

Japanese Small and Medium-Sized Enterprises in an Era of Globalization

Case Study 1:
Nakashima Propeller Co., Ltd.

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Aspiring to Become an Optimal Creative Company

Our company is a medium-sized enterprise that has manufactured marine propellers for 75 years. Marine propellers are characterized by some special features that are not found in other industrial products. The most important of these features is that each propeller is a unique one-off production. This uniqueness has characterized our company culture and ideas.

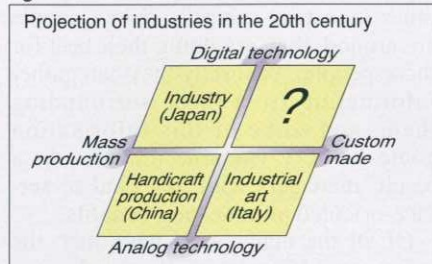
An example of the relationship between the features of our products and our company culture and how they might develop is described below.

Propellers are singly produced because their design is composed of various complicated factors – the ship's shape, engine parameters and sailing method – that are unique to each production. As a result, all propellers, whether they are for a small fishing boat or a super-large tanker, must be singly produced like custom-designed art objects.

Most of the processes of propeller design are automated. However, computers are not capable of determining the optimal design of a propeller because in order to reach a high-level optimization, compromises must be made between various performance parameters that can only be carried out by very experienced engineers. Designing a propeller, an industrial product that was first made about 150 years ago, requires optimization techniques that are as delicate as the flavoring techniques used in cooking.

In the last step of the design process, a propeller is defined digitally as a three-dimensional object. Next, the propeller enters the manufacturing process. The first step of the manufacturing process is casting into sand molds. The human factor is very important in this stage because humans

Figure 1



can make much better sand molds than computers in single-part production. Moreover, the manual work involved in making a single optimal product can provide great pleasure to workers – one of the things that computers can never provide.

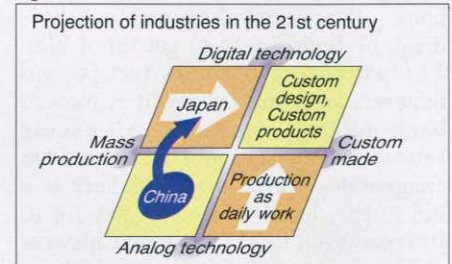
However, because propellers are fluid products they must be finished by numerical control. For example, to evenly finish the five blades of a giant propeller of 10 meters in diameter which have complex helicoidal curving configurations, very rigid and precise machines – true robots – are required.

Over our long history of manufacturing marine propellers, we have thought very highly of both human ability and digital technology, and we have tried to merge them to provide more optimal products. In the process, we have found that good optimization always relies on human ability. At present, many factories in the world are moving to China. However, we think that the manufacturing keywords of 21st century Japan will be “optimal production of every single part,” “human ability” and “digital technology.”

Figure 1 shows our image of industries in the 20th century. In that century, Japan functioned as a world factory, and we hardly considered the possibilities of “custom design” and “digital technology.”

Figure 2 shows a projection of industries in the 21st century. In this century, the industrial process in which the integration between custom design and digital technology are made will

Figure 2



become very important. That is, beyond the sectional manufacturing processes such as manual casting and digital finishing, all steps of production will be executed through a fusion of human ability and digital technology. Computers will not be used as energy saving and efficiency improvement means but as tools for extending human feelings and expression. Digital machines will be utilized to assist analog processing by human workers, and Japanese artisan spirit will be respected as one of the country's characteristics. The products that are made by adding a concrete shape to the optimals developed during that process will be labeled “Made in Japan” in the 21st century.

Now we are building an “Optimal Creative Company” concept for the near future. This concept is supported by other products of our company: artificial joints and house interior products, which were derived from our propeller production technology. These products are single or small-lot products for which optimization is highly regarded.

For those who produce industrial products, the merging of custom design and digital technology is a great challenge. Fortunately, we have developed our company culture through our production of propellers. We want to establish an “Optimal Creative Company” without missing the essence of our culture. JTI

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