Competition in the Japanese Road-racer Bicycle Components Industry : Analysis and Implications

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Abstract

This article discusses the competitive relationship between two Japanese road-racer bicycle components companies, Suntour and Shimano. After a lengthy period of comparable performance during the 1970s and 1980s, the development of an innovative product by Shimano enabled the company to overtake Suntour. The latter part of this article discusses two implications from the case: the absence of exception handling systems in corporate division of labor systems and a new pattern of organizational isomorphism.

The "Shimano-Index-System" Changes the Japanese Road-Racer Components Industry

In the 1970s and 1980s, there was intense competition between two Japanese road-racer components companies, Suntour and Shimano, both of which specialized in bicycle gear-changing components. These components are the most precise and complex of bicycle components (Osaka-huritsu Sangyo Kaihatsu Kenkyujo, 1996), and have been improved substantially over the past few decades (Nakazawa, 2010; Kabushikigaisya Maeda Tekkojo, 1967). In the early 1970s, Suntour was a leading company with high-level R&D capabilities while Shimano was a newcomer and potential challenger. From the mid-1970s to the early 1980s, the two companies were in close competition, taking different approaches to developing their technological systems. In 1984, Shimano introduced an innovative product, the Shimano Index System (SIS). This new product completely changed the division of labor approach to manufacturing in the industry, causing irreparable damage to Suntour's business and leading to their bankruptcy in the 1990s.

Suntour Takes the Lead with Slant-Pantograph Technology

Suntour (Maeda Industry) was one of the oldest companies in the Japanese bicycle components industry. Just after World War II, they began to make parts for use in bicycles for amateur riders, but in the early 1960s, during a period of high economic growth in Japan, they shifted their emphasis to road-racer bicycle components. At that time, most of the components for road race bicycles being made in Japan were an imitation of those being manufactured by European companies. In order to differentiate themselves, Suntour began to develop original components.

Suntour's development of the slant pantograph technology was one of the most influential innovations in bicycle components history, and continues to be the de-facto technology standard, used for the installation of almost all existing derailleurs for road-race bicycles (Nakazawa, 2010). The advantage of the slant pantograph technology is to allow the derailleurs to accurately match the chain to the shape of the gear. A road-racer's gears are usually made up of multiple layers of different sized gears, in the shape of a pyramid, which causes momentary instability in the chain when a derailleur shifts gears. The slant pantograph keeps the line of the chain parallel to the steps of the gear's pyramid, stabilizing the shifting action. With this innovation, Suntour moved into a leading company in the Japanese bicycle components industry.

After the success of the slant pantograph technology, Suntour continued to work on improving their derailleur products. One area of focus was to reduce the weight of the derailleurs. In those days, weight was one of the most important ways in which manufacturers appealed to customers, including the weight of their products in their catalogs. However, decreasing the weight made it difficult to maintain durability and components companies worked on making derailleurs lightweight without compromising their robustness. Using the process of cold forging, Suntour succeeded in reducing their derailleur weight from 320 grams in 1964 (GRANPRIX model) to 184 grams in 1975 (CYCLONE model).

Suntour was also committed to improving the rotation performance of their derailleurs (Nakazawa, 2010). A rear derailleur generally has two rotating parts that support a chain. The performance of these parts affects the performance of the whole derailleur, and Suntour was the first in the industry to work on improving their function. In the early 1980s, Suntour began to install a ball bearing, which could improve the rotation performance of derailleurs, into these components, and competitors followed suit because this was a very novel and effective idea.

In addition to those efforts, Suntour continued developing their products and established a firm position as a leading company in the Japanese road-racer component industry.

Shimano Challenges Suntour with the Concept of "System Components"

While Shimano is a leading company in the bicycle industry today, that was not always the case. In the beginning of the 1970s, without a unique technology like Suntour's slant pantograph, Shimano had a smaller share of the market than Suntour. "The slant pantograph technology was very powerful and such technology patents were a kind of barrier that interrupted Shimano's development. Suntour was a competitor, but all the R&D staff at Shimano recognized the superiority of the te chnology" (Yamaguchi, 2003, p.136, translated by author).

Forced to develop their own technology, Shimano introduced the concept of "system components" which looks at the multiple components related to shifting gears as one system, and which differed dramatically from Suntour's focus on only derailleurs as a shifting mechanism. Initially, Shimano did not intend to compete with Suntour with their new technology, but their primary purpose was to establish themselves in European markets. In the mid-1970s, although Suntour and Shimano were familiar names in the United States, they were either unknown to European customers or seen as makers of inferior components. While US market was open to foreign companies, European one was too closed for Japanese makers which had not had a kind of tradition in major road race competition such as Tour de France. The most well-known manufacturer in Europe at that time was Campagnolo. In the

1950s, Campagnolo adopted the unique strategy of manufacturing multiple components, which had usually made by different companies, by only themselves (Facchinetti and Rubino, 2008). With most companies' technological capacities still in their infancies, this extended product line caused Campagnolo to be viewed as a company with superior capabilities. To change their brand image and compete with Campagnolo in Europe, Shimano adopted the same approach.

In adopting the system components approach, Shimano had to develop some components with which they had never dealt before. This was a departure from existing practices in Japan and was fraught with difficulties, such as a crank that was initially too soft to use in a road race (*Ibid.,* p.79).

Although the early going was difficult, during the 1970s, Shimano managed to overtake Suntour based on their multiple components approach which paid attention to not only the derailleur but other components like a chain or a gear. Their hope was that improving the chains and gears to support the shifting action would compensate for the fact that their derailleur (which was not installed with slant pantograph technology) was relatively inferior. Until then, the shapes of chains and gears had been optimized for transmitting power from the pedals to a rear wheel. Those shapes were not, however, ideal for shifting gears. Because the gears were designed to reduce a loss of power, they were too tightly meshed to allow for smooth shifting. Shimano developed uniquely shaped gears and chains, which they called the Uni-Glide (UG) series. The UG gear's teeth were slightly twisted to enable smooth derailing, and the UG chain had small raised areas that were designed to catch the gear easily when shifting. Together, these features contributed to overall improvement in gear changing.

After putting the UG series on the market, Shimano continued to develop their system. Suntour's development, however, had stalled at that point. From the late 1970s to the early 1980s, while they did venture into the system components market, Suntour's main product remained derailleurs and they continued to focus on improving the performance of discrete parts individually.

The “Shimano-Index-System” Changes the Japanese Road-racer Components Industry.

In 1984, Shimano released a revolutionary shifting system, the Shimano-Index-System (SIS), which made shifting much easier by changing the structure of the gear shifting system. This innovation had a strong impact on Suntour’s ability to compete with Shimano.

Friction System

Before the introduction of the SIS, shifting gears on a road-racer was very difficult for unskilled riders. In those days, changing gears required adjusting the shift levers manually and realigning the levers if they failed to move the derailleurs accurately. This shifting system called the "friction system" required riders to make difficult manipulations. Although it was taken for granted by riders at the time, especially professionals, this complexity occasionally caused problems during a race (Facchinetti and Rubino, 2008).

Despite the complexity, the friction system did have some advantages, the most important being the ability to use the components of different manufacturers. At that time, most companies in the industry shared “technological standards,” with “interface specifications or “rules of engagement” that dictate how different components of technological systems work together to provide utility to users” (Graud, Jain, and Kumaraswamy, 2002), and each company specialized in particular components (Anand and Daft, 2007; Fujimoto, 2001). While manufacturers technically adhered to the standards, they also made efforts to differentiate themselves from competitors, which resulted in varying degrees of compatibility between components (Inoue, 1979; Nakahori, 2011; Shiratori, 2012). Not surprisingly, even though the technological standards helped with compatibility, minor complications could not be prevented, and the various combinations of derailleurs and shift levers from different manufacturers inevitably created problems for riders, who had to manually manipulate the components. Even though riders were inconvenienced, the friction system was essential to maintaining the structure of the industry, where different companies specialized in different components and the makers of road-racers chose freely among them.

Index System

Shimano's introduction of the SIS in 1984 had a strong impact on the industry, because its design differed dramatically from the friction system. The focus of the index system was to make the shifting action much easier. The new system "utilizes a ratchet type shift lever that is coordinated with the position of the rear derailleur in relation to the free (rear) wheel gears. This means that gears are changed by simply moving the lever to the next click-stop" ("Shimano New Dura-Ace brochure," 1985, p.2). By sacrificing the flexibility of the derailleurs' motion, the index system made changing gears easier for riders.

Although the index system was an innovation over the existing system, it was met with opposition from other companies in the industry. Rather than using components from multiple manufacturers, the SIS required all components associated with shifting action–such as gears, shift levers, chains, and derailleurs–to work together very precisely, which meant they all needed to be made by the same manufacturer. In essence, the SIS dictated that all components related to shifting would need to be manufactured by Shimano.

Surprisingly, in addition to other manufacturers who reacted negatively to the index system customers were also initially displeased. One of the reasons was that, because of earlier systems introduced by Shimano and Suntour, cyclists regarded the system as something more appropriate for children. Prior to the release of the SIS in 1984, both companies had introduced a pseudo index system for children's bicycles. Although the earlier system had different mechanisms than SIS, the fundamental function of the two was very similar. In addition to the association with children's bicycles, there was a concern that professional riders, who took pride in their ability to skillfully manage the complex friction system, would be insulted by a mechanism that could be used as easily by amateurs (Takeishi and Aoshima, 2002). Based on these initial reactions, even Shimano employees had a negative view of their new system (Yamaguchi, 2003).

While the SIS was regarded as heretical and stirred controversy in the industry at first, some customers, including many top players in Europe willingly adopted the new system because it freed them from complicated shifting actions and allowed them to concentrate on other strategically important things, such as tactics or the timing of a spurt. These early adopters gradually changed the attitudes of other cyclists, which triggered Campagnolo's development of their own index system (Takeishi and Aoshima, 2002). The success of the SIS also forced Suntour to begin work on a system of their own, as the road-racer component industry entered the era of the index system.

Suntour Cannot Compete with the SIS

Following Shimano's success with the SIS, Suntour immediately began to develop an index system, but ran into some unexpected difficulties. A key barrier was the co mpany's lack of technological capability related to components other than derailleurs. For an index system to function effectively, *all* components-derailleur, gear, shift lever and chain-must work together (Takeishi and Aoshima, 2002). Suntour had a great deal of expertise in derailleurs but little knowledge of the other components. They had begun to expand their components lineup to add chains or shift levers in the early 1980s, but their development had not kept up with Shimano.

Three years after Shimano's SIS was introduced, Suntour launched their first index system, "ACCUSHIFT." However, in addition to lagging behind the SIS, the system was viewed as inferior in quality. While Suntour struggled, Shimano steadily improved the SIS and increased their worldwide market share. The failure of their index system caused irreparable damage to Suntour and, around 1990, the company fell into financial difficulty, and ultimately went bankrupt. Although their insolvency cannot be attributed to a single cause, the failure of the index system was a critical blow.

Implications

There are two key themes that emerge from this case and that are discussed below: the absence of exception handling systems in corporate division of labor systems and a new pattern of organizational isomorphism.

The absence of exception handling systems in corporate division of labor systems

One implication of this case is the fragility of a system using a division of labor approach to manufacturing based on technological standards. As discussed above, a technological standard is a kind of preconditioning (Numagami, 2004) that can eliminate the need for complex coordination among companies when they are sharing common rules about interfaces among many parts. Technological standards can promote specialization among companies and enable efficient innovation (Aoshima and Takeishi, 2001). However, the more specialized companies are, the more difficulty they will have dealing with unexpected issues that arise, even when most companies follow the rules. If the specialization is *intra*-organizational, such issues could be dealt with and solved hierarchically by senior managers (March and Simon, 1958; Numagami, 2004). However, when specialization is *inter*-organizational, there is no efficient system to solve exception issues because there is no common leadership. In some cases, a company which takes the lead in setting a technological standard may play the role of a pseudo upper manager (Garud, et al., 2002), but it is unclear whether they could manage the problem effectively without formal authority. In addition, specialization tends to go hand-in-hand with fractionation of knowledge and information, making it difficult for one company to analyze and process exception issues, which then remain unresolved.

Consider a customer encountering a problem with a technological system, in which multiple companies have divided the work based on a technological standard. None of the individual companies will be able to solve the problem for the customer because none of them will be able to understand the fundamental cause completely. In such a situation, it will fall to the customer to resolve the problem.

In the road-racer components case, because the friction system allowed for the combination of various manufacturers' components, riders needed special skill to change gears, taking into account the compatibility of the various components, and were required to deal with any problems that arose. Further, while compatibility issues could be solved by interaction among components makers, there was no single, powerful actor who could undertake all of the problems in the industry on their own. By contrast, because the SIS was composed only of parts made by Shimano, it is the company and not the customer who is responsible for resolving issues, thus decreasing the burden on riders.

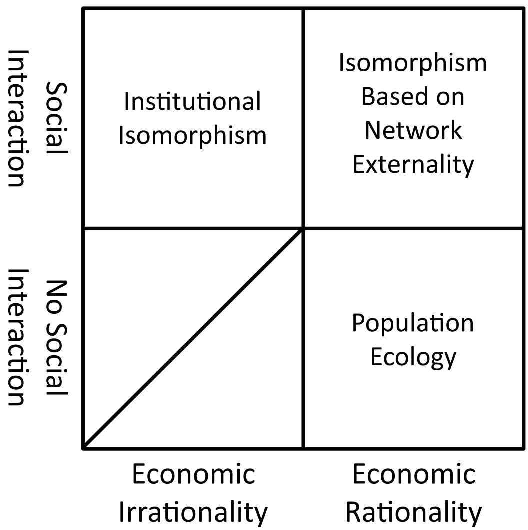
This issue applies not only to the road-racer components industry but to other situations, such as personal computers installed with Windows (and peripheral devices). The elements of the Windows PC have been developed by a division of labor among various companies based on technological standards, and this development has resulted in many unresolved issues. Even today, although the components of the system are updated frequently, there is persistent malfunctioning. When a user is faced with a malfunctioning PC, they have to determine whether the cause is the compatibility between hardware and software or only in the software, and solve the problem themselves. Unfortunately, as the technological systems have improved, the related problems seem to have increased rather than decreased. A system that would function like a hierarchy in an organization could help to address these issues and an effective way to add such a function in to the system of division of labor should be considered in future researches.

A new pattern of organizational isomorphism

The case presented in this article suggests that there is a pattern of isomorphism of organizational forms that has not been extensively discussed in existing research and that this pattern might make it difficult for companies to easily change their organizational structure. Existing research has mainly discussed two typical patterns of isomorphism in organizations. One is isomorphism caused by natural selection, which has been considered by population ecologists (Hannan and Freeman, 1997). They argue that only those organizations that are able to adapt to their surrounding environment survive, resulting in isomorphism across the surviving organizations. In this discussion, economic rationality would be regarded as only one factor that determines desirable organizational forms. The other is the idea that isomorphism is caused by institutions, which has been discussed by neo-institutionalists (DiMaggio and Powell, 1983). They argue that not only economic rationality but social institutions often affect organizational forms, leading to isomorphism.

This article suggests that there is another isomorphism pattern, one caused by network externality. This pattern occurs when a division of labor exists, leading to improved efficiency of market transactions and increasing the merits of specialization. This scenario could result in companies with similar organizational structures (Coase, 1937; Williamson, 1975). This pattern of isomorphism would be different from population ecology in that it may be caused by social interactions between organizations, and from institutional isomorphism in that it may be based on economic rationality (Figure 1).

Figure.1 Three ideal patterns of isomorphism of organizational forms



This third pattern of isomorphism affected organizations in the road-racer bicycle components industry illustrated in this article. As the number of companies sharing common technological standards increased, the benefits for a given company of specializing in specific components grew, and the division of labor expanded.

Although this isomorphism is usually advantageous for organizations, a company that wants to change their organizational form may be putting themselves at risk. Because decisions regarding economic efficiency are made *collectively* among many organizations, a company that tries to change its organizational boundary, may be disadvantaged in the short-term if other companies fail to follow suit. Around 1975, Suntour structured an alliance among major Japanese components makers to compete with Shimano’s system components concept, and produced the "Superbe" components set. However, synergies between the participating companies were disappointing and the project failed. It may be that the other companies in the group were afraid that too close an alliance with Suntour would exclude them from the broader market.

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