employees. The personal growth and improvement of employees is a key part of Lean Management which can help companies focusing on providing employees with ongoing training and learning opportunities to continuously improve their professional skills and management capabilities. This not only helps to improve productivity and product quality but also enhances employees' professional fulfillment and promotes cohesion within the team. Second, lean manufacturing management encourages employee participation and innovation. By encouraging employees to participate in improving processes and proposing new

solutions, companies can gain valuable ideas for improvement from the practical experience of their employees, as well as stimulate their spirit of innovation and enthusiasm for work. This contributes to an open, cooperative, and innovative team culture. In addition, lean manufacturing management focuses on processes and efficiency, while efficient work processes and clear job responsibilities help to reduce friction and conflict within the team and increase the team's job satisfaction. Through continuous improvement of work processes, organizations can reduce production costs and increase work efficiency, thus giving team members more time and energy to devote to more challenging work and personal growth. Therefore, Lean Management can effectively promote the team building of vehicle engine manufacturing enterprises and provide strong human resource support for the sustainable development of the enterprise by improving the skills and knowledge of employees, encouraging employee participation and innovation, and optimizing the workflow.

2.2 Improvement of enterprise production performance

The lean management model provides substantial help for the transformation and development of vehicle engine manufacturing enterprises. First, it emphasizes customer value and demand as the driving forces, which is precisely in line with the core driving forces of the market economy. Secondly, lean management encourages the transformation from extensive management to intensive management, aiming to minimize all kinds of waste and effectively use social resources in order to improve overall economic efficiency. In addition, lean management is also beneficial to the innovation of the operation mode of vehicle engine manufacturing enterprises. In the production process of vehicle engine manufacturing enterprises, there are serious problems such as waste of resources, a long product development cycle, a low success rate, an inventory backlog, and financial process difficulties. By introducing the concepts and methods of Lean Management, it can promote innovation in the production and operation modes of the enterprise and reduce unnecessary human and material resources. Finally, lean management also has a positive effect on the strategy and execution of engine manufacturing enterprise groups. Therefore, the implementation of Lean Management in vehicle engine manufacturing enterprises can make the collaboration between various enterprises closer, reduce inventory, improve the efficiency of capital operations, and reduce the waste of social resources.

2.3 Promoting corporate lean manufacturing technology innovation

Lean Management plays a crucial role in promoting the progress of lean production technology in automobile engine manufacturing companies. First, lean management emphasizes the principle of continuous improvement, which directly promotes the continuous progress of production technology. By constantly identifying and solving problems in the production process, the enterprise can continuously optimize the production process and improve production efficiency, and at the same time, it will also motivate employees to continuously improve their personal technical skills and promote the progress of production technology. Secondly, lean management focuses on data-driven decision-making, thus promoting scientific and standardized lean production technology. By systematically collecting and analyzing production data, companies can identify bottlenecks and wasteful links in production and then adopt scientific methods and techniques to make improvements. This data-driven decision-making approach ensures that production technology improvements are going in the right direction and improves improvement results. In addition, lean management focuses on the overall optimization of processes, which is particularly important in the field of vehicle engine manufacturing. Because vehicle engine manufacturing involves numerous processes and assembly links, the efficiency and quality of each link will directly affect the performance of the final product. Through Lean Management, companies can expand their focus from a single link to the entire process,

achieving optimization and progress in production technology on a wider scale. Therefore, the principles and methods of Lean Management can effectively promote the progress of lean production technology in vehicle engine manufacturing enterprises, thus improving production efficiency and product quality and enhancing the competitiveness of enterprises.

3. Practical Review: Current Status of Lean Management in Automotive Engine Manufacturers

3.1 Improve the production and operations management systems

The primary goal of the production and operation management system, in conjunction with lean management, is to maximize economic benefits while utilizing as few resources as possible. From the standpoint of site management, production operation management is the dynamic deployment and improvement of each aspect of the production process of vehicle engine manufacturing businesses in order to promote the realization of company benefits. However, there are several stumbling blocks in the lean management system of vehicle engine production companies, and the fundamental flaws can be linked to three factors: First, the manufacturing workshop lacks the ability to establish specific lean management objectives. Most vehicle engine manufacturing workshop production plans, performance appraisal responsibility letters, and other documentation lack lean management objectives. Second, the workshop has not developed an organization that promotes lean management effectively. The existing organizational structure is a functional management body that focuses on day-to-day management rather than a goal-oriented body, resulting in inflexible and inefficient management. Finally, the workshop's management system falls short of covering lean management components. It commonly causes illogical production line designs, uneven assembly line stations, low efficiency of supporting logistics, and other problems to develop in vehicle engine manufacturing firms. Thus, more research and analysis are required, followed by a retrospective solution to the problem.

3.1.1 Unreasonable Production line layout

Production line layout is a critical engineering task in vehicle engine manufacturing organizations, affecting not only production efficiency but also the safety of enterprise personnel and economic rewards. However, in practice, the issue of unreasonable enterprise production line layout arises frequently. To begin with, incorrect space usage is a prevalent issue. A good production line architecture should take into account the efficiency of space use. However, some businesses may not fully maximize the space layout of their manufacturing areas, resulting in limited space for equipment and personnel operations. When the distance between equipment and personnel is too short, it not only limits employee activities, causing low productivity, but it may also cause machinery to malfunction.^[3] A large-scale re-layout is required when changing the production process or adding a new product line. This will take a significant amount of time and money, negatively impacting the enterprise's economic efficiency. In conclusion, the layout of the production line is closely related to the high-quality development of vehicle engine manufacturing enterprises and must take into account the influence of multi-dimensional factors, such as only considering current production needs but failing to anticipate future development needs. Vehicle engine manufacturing enterprises cannot build a highly efficient, safe, and economical production system.

3.1.2 Imbalanced assembly line workstation

There is a clear imbalance in vehicle engine manufacturing businesses' assembly line stations. Firstly, most vehicle engine manufacturing companies lack long-term integrated planning for workplace layout. With product upgrades and replacements, production equipment continues to grow,

and the original workshop layout can no longer match production demands. However, the newly purchased equipment layout planning does not take into account the total productivity of the workshop and the smoothness of the process, which cannot be effectively implemented, resulting in a chaotic workshop layout, and the equipment layout is not fair. Second, financial support for the modernization of assembly line stations in vehicle engine production businesses is insufficient. The movement and adjustment of the assembly line station necessitates a capital expenditure, but the workshop and firm are profit-driven and do not prioritize the building of compliant assembly line infrastructure. The budget simply lists the expenses of equipment repair and maintenance and does not include the costs of workshop layout adjustment, resulting in the workplace layout being unable to be successfully optimized.

Furthermore, the insecurity and irrationality of the manufacturing process increased the imbalance of assembly line workstations. Large deviations in the execution of production plans, equipment breakdowns, and workpiece rework issues frequently impede production progress. In the meantime, incorrect inventory counts have an indirect impact on the enterprise's production decisions, resulting in an uneven allocation of workstation loads. Finally, process improvement measures are insufficient; the process operating cycle varies greatly, is not based on the needs of the production beat to design, and cannot realize standardized operation, resulting in increased instability of the workflow and decreased work efficiency at the assembly line workstation.

3.1.3 Low efficiency of supporting logistics

There are numerous variables that contribute to the low efficiency of vehicle engine manufacturing firms' supporting logistics. The first is an issue with information management. The important information in production logistics includes the actual vehicle order, production line status, material consumption rate, online distribution information, material assembly information, picking information, and inventory information. This information primarily comes from the manufacturing line, and if it is not handled appropriately during the logistics stage, it may result in uneven production. The second issue is one of material classification. Material classification is critical in all elements of manufacturing logistics. The classification of materials directly affects the determination of replenishment strategy in the production line; in the online distribution stage, the classification of materials can optimize distribution route planning and balance the use of manpower and equipment resources; and in the inventory chain, the classification of materials determines the layout of storage space. All of this must be based on the material's properties and the use of appropriate classification criteria, which influence logistics efficiency. In addition, management and technology application issues are also closely related to production logistics. Factors such as interdepartmental communication, implementation of process regulations, visualization management, storage space planning, and workflows all indirectly influence the smooth operation of production logistics. Finally, prerequisites and constraints, such as the stability of materials at the workplace, financial strategies, supplier strategies etc., which also play a major role in the creation of inefficiencies in logistics.

3.2 Lack of operational control of production plans

Most vehicle engine manufacturing companies confront difficulties in acquiring and producing significant volumes of orders. This is because a greater number of enterprises frequently lack the high-volume production knowledge and managerial competencies required to compete for large-scale contracts with low pricing, excellent quality, and short lead times. Many small and medium-sized orders are required to keep operations running, resulting in a high number of customized needs and a small-lot, multi-batch, multi-state production model.

In terms of cost control, the small-lot production model raises costs. The variety and small quantity

of production materials make it impossible to centralize purchasing, which reduces the negotiating power of enterprises. At the same time, the high diversity of products requires frequent adjustments to personnel and equipment, which interrupts the production process and not only increases the number of production transitions, resulting in excessive time consumption, but also hinders the maximization of the efficiency of personnel and equipment. Furthermore, due to the high demand for product customization and small quantities, it is difficult to properly validate the process methods, which necessitate additional inputs of production materials to ensure that the products can be produced on time and in adequate quantities. In terms of quality control, it is difficult to carry out large-scale standardized and specialized manufacturing due to the great variety and small number of products, relying primarily on manual or semi-mechanized production methods. Employees must cope with more production factors, swap job content frequently, and fail to develop their work proficiency as a result. Similarly, product quality may be unstable since process procedures are difficult to adequately validate. These two problems interact with each other, not only exacerbating the difficulties of small and medium-sized manufacturing enterprises in obtaining and producing large-volume orders but also posing serious difficulties for the high-quality development of enterprises.

3.3 Lack of attention to human resource management

With the updated iteration of the economic system, most vehicle engine manufacturing enterprises lack long-term planning in the development of strategic management of enterprise operations, a lack of attention to human resource strategy, a management system that has not been perfected, a comprehensive performance appraisal system, and employee standards. Because of the advancement of the market economy and the deepening of the contradiction of internal competition in the firm market, the development of a human resource management system is critical to preventing talent loss and enhancing employees' core competitiveness. However, in the actual production management process, enterprises frequently choose to ignore systematic training of the comprehensive management abilities of staff; the assessment content and incentive mechanisms cannot be balanced; and the brain drain resulting in further implementation of corporate strategy is difficult to guarantee.^[4]As a result, in order to ensure long-term management of the enterprise, it should be established to improve the comprehensive training system and performance appraisal system, the use of professional calculation tools and management methods, the results of the work of the staff, and the state of regular feedback so that the enterprise's work and the quality of the personnel complement each other.

4. Lean Management system under the strategic elements of enterprise development

4.1 Vehicle engine enterprise organization structure improvement

We need to improve the production layout. In the field of vehicle engine manufacturing, the SMT layout of many enterprises follows the traditional linear production mode, which indirectly leads to discontinuity in production and loss of efficiency due to waiting and batch handling between processes. In order to avoid similar risks, a U-shaped layout can be used to achieve continuous production of SMT, reducing the wastage caused by standstill time, handling and movement. Theoretically, this U-shaped layout can reduce the manpower requirement of the SMT line, shorten the production cycle time, reduce the inventory of semi-finished products, reduce the waste of product handling, and at the same time reduce the complexity of the production planning. This optimization path first needs to classify and analyze the products, including board width, number of daughter boards, number of standard parts and number of non-standard parts etc., and then vehiclerly out beat time analysis, such as bottleneck man-hours, mounter performance and hourly capacity etc, and

finally select high-frequency products for the U-shape line production. Since most of the enterprises in the industry still use linear layout, the effect of U-shaped layout has yet to be verified as well as the migration of SMT production line will involve a number of influencing factors, including customer acceptance, safety stock level, migration cost, manpower allocation, re-verification etc., it is recommended to first select part of the SMT production line for the trial run of U-shaped production. If the results of the trial run meet expectations, then consider rolling out to other SMT lines.

Enhancement of production line design. For vehicle engine manufacturing products, the long-term strategy must be to create platform products so that they can meet all kinds of needs. Vehicle engine manufacturing enterprises need to take this as a benchmark for strategic adjustment, introduce management personnel with platform development capabilities, conduct research and development of platform products, and correspondingly design a platform production line. In the case that the product platform has not yet been realized, the enterprise can explore the development of platform assembly and testing lines so that multiple products can share the same production line, and further, based on the development of mixed-flow production lines, within a certain period of time, different models and specifications of the product can be produced on the same production line. The first step is to work with the R&D and design departments to analyze the common features of the products in terms of their software, hardware, and mechanisms, such as the program function, the number of PCBA boards, the shape of the cover plate, and the way it is fixed. Next, based on these common features, a standard module library is constructed, and when new products are developed, priority is given to selecting existing modules from the standard module library. If no suitable module can be found, new modules are considered. Finally, manufacturing engineers can develop automated assembly machines, automated functional testing machines, and automated optical inspection machines that can meet the needs of multi-product co-production based on modularized product design.

We need to optimize production schedule management. Considering the current equipment layout, order status, and factory environment of most vehicle engine manufacturers, it may not be practical to implement full-scale continuous flow production. Therefore, we can try to introduce Kanban pull production to replace the current push production mode. ^[5]The pull production system is an implementation of just-in-time production in which the demand for the next process drives the production of the previous process, avoiding overproduction and effectively reducing inventory and waste.

In order to improve production efficiency, reduce production costs, and improve customer satisfaction in the face of globalized market competition and increasingly demanding customer needs, vehicle engine manufacturing companies must implement effective reform and optimization.

First, planning tasks should be stated, and organizational structure should be altered to improve the efficiency of production and planning management. Remove the production planning role from the production department and delegate it to the head planner in the logistics department to assist the organization in better coordinating and balancing production and inventories, thereby eliminating wasteful expenses. Simultaneously, a separate planning manager post can be established to oversee the work of the lead planner team and organize communication and collaboration with other departments. Second, the assessment indicators should be redesigned to be more thorough and practical. In addition to the regular order fulfillment rate and on-time delivery rate, other significant indications for data support, such as inventory turnover and material obsolescence rate, should be included. Improved usage of Enterprise Resource Planning (ERP) systems for production planning management. With the ERP system's pull production method, the production plan may be directly driven by client orders, which not only decreases inventory but also enhances production efficiency. The supply chain can be better controlled by influencing the material procurement plan to more efficiently change raw material purchase orders as well as the quantity and timing of suppliers'

shipments. Third, more adaptable manufacturing procedures are fully implemented. For example, because a vehicle engine manufacturer's suppliers typically come from overseas or other locations, we can use the Material Requirements Planning (MRP) system to ensure raw material supply and adopt Kanban-pull production in-house to reduce overproduction and waste while increasing production efficiency. For high-frequency and medium-frequency products, the production planner can directly release the production plan, whereas for low-frequency products, such as aftermarket parts, this paper suggests that the production plan must release a separate work order due to the high risk of inventory hold-up.

4.2 Innovative application of Lean Management energy consumption control

Because engine manufacturing enterprises lack the ability to control production operations, cost control and quality control are difficult to ensure. As a result, two manufacturing process optimization methods, such as group production and cell production, should be coordinated and applied, focusing on waste reduction, efficiency improvement, effective production planning, and practical operation based on their characteristics and commonality.

Group production is the process of categorizing products based on similarities in structure, procedure, materials etc., and assigning these groups to relatively fixed equipment and production stations. The benefit of this method is that it can significantly reduce changes in production preparation and personnel capacity requirements due to product switching in cases where the process layout cannot be easily adjusted, avoiding reductions in effective production time in order to achieve rapid switching in vehicle engine manufacturing. ^[6]Cell production, on the other hand, is a technique for converting the typical long-process assembly line into a short-process production line via the product flow by unit mode. This method of high flexibility can modify the number of units at any time, from the composite collaborative production to a small unit of individualized production based on the features of different products. The benefits of this model are mostly apparent in its adaptability to handwork. Group and cell production can be utilized in tandem to advance the optimization of manufacturing processes such as vehicle engine production. Using both methods can reduce energy consumption in the manufacturing process, reduce the increase in quantity and distance caused by long line transfers, avoid excessive recycling time and manpower consumption, utilize space more efficiently, and improve the production line's adaptability.

4.3 Periodic evaluation of vehicle engine enterprise performance management

Lean Management is a production method that aims to eliminate waste, improve efficiency, and add value, but the ever-changing market mechanism drives vehicle engine manufacturing enterprises to create a perfect periodic evaluation management system, urging them to identify and eliminate all forms of waste, optimize the production process, and improve production efficiency.

Vehicle engine manufacturing firms might look for lean management professionals to provide specific direction and help for the engine production process when implementing lean management. We need to select and implement the proper tools and procedures to obtain optimal improvement results based on the real-life scenario of the vehicle engine manufacturing company. The most crucial part of this procedure is identifying and removing all types of waste. Overproduction, long waiting times, wasteful transit and movement, unsuitable handling, over-processing, excess inventory, a lack of innovation, and other factors can all contribute to waste. Only by frequently evaluating vehicle engine businesses' performance management can engine manufacturers successfully detect and solve these problems, optimize the production process, increase productivity, and reduce production costs. Furthermore, it should be noted that Lean Management is a continuous process; Therefore, while implementing Lean Management, vehicle engine manufacturing enterprises can continuously monitor

and improve their enterprise strategy by establishing an effective evaluation and feedback mechanism. This comprises a quantitative evaluation of results as well as an in-depth examination of existing problems in order to identify relevant improvement methods. Furthermore, the vehicle engine enterprise performance management system should be implemented in the direction of a lean culture system in enterprise practice to encourage and guide all employees to use the corporate culture as a benchmark to actively participate in the manufacturing process through a series of training activities to cultivate the lean thinking of the staff to improve core competitiveness. Form a fair reward and punishment mechanism, provide suitable awards to employees who make great contributions, and encourage enterprise employees' passion and innovation.

4.4 Guarantee measures for Lean Management in vehicle engine manufacturing enterprises

Leadership commitment and practice to strengthen business culture-building strategies First, lean management strives for total waste elimination, a process that will undoubtedly be accompanied by a series of adjustments and may confront a variety of unexpected challenges and opposition. It is impossible for Lean Management efforts to progress successfully without the full backing of senior management. Lean Manufacturing Management implementation is similar to an organizational reform, with measures covering all processes, from R&D and design to order management, production operations, quality control, and product shipment to the customer, requiring the active participation and cooperation of all functional departments. As a result, leadership commitment and practice are inextricably linked to the active execution of Lean Management actions and are the bottom line of all actions. Second, the leadership must set a good example, encourage all employees to participate in Lean Management, create a lean improvement plateau, continue to promote enterprise reform and development, change the concept of corporate culture, fully stimulate employees innovation potential, continuously improve the assessment mechanism, gradually improve the training system, and promote the improvement of the enterprise's core competitiveness.

Innovative artificial intelligence applications entail anticipating the evolution of the digital economy. In today's increasing digital economy, artificial intelligence innovation and application have become vital ways for organizations to actively react to this growth. This is particularly evident in the Lean Management systems of vehicle engine manufacturing firms, which may leverage the power of the digital economy to optimize the manufacturing process, enhance operational efficiency, and thereby innovate their service model. Companies can first introduce advanced data analysis tools and technologies, such as artificial intelligence and machine learning, in certain applications. The utilization of these tools and technologies enables businesses to evaluate production data more effectively, predict market trends, and detect and address problems. Enterprises may monitor potential problems in the manufacturing process in real time and make appropriate modifications and optimizations, avoiding excessive waste of resources and enhancing production efficiency, thanks to in-depth analysis and mining of massive amounts of complicated data. Second, with the help of digital tools, businesses can achieve transparency and real-time monitoring of the manufacturing process. Enterprises can carry out comprehensive control of the production process through the construction of intelligent factories and production lines, from the initial stage of raw material procurement to production and then to product shipment, with real-time monitoring, comprehensive data, and transparent information. This method can minimize errors and delays even more, increase product quality, and ensure product stability and reliability. In addition, the digital economy can assist businesses in better connecting with and understanding their customers. Companies can understand consumer requirements and expectations and hence provide more accurate products and services by analyzing enormous amounts of data on consumer behavior, purchase habits, use feedback, and so on. Simultaneously, data-driven individualized services and marketing tactics can be employed to

improve consumer happiness and boost an enterprise's competitive advantage in order to gain market favor and accomplish long-term development and growth.

5. Future Outlook of Lean Management in Vehicle Engine Manufacturing Enterprises

The implementation of a Lean Management system is impending in the face of increased production pressure. To increase their competitiveness, vehicle engine manufacturing companies must rely on high-quality reform and development. However, we must recognize that Lean Management innovation and development in vehicle engine manufacturing enterprises is not a one-stop solution; for vehicle engine manufacturing enterprises, continuous improvement of Lean Management in the workshop is the key, only through enterprise innovation and development can the enterprise achieve a competitive advantage. This study examines the production management challenges of vehicle engine manufacturing firms using lean production. Making the Lean Management concept the bottom line ethical guarantee, it proposes the improvement strategy of perfecting all levels of organizational structure of vehicle engine enterprises, using innovative Lean Management evaluation system, and regularly evaluating the performance management of vehicle engine enterprises as the main means to form a more perfect Lean Management system. This is critical to achieving the lean goal of workshop production, responding to market competition, improving efficiency, and saving money. Furthermore, this article proposes that, as part of the process of implementing Lean Management optimization, all employees should be adequately trained to improve their understanding of the concept of lean production systems as well as reinforce the lean management style and operation observation, further improve the enterprise production management system's construction and accumulate Lean Management optimization experience, in order to establish a firm foundation for the enterprise's production operation and long-term sustainable development.

In summary, This study not only allows enterprise managers to pay more attention to various problems in production management activities, and provides targeted and effective strategies for the resolution of existing problems in the enterprise, but also strengthens the cultivation of core competitiveness of the enterprise's staff, boosts the Lean Management system to go deeper and deeper within the enterprise, and facilitates the precise implementation of the Lean concept.

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