

Green Manufacturing Framework Development and Implementation in Industry

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Abstract: The automotive industry covers every country on our planet. But only a few of them are engaged in waste processing. The introduction of green production is one of the salvations of our planet. What is green production and how to implement it in the automotive industry. This is what will be discussed in this scientific work.


1 INTRODUCTION

Green production, also called environmentally safe production, environmental environment-oriented production and So Further. it comprehensive consideration environmental impact and efficiency use resources contemporary production models. Goal "Green production" is in minimum negative impact on the surrounding Wednesday and maximum usage resources from development product, production, packaging, transportation, usage and processing product. ultimate goal "green production" consists in volume, to coordinate development enterprises and social benefit.

At present, the manufacturing industry is developing rapidly. However, it also produces a ton of garbage and resource consumption. Nowadays the idea of sustainability and environmental friendliness is very popular. "Green production" is a problem that every manufacturer must solve. taken into consideration. However, in fact, many manufacturing companies would not like to apply green production and are not able to apply it. The reasons are mainly that those companies misunderstand green manufacturing and the lack of green technology manufacturing. Therefore, the author will analyse it and develop a new structure so that readers can better understand green production and learn more practical experience about green production.

The new structure of "Green Production" includes the principles of 4R and five core technologies. The implementation of this new structure will also be present in the automotive and electronics industries. This thesis is important for the author himself due to the fact that the Chinese government planned to reduce the environmental problem by the full-scale use of "green production" (Association for Manufacturing Excellence, 2007).

The first step towards green manufacturing is green design. It requires consideration of environmental influences in the design process. For example, recoverability, manufacturing complexity, the green level of the material used. The enterprise must also apply some advanced manufacturing systems to reduce waste, waste and improve production efficiency. Maintenance can extend the life of the product. It is better to consider the product design process in time. After "green" design, attention should be paid to "green" production. The company must use new technologies to reduce resource consumption and emission losses. The green package requires the manufacturer to use an appropriate package to achieve sustainability through design and material selection. The refined product must eventually turn into a reusable resource. Green recovery technology helps the company return defective products to their previous state close to new products.

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2 MATERIALS AND METHODS

Green production" has received a lot of attention from experts and scientists, where some measures have been taken. Although the literature on green production is theoretically focused on key issues, including the implementation of the mechanism, as well as the information system, and empirically quantitative researchers on some data in surveys, when it comes to status around the world, there are still many difficulties in green production.

It is very important for society to realize the importance of Green Production in order to realize this. It is undeniable that "green production" can be easily accepted and supported by the population, government and non-profit organizations. However, the theme of "Green Production", enterprises, plays a key role in the process of consciousness, which is long and continuous.

In developing countries such as China, most enterprises do not consider "green production" with little concern for resource consumption and environmental emissions. Many corporations viewed "green manufacturing" as an environmental burden that would not bring any efficiency or even some trouble. In fact, even some of those corporations that have passed the ISO 14001 Environmental Management System authentication, the ultimate goal of which is simply to meet the requirements of the environment department, were not aware of the value of green production.

However, some businesses are suffering direct economic damage due to lack of resources, deteriorating pollution and an ever-growing barrier to green trade. For example, two EU regulations, ROHS (Restriction of the Use of Certain Hazardous Substances) and WEEE (Waste Electrical and Electronic Equipment), mechanical and electrical products from China. At the same time, industries affected by Green Trade Barriers are starting to find solutions to gradually shift our Green Production while these unaffected corporations remain indifferent to Green Production. On the contrary, a group of leading companies in the world considers "green production" as one of the priority development strategies, in which many multinational enterprises have set specific strategic goals for "green production", striving to be green leaders and set environmental criteria for the entire industry. Obviously, awareness of Green Production is a key issue in its implementation. Green production is well-tuned images for the corporation, the formation of a green brand and the promotion of its market

competitiveness in the market, which will ultimately create more profits.

Cost is one of the inevitable problems that green manufacturing has faced since the development of green products, and the application of new green manufacturing, methods require some cost without instant benefit, so some corporations may consider it unprofitable, which limits implementation to some extent. Green Manufacturing.

In fact, if new methods to help reduce energy and resource consumption are put in place, costs will be reduced directly, which will increase economic benefits in a short time. From a long-term perspective, once consumers become more sympathetic towards sustainable products that turn eco-efficiency into marketing benefits, the company's economic profits will also increase. Like other advanced model manufacturing, the introduction of green manufacturing seems expensive at first, but brings long-term benefits. Thus, corporations need to make ends meet and intelligently plan the implementation of "green production". Not surprisingly, these days almost all leaders in Green Manufacturing are international tycoons (Chinese government specialized planning).

Up until today, green production methods are not thorough enough, because the critical idea is green production is a specific green production technology, while most of the existing research is focused on the study of theories and concepts, that is, such research has not delved into industrial practice. production, there is a particular lack of green technologies for each individual industry.

The introduction of green manufacturing in corporations should depend on the leadership of the market, as well as laws, regulations, financial policies and standard specifications that are mandatory. Take the automotive industry as a model, green mobile devices such as hybrid cars and electric vehicles have developed rapidly in the United States, while in China, it has developed at a slower pace, which is due to the fact that so far, when it comes to the automotive industry in In China, cost reduction is still in first place due to the lack of relative preferential policies to boost corporate enthusiasm. Another epitome is car refurbishment, which is currently well developed in Europe and America, but still slowly developed in China because China's laws forbid the privacy of used mobile phone recycling businesses. Thus, the implementation of Green Production requires coordinated support from laws and regulations, financial policies along with customary standards.

The main ideas of "green production" refer to the implementation of the "4R" theory, i.e., reduce, reuse,

recycle and remanufacture. Reducing requires reducing the consumption of resources, including energy, as well as the release of waste, which can help reduce environmental pressure, resulting in less harm to human health (Treehugger, 2015).

Reuse requires the reuse of products or components in order to extend the life of the product to reduce waste. Recycling requires products to be able to turn into reusable resources rather than waste that can no longer be used. There are two recycling methods, one is recycled at the same level, which means that the waste can be recycled to produce the same kind of new products, the other is recycling, when the waste is transferred to the raw materials of other products.

Remanufacturing is the approach of restoring dragged products back to those that were close to new products after a series of processes including disassembly, cleaning, inspection, refurbishment, repair, and refurbishment.

Reproduction is an approach to restoring cleaned products to those that were close to my products after a series of processes, including disassembly, cleaning, inspection, refurbishment, repair, and refurbishment.



Figure 1: The principle of "green production" 4R.

3 RESULTS AND DISCUSSION

The automotive industry, the epitome of the industry, includes almost all other industries such as machinery, foundry, chemical, energy, electronics, rubber, and leather. In other words, the level of the automotive industry in a country can be thought of as the general level of the industry, the peculiarity and significance of which makes all advanced manufacturing technologies enter it for the first time, such as Lean Manufacturing, Six Sigma, etc. Thus, Green Manufacturing in the automotive industry plays a vital role. important role in sustainable development.

At present, the automotive industry has become an indispensable branch of modern construction, which plays a significant role in the national economy. However, since the traditional vehicle industry is based on a large consumption of resources and energy, with the increase in the number of cars produced, a lot of energy and steel is used, while the constant increase in scrapped vehicles leads to heavy pollution of land, air and water. Faced with environmental pressure as well as resource scarcity, striving for long-term development, reuse of resources and energy is of great importance as a prerequisite for continuous sustainable industrial development.

Products and production are the two main areas of the negative environmental impact of the automotive industry, where the former can be reduced by cutting down emissions and energy consumption, which can be divided into green design, green production and green package in five main methods, while the latter can be minimized through equipment and structural dismantling and reuse, also known as green recycling and green manufacturing.

Currently, waste-free recycling methods are being promoted in the EU and the US, where new environmentally friendly materials are widely used. The most famous automobile factories are actively implementing "Green Manufacturing" in research and practice, and regularly publish their resource and environmental reports to show their achievements to the public.

In the automotive industry, special Green Manufacturing technologies are popular. For example, Austenitic bainitic ductile iron has replaced hardened steel for vehicle manufacturing. Spiral bevel rear axles in automotive corporations such as GM, reducing 50% energy consumption and 40% cost. In addition, Chevrolet has developed a new type of car engine that can be recycled and reused, which can be used in 43% of the engine is directly dismantled, and most of the components can be reused (Rusinko, 2021).

To study "Green Production" in the automotive industry, the entire PLC and automobile production processes should be known at the beginning. The whole PLC is shown in Figure 2, including research and feedback on market requirements, product development and design, organization of production resources, production resources delivery, component production, production equipment, product sales, product maintenance and repair, product disposal, product recycling, dismantling, reuse of components, recovery and regeneration of materials.

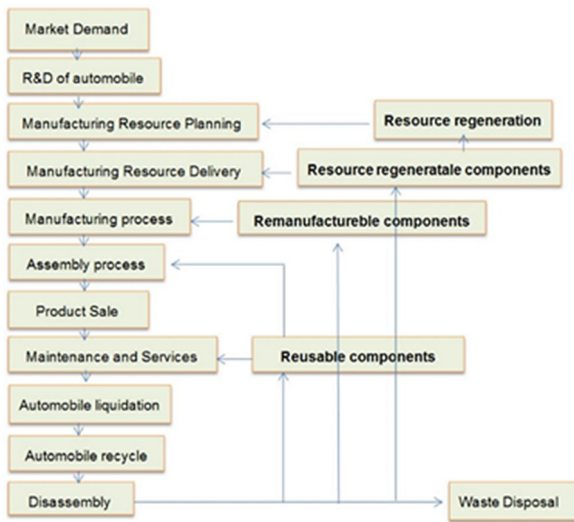


Figure 2: The life cycle of an automobile "green production" product.

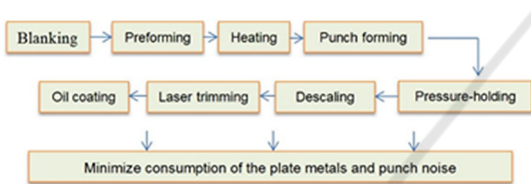


Figure 3: Stamping process and problem.

The stamping process includes blanking, pre-forming, heating, stamping, pressure holding, descaling, laser cutting and oil coating, where die-cut sheet metals to produce components such as car bodies, bodies, chassis, in time what problems may occur like sheet metal consumption as well as noises.

Pressure shop noise can be eliminated in two ways: proactive and passive. The former is to manage from resource, i.e., use low noise equipment, while the latter is to minimize the impact of noise during its delivery. The initiative path is complex with difficulties, but with the highest efficiency. For example, to replace the hydraulic pressure punching machine will greatly reduce the noise. Passive approaches mainly include absorption, attenuation, isolation and attenuation with silencers, acoustic ceilings and walls, soundproofing coating, baffle and shock absorber (Guo, 2018).

The welding process is mainly composed of base plate, side body, front side panel, stringer, frame assembly, car body, car door, front cover and black door, where the motor transport system inside each step and car body with completed are delivered to the paint shop transport line. All six assemblies of the engine, transmission, vehicle axle, vehicle frame, vehicle body and carriage are involved in the process.

The solution to reduce the resource consumption of the ownership process is to use efficient and energy-saving equipment such as MIG and MAG, advanced ownership methods such as electric resistance welding, arc welding, friction welding, laser welding, braze welding, advanced transportation equipment, such as a laser automated driving system and energy providers (for example, to provide multiple exchanges with cooling towers). Environmental issues in the process of ownership concentrate on recycling and cleaning of welding fumes, adjusted sealing noise treatment during inspection, and noise suppression device equipment.

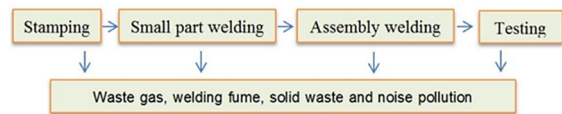


Figure 4: Welding process and problem.

The coating process consists of pre-treatment, electrophoresis, electrophoresis drying oven, electrophoretic polishing, sealant, PVC coating, sealant oven, floating coating, floating coating oven, finishing coating and finishing coating oven. Between the various processing steps, hanging chains are used for transport and hoists are used for connection. The main environmental problem in this process is the generation of a large amount of liquid waste, which is a key issue of green improvement. Such liquids should be treated by a series of chemical reactions such as acid-base neutralization, coagulation, sedimentation and dephosphorization, after which it enters the management of hazardous substances, as well as water recycling (Huang, 2020).

The final assembly process is the last process of production, storage and operation of vehicles of the transportation line, trim assembly line, chassis assembly line, final assembly line, final inspection line, dashboard assembly line and car door assembly line. Green improvements in this process include treatment of contaminated water, sludge testing for recirculating water in the assembly shop, off-gases from static fan speed measurement, and disposal of packaging and assembly solids.

Traditional automotive recycling is focused on the recycling of raw materials, multi-components disposed of by destructive dismantling, which results in low reuse costs, since the dismantled components are simply separated and reassembled without effective separation, where materials with a high reuse value, such as aluminium and magnesium, are waste, in while other materials that are not easily disposed of, such as plastic, rubber, and waste oil, are

stockpiled, dumped, and incinerated if desired, resulting in severe pollution of soil and water resources. Often found in underdeveloped areas. There was a time when a number of environmental problems arose in China due to the untimely processing of the method, which caused inefficient use of resources, low profits from processing, as well as unbalanced development of industries. However, green recycling benefits from recycling and reduce environmental damage through technology dismantling and maximizing management (Zhang, 2011).

Traditional automotive recycling is focused on recycling raw materials, multi-components are disposed of by destructive disassembly, resulting in low reuse costs as dismantled components are simply separated and reassembled without efficient separation, where materials with high reusable value, such as aluminium and magnesium, are waste, while other materials that are not easily disposed of, such as plastic, rubber, and waste oil, are stockpiled, dumped, and incinerated if desired, resulting in severe pollution of soil and water resources. Often found in underdeveloped areas. There was a time when a number of environmental problems arose in China due to untimely recycling methods, which caused inefficient use of resources, low profits from recycling, and unbalanced development of industries. However, green recycling benefits from recycle and reduce environmental damage through disassembly technology and maximizing management.

A car is an assembly of thousands of components made from different materials. materials. Thus, simple remelting has little to do with green scrap recycling, a vehicle that requires scientific approaches to disassemble them and handle them accordingly.

The green recycling process in the automotive industry includes acquisition, disassembly, cleaning, testing and reuse, where the dismantling process plays a vital role. In the US, car stripping was a large industry that employed about 15,000 corporations stripping components from vehicles, selling valuable car parts to manufacturers for fixing and refurbishment, and then reusing them. When the valuable parts are dismantled, the car frames will be smashed in the spray guns, after which the magnetic separation is supplied to separate the steels.

The disassembly process of green recycling is very important, whose recycling value can only be illustrated after scientific disassembly with the premise of reuse, rework, and regeneration of component materials. In this section, the green recycling of the automotive industry will be

introduced in terms of the dismantling and recycling of materials.

There are 3 types of disassembly: complete disassembly, partial disassembly, and target.

- Complete disassembly means the careful disassembly of a product into every detail of a component, which is often used in theoretical studies instead of practical applications.
- Partial disassembly refers to the dismantling of a portion of a product's components, usually out of consideration for cost savings. When dismantling a certain component, if the cost of recycling the remaining components is less than the cost of dismantling, we consider it useless continue dismantling as recycled material; or when the remaining components are in the same materials, we stop disassembling and recycle them entirely. This method is widely used in practice.
- Purposeful disassembly refers to dismantling between or within certain components, mainly due to reuse or environmental factors. For example, the period of use of a product when its component part has failed and requires disassembly for repair or discard, while other parts or components may still be useful for reuse or replacement; or when the disposal of a part or component causes great harm to the environment, they should be considered as target components to be disassembled. This approach is also widely used in practice.

Disassembly level decisions depend on economic evaluation. As the steps increase, the amount of components received and recycled increases, which leads to an increase in the profit from dismantling and recycling, while the cost of the landfill decreases. However, for the components are difficult to separate, the processing profit is low, and then with low economic value. Thus, when comparing the profit from processing and the cost of dismantling, when the economic effect decreases, the dismantling process should be stopped (Li, 2021).

Let's start with the economics of dismantling the product, the cost of recycling, and easily dismantled components and equipment, when products are billed with the premise of not affecting function during design, aiming for fewer disassembly steps and fewer connections for ease of disassembly, which is one of the requirements of green design. Here, as we can see, each process in "Green Production" is closely related to each other, which reveals the integration of green production (Flame Retardants, 2001).

Recycling at the level of parts and components contributes greatly to environmental sustainability.

Production in the automotive industry, but with some difficulties in implementation. In developed countries such as the US, vehicle components are reused unless they are expired or damaged. In Japan, 30% of salvaged car components are reused and 50% are recycled as raw materials. In Germany, the level of recycling reaches even 90%. In contrast, it is illegal in China to recycle parts and components where only raw materials can be recycled, resulting in an immature market for remanufactured components or even belated recovery practices in the automotive remanufactured industry. Green production is necessary to maximize green production in the automotive industry.

4 CONCLUSIONS

First, companies need to know "green production" before implementing it. According to research and analysis, the new structure of Green Manufacturing has been developed by the 4 R production principles : reduce, reuse, recycle, and recycle and five core technologies: green technology design, green manufacturing technology, green packaging technology, green recycling with green recovery technology. "Green production" is not only a theory, but also a technology. Patterns Green production differs across industries. The automotive industry is selected to show the implementation of "Green Manufacturing". Under the new structure, here I present green design, green manufacturing, green packaging, green recycling and green recovery in the automotive industry. Each part is in the light of the 4R principles. The reason for choosing the automotive industry is that it is so popular nowadays with huge performance. This industry also has a huge impact on other industries. For example, lean manufacturing, developed in the Toyota automobile, is now the epitome of almost every industry. Therefore, the value of introducing Green Manufacturing in this industry is excellent.

In the automotive industry, most of the problems with "green production" occur in the production (especially painting) and the restoration stage. The automotive industry has a very practical method and technology in restoration.

The structure and technology presented in this study have a very high degree of generality. For example, a tea bag manufacturer might start to implement green manufacturing. This thesis will help raise the awareness of decision makers about green production. He will also guide them to think about "green production" in reduction, reuse, recycling and

recovery. Perhaps they will find methods to reduce and reuse package.

In the future, many governments will set high budgets for pollutant emissions. The use of "green" production is the key to the survival of companies, and this article will greatly help these companies.

REFERENCES

- Association for Manufacturing Excellence, 2007. *Green Manufacturing: Case Studies in Lean and Sustainability*. Productivity Press.
- Chinese government specialized planning*. Green Manufacturing technology development. <http://www.most.gov.cn/tztg/201204/W020120424330209534599.pdf>.
- Treehugger, 2015. *World Energy Use over the Last 200 Years*. <http://www.treehugger.com/fossil-fuels/world-energy-use-over-last-200-years-graphs.html>.
- Rusinko, C. A., 2021. Green manufacturing: An evaluation of environmentally sustainable manufacturing practices and their impact on competitive outcomes. *IEEE Trans. Eng. Manager.* 54(3). pp. 445-454.
- Guo, H., 2018. *The research of key technology about recycling and remanufacturing in parts of End-of-Life Vehicle*. A Thesis Submitted to Chongqing University in Partial Fulfilment of the Requirement for the degree of Master of Engineering. College of Mechanical Engineering Chongqing University.
- Huang, J. Y., Zhu, H. Y., 2020. Analysis of Implementation the Key Technologies of Green Manufacturing. *Applied Mechanics and Materials.* 522-524. pp. 787-790.
- Zhang, Y., 2011. Research on Development & Application of Information Resources of Green Manufacturing Enterprise. *IEEE*.
- Li, J., Tian, B., Liu, T., Liu, H., Wen, X., Honda, Shinichi, 2021. Status quo of e-waste management in mainland China. *Journal of Material Cycles and Waste Management*.
- Flame Retardants, 2001. DG Environment Video 2000, cited by AEA technology, January 2001. <http://www.guokr.com/article/439186/>.