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技術資料
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The Casting Industry of Japan - Current Situation and Challenges -

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1. Introduction

The development of the Japanese material processing industry has been largely dependent on the growth of the automotive industry. In iron castings, for example, Figure 1. shows that about 58 percent of total production is destined for the automotive industry. Therefore the collapse of Japan's bubble economy coupled with the decline in domestic automobile production due to plant relocation abroad by automobile manufacturers have resulted in a continuous decrease in casting production in Japan.

Moreover, the trend towards more light-weight automobiles is providing further impetus to the adoption of light-weight materials.

The following is a description of the situation facing Japan's foundry industry under the above-mentioned conditions and countermeasures taken, including recent trends in the automotive industry.

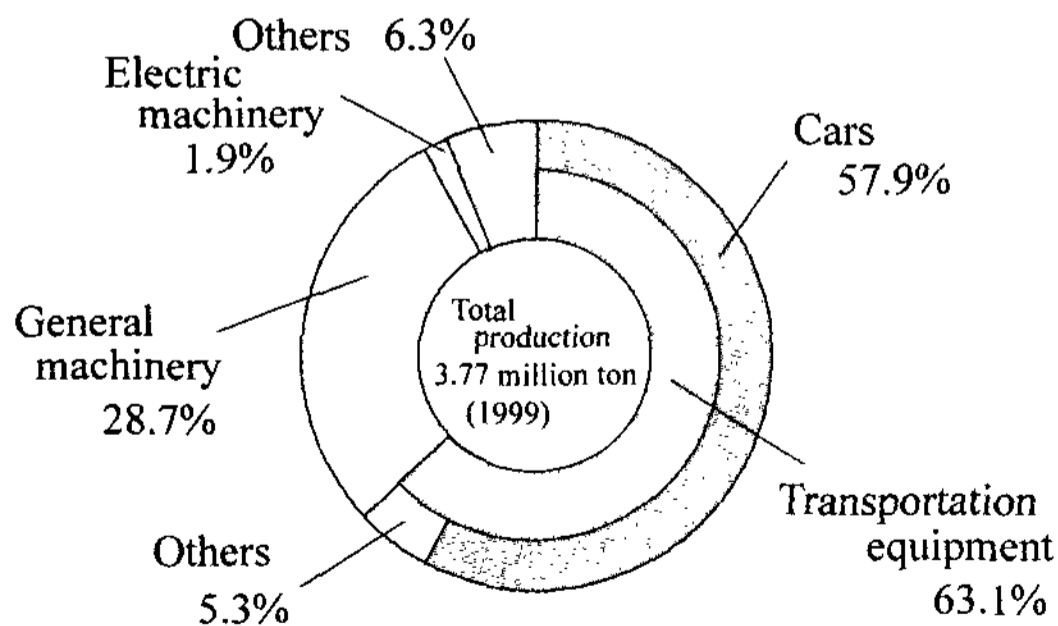


Fig. 1. Iron casting production ratio(material processing year book).

2. Trends in the World Automotive Industry

Figure 2 shows global automobile production. In Europe, production has increased by 22 percent compared to 1990 due to the expansion of the market since the introduction of the Euro currency. In the US, production increased markedly by 37 percent since 1990, due to increased demand resulting from the business upturn of recent years and the plant relocation of Japanese automobile manufacturers to reduce trade friction. South East Asia continues to show signs of recovery from the currency crisis. In Japan, however, production has decreased by 27 percent since 1990 influenced by a decline in exports mainly to North America, business stagnation and the contraction of the domestic market. It can be anticipated that Japanese domestic production will suffer further decline as competition grows, and the trend towards local sourcing by Japanese transplants abroad continues.

Moreover, automobile manufacturers have undergone reorganization on a global basis and automobile parts procurement has been internationalized. As figure 3 shows, the automobile industry has been subdivided into a few huge groups and Japanese automobile manufacturers are also having to reorganize themselves in order to survive. This formation of giant groups has made it possible to produce platforms and parts in common, leading to more efficient globally-based vehicle development and production. This will make for even more efficient use of raw materials, increased efficiency through mass production, and improved

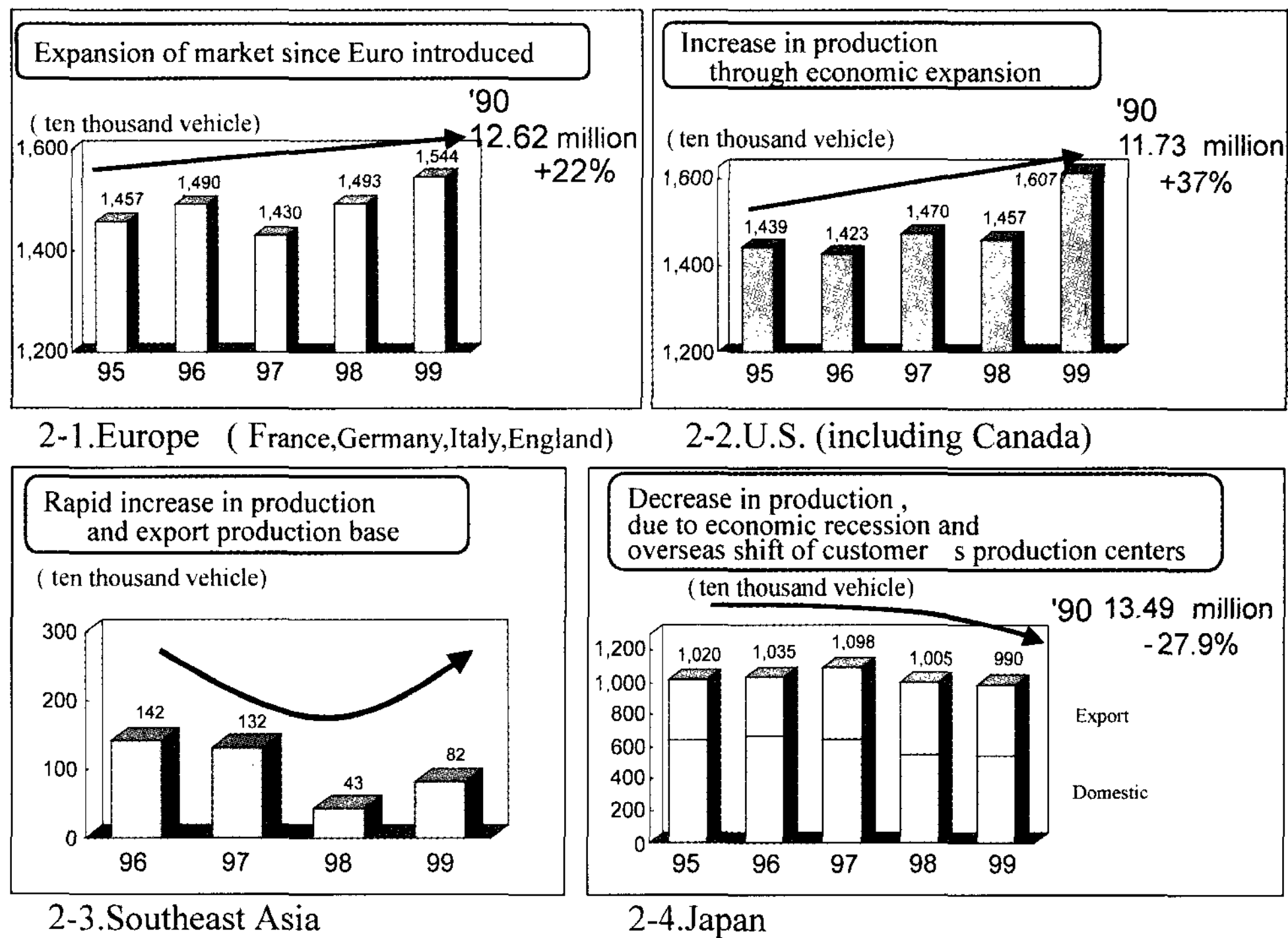


Fig. 2. World car production Material processing year book.

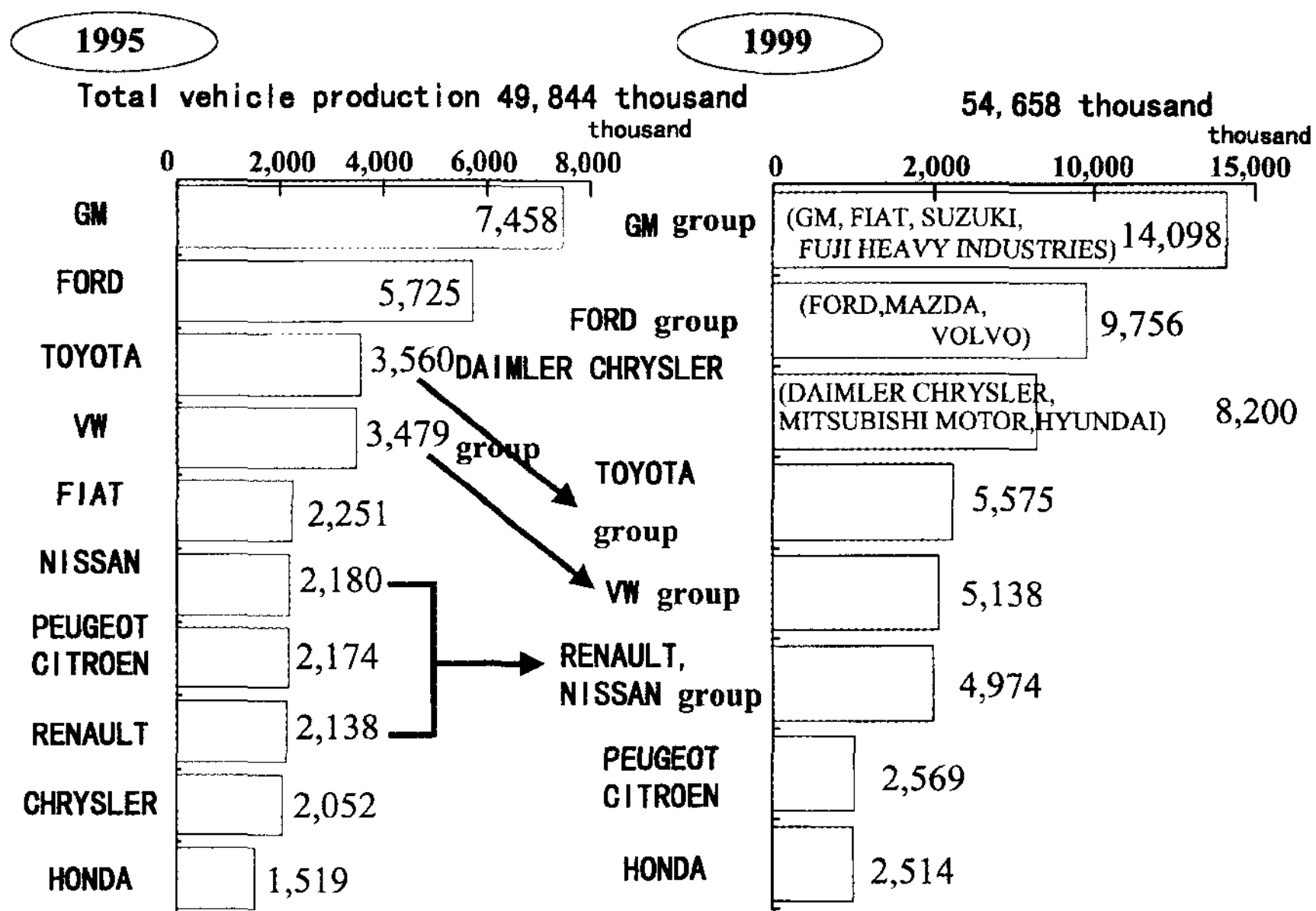


Fig. 3. Global reorganization of car makers (source: Aisin Takaoka).

procurement on a global, borderless level. As a result, both the automobile industry and the parts industry will

facilitate internationalization and in turn face more intensified international competition.

3. Trends in the World Casting Industry

Figure 4 shows global production of cast products by area. In Europe, the production of cast products has increased due to the growth in automobile production. Production is now being shifted to Eastern Europe and Asia, however, due to lower cost factors and environmental aspects. In the US, the volume of cast products has increased by 42 percent compared to 1990, in direct proportion to the increase in automobile production. In Asia, excluding Japan, production has increased markedly by some 35 percent compared to 1990, due to low labor costs, the relocation of Japanese and European plants abroad and improvements in casting technology. On the other hand, production in Japan has decreased by 30 percent compared to 1990, due to a reduction in automobile production and overseas plant relocations to North America and Asia, mainly by automobile manufacturers.

4. Trends in the Japanese Casting Industry

Figure 5 shows the production of iron castings in Japan by industry type. The production of cast products for transportation equipment has accelerated due to the influence of the trend towards motorization. Production declined after the collapse of the bubble economy, however, due to plant relocation and business stagnation. Total production in 1999 fell to 3.77 million tons,

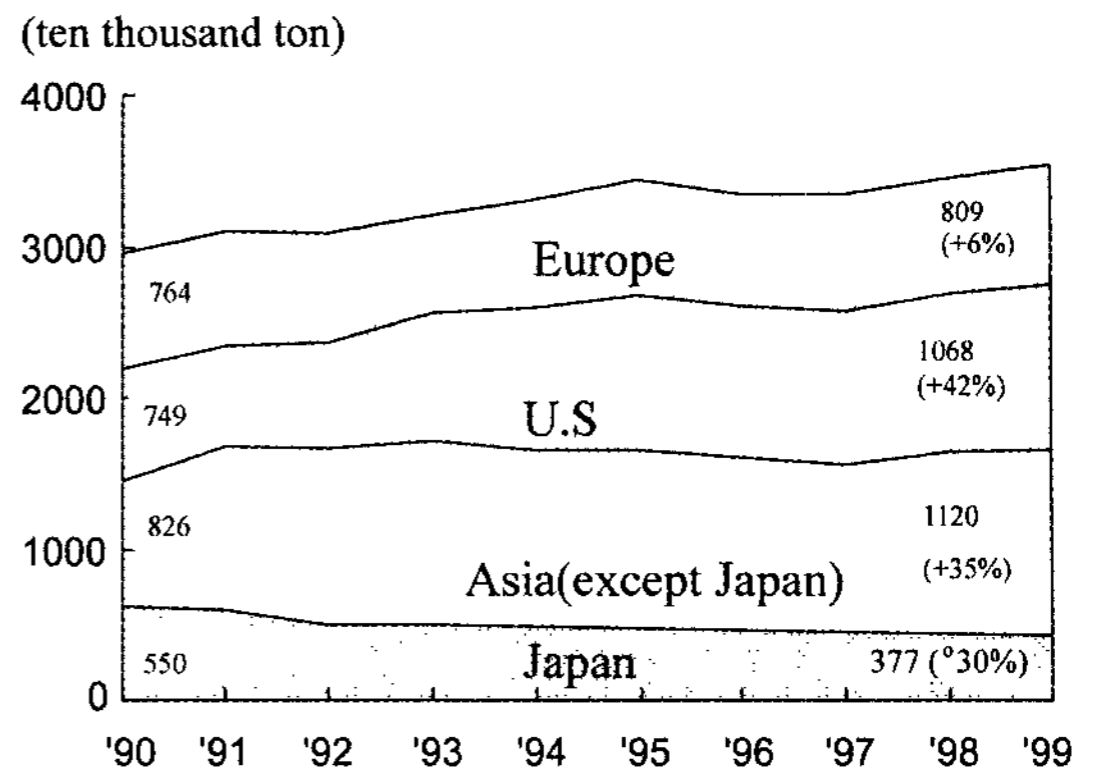


Fig. 4. Production of cast iron by area (Material processing year book).

equaling the amount of 16 years ago.

Figure 6 shows the advances made in casting technology. In response to changes in the economy in general, the casting industry has further developed mass production technology, and higher productivity. Casting technology has developed a variety of new materials and new production methods as shown in the figure.

5. Position of Casting in the Automotive Industry

It is apparent that as previously mentioned, casting production is strongly influenced by automobile production, although the type of materials used in automobiles has changed. Figure 7 shows the com-

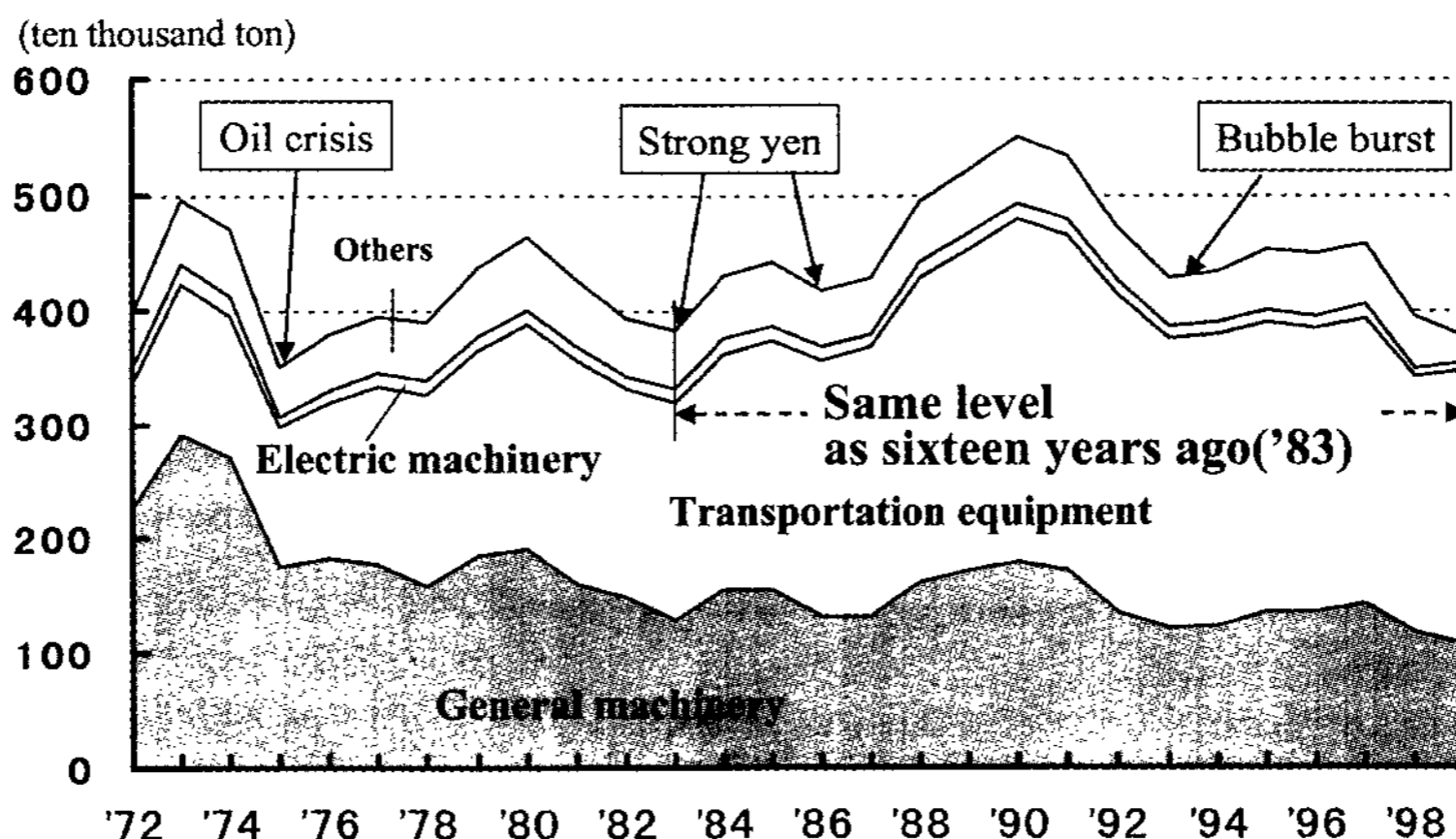


Fig. 5. Change in Japanese production of iron casting by industry type (Material processing year book).

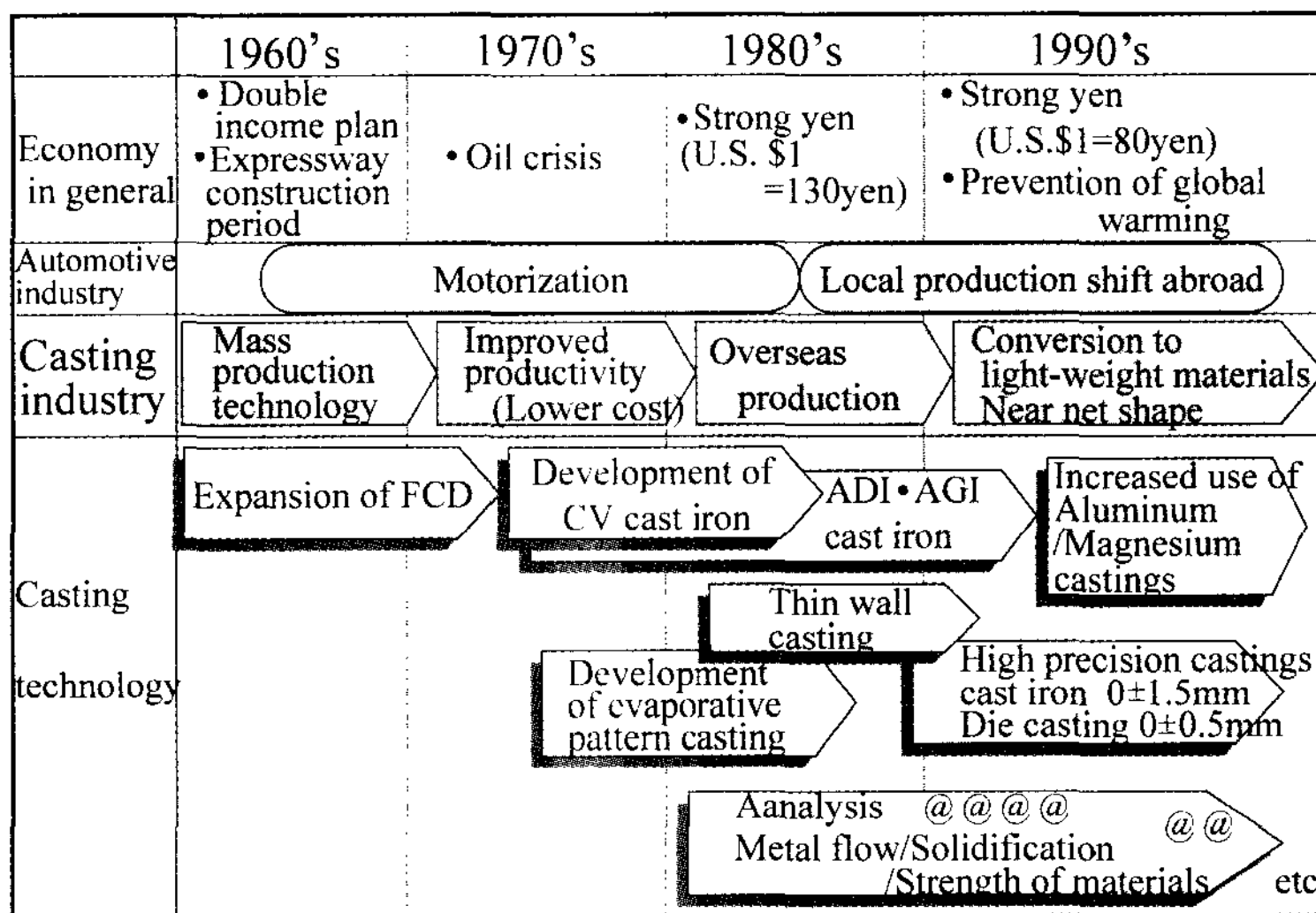


Fig. 6. Advances in casting technology.

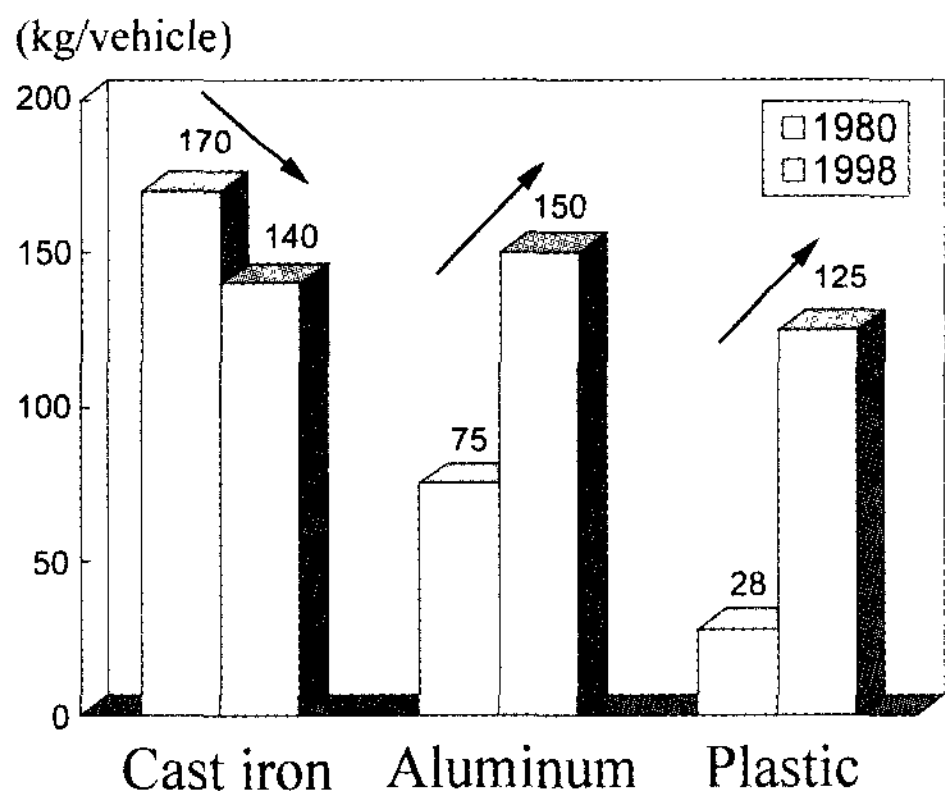


Fig. 7. Material use for automobiles (source:Aisin Takaoka).

Chart 1. Future prediction by Delphi X(2000) (University of Michigan, MArch 2000).

	Year CAFE	Passenger cars			Passenger cars Trend
		2004 27.5mpg	2009 30.0mpg	2009 35.0mpg	
Steel	-5%-	-10%	-15%	↘	
Cast iron	-5	-10	-20	↘	
Aluminum	9	14	17.5	↗	
Magnesium	7.5	10	20	↗	
Zinc	2	3	4	↗	
Plastic	10	15	20	↗	
Powdered metal	5	5	7	↗	

parison of 1980 and 1998, and Chart 1 shows the forecast by Delphi X(2000) of Michigan University in the USA. The trend towards lighter vehicles and the demands of environmental issues are certain to increase. It can be safely forecast that the use of iron castings will continue to fall, while the use of lighter materials such as aluminum and plastic will accelerate.

6. Current Situation of the Japanese Casting Industry and its Tasks

The current situation of the Japanese casting industry and its tasks are considered amidst the changing environment facing the industry.

1) The change in market needs in conjunction with globalization dictates the necessity for a worldwide parts supply network. It is now necessary to be able to supply parts to the assembly plants of automobile manufacturers anywhere in the world.

2) The first change in market needs is the even stronger requirement for cost reduction in parts demanded by automobile manufacturers. Therefore, improving cost competitiveness will become more indispensable than ever, as companies which are not cost competitive will be unable to survive.

3) The second change in market needs is mainly caused by the trend to light weight automobiles or light

weight components required to satisfy stricter environmental standards that demand improved fuel efficiency. The solution to this problem has been to move towards replacement by light materials, although parts integration by casting and thinner-wall castings are also effective. However, castings are generally dealt with by unit cost per kilogram and thinner-wall and light weight products might well reduce the selling price of castings. Thus it will be necessary to ensure customers acknowledge the cost of the additional value of light-weight products.

4) The changes taking place in the production process are also notable. In order to cope with the demands for price reduction and increased labor costs, further improvements in productivity have been achieved through facility automation. In addition, changes in the development process have resulted in remarkable timesavings prior to the mass production stage. It will be necessary to further shorten the period of development and reduce the number of prototype evaluations, or ultimately to eliminate prototyping altogether.

5) Environmental awareness in casting production is one of the biggest tasks. The foundry industry is a high-energy consumption industry and global warming caused by its CO₂ discharge is an issue of major concern. Also, industrial waste disposal is a serious issue and it is necessary to make even greater efforts to Reduce, Reuse, and Recycle.

7. Progress of the Tasks

The casting industry of Japan is facing a severe situation and the following shows the progress in each task as major steps are being undertaken by Japanese manufacturers of casting parts for automobiles to solve these problems.

1) Globalization corresponds to the establishment of a production base in the world's four major areas, not only in Japan but in Europe, North America and Asia. Forming alliances with foundry manufacturers will also be essential in the future to meet the requirements of automobile manufacturers.

2) With regard to the issue of cost, as the labor cost of Japan is high, cost reduction will be achieved through the adoption of ultimate efficiency measures such as less operators, increased automation, high-cycling, and fewer processes.

3) Demands for weight reduction will be met by developing thin-wall and high-toughness materials. In addition, it will be necessary to develop a form design which makes the best use of CAE and casting technology to support production.

4) In order to reduce the total cost by shortening development lead-time and to improve quality, casting production must make the most of IT ; In this regard utilization of a three-dimensional database from prototype design to mass production has already been commenced.

5) As for environmental protection countermeasures, it will be necessary to further develop recycling of industrial waste from casting plants. For example, technology to reuse waste molding sand and foundry dust has been developed for commercial purposes. It will be essential to acquire ISO14001 accreditation.

8. Conclusion

The casting industry of Japan has grown along with the automotive industry. It now faces an extremely difficult period, however, as the adoption of more light-weight materials and the reduction in domestic automobile production, have caused a dramatic decrease in casting production. Nevertheless, Japan's foundries have developed highly efficient production and recycling methods. Our goals must be to expand the range of casting products by developing new commodities which make the most of our strengths, and enhance competitiveness by improving the efficiency of the production process.

I am confident that the foundry as a material processing industry can meet and successfully overcome these challenges and continue to develop into the 21st century and beyond.