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Motives and barriers of the remanufacturing industry in China

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ABSTRACT

Realizing the importance of remanufacturing for sustainable development due to the large scale of the economy and its increasing pressure on the environment, the Chinese government has been strongly promoting its remanufacturing industry since around 2008. The objective of this paper is to identify the motives and barriers for remanufacturing in China. According to the survey conducted among remanufacturers in China, *environmental and ethical responsibility*, *customer orientation* and *strategic advantage* are the three most important motives, while *customer recognition* is the most serious barrier at present. This survey also shows that there are many differences between car part and machinery remanufacturers in China. For example, car part remanufacturers are more motivated by *subsidies*, at the same time, they are also more restricted by *legislation*, while *lack of sales channels* is a more serious barrier for the machinery remanufacturers. The differences exist partly due to the Chinese remanufacturing environment, for example the policies from different government departments that regulate the related industries. Suggestions for improving the remanufacturing industry, in particular from the policy makers' perspective, are provided according to the survey results.

1. Research background

Remanufacturing is the process of collecting used products/parts (cores), and recovering the quality of those cores to the same/like-new condition, by a number of procedures such as core disassembly, cleaning, examining, repair and replacing parts, resizing, assembly, quality testing, etc. According to several research studies, remanufacturing saves energy and resources, which benefits the environment and also provides value for customers (Sundin and Lee, 2011). As a business, remanufacturing has been long developed in the United States and Europe.

According to a multi-case study of five automobile engine remanufacturing companies and 130 interviews made by Seitz (2007), the influences of classic motives, for instance legislation, profitability, moral and ethical concerns, are actually low for OEM remanufacturers. Profit is weak for them because of the barriers of uncertainty in core acquisition, competition for cores, the necessity to incorporate expensive new parts, and high labor cost. New motives identified by Seitz (2007) with high influence are: *secure spare part supply, warranty, market share* and *brand protection,* and *customer orientation*. Other identified motives found in previous literature are: *competition, strategic advantage*, etc. (see e.g. Östlin et al., 2008a,b).

Through an industrial survey, Lund (1983) discusses some of the barriers which are peculiar to remanufacturing in America: market attitudes, a lack of high-quality cores and reasonable cost, opposition from OEMs, and frequent change designs. He also mentions that tariff barriers and lack of demonstrated successes could be problems for developing countries. Other identified barriers that limit the profitability of remanufacturing include *lack of product knowledge, lack of technology*, and *legislation restrictions*. A summary of remanufacturing barriers can be found in Lundmark et al. (2009), who state that *uncertainty* and *complexity* are the main challenges to remanufacturing. There have been previous surveys conducted about remanufacturing companies' motives and barriers, for example, according to the survey conducted in Greece (Kapetanopoulou and Tagaras, 2010), *customer service* and *green image* are identified as the top motives for companies to embark on product recovery activities, while the greatest barriers are that such activities do not fit well with or greatly complicate the existing operations. The studies in Sweden (Sundin et al., 2005) and Finland (Guidat et al., 2014) observe that motives such as *improving*

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turnover, *competition* and *strategic advantage*, barriers such as *high cost related with remanufactured products*, *lack of control*, *lack of economic incentives*, etc. are important for remanufacturers.

As shown in the studies above, the main motives and barriers for remanufacturers have been investigated in different countries, and their variations indicate that they are in fact region-dependent. The remanufacturing industry in China, despite its great potential, has only recently been strongly promoted by the government. Increased manufacturing industry growth in many ways makes remanufacturing in China interesting to study. For policy makers and company managers, it is also of great importance to understand the motives and barriers of the remanufacturing industry in China in order to enhance their decision-making process. It could also be interesting for academia to help formulate research questions, establish related research objectives and provide appropriate research assumptions. Therefore, ***the objective of this paper is to identify and explore the motives and barriers for remanufacturing in China***.

In the following section, the recent development of the remanufacturing industry in China is described to provide background information. In Section 3, the research questions and methodology are explained. The results of the survey study are then presented in Section 4. Next, discussions of the results are presented in Section 5. Finally, conclusions of the study are summarized in Section 6.

2. Remanufacturing in China

China's economy has been growing rapidly in the last decades. This development also boosts the domestic market. Taking the automotive market as an example, it has maintained a hasty growth rate in recent years. China surpassed the United States to become the world's largest automotive market in 2009, a year in which China produced about 13.8 million vehicles including 10.4 million passenger cars (sedans, SUVs, MPVs and crossovers) and 3.4 million commercial vehicles (buses, trucks, and tractors). In 2013, China became the first country to sell more than 20 million vehicles (OICA, 2014). This trend continues according to the recent report, with sales in the first three months of 2014 increasing 9.5%. The number of registered vehicles on the road in China reached 109 million in 2013 (National Bureau of Statistics of China, (2014)), and is expected to exceed 200 million by 2020 (The Central People's Government of China (2012)).

The figures above indicate that the automotive industry in China is now still enjoying an expanding market. However, along with the growing number of new car purchases, there is a question to face in the coming years: how to deal with returned vehicles and returned car parts in a sustainable manner. Remanufacturing in this case provides an alternative to used returned cores instead of virgin materials for reprocessing car parts. This remanufacturing business is in particular interesting and important for the automotive service market. The economic advantage in many countries has proven remanufacturing to be a lucrative business. In addition, it can substantially reduce the resources input, and thus this is a perfect example of clean and sustainable manufacturing.

Nevertheless, in China there are some regulations and directives which limit the activities of remanufacturing (some of the constraints are being relaxed though). According to the Scrap Automobile Recycling Regulations of 2001, it is forbidden to use end-of-use vehicle parts for remanufacturing. This greatly limits the potential resource of returned cores for remanufacturing. The Motor Vehicle Maintenance and Management Regulation sets constraints on replacing engines and some other key parts. The related legal procedure usually takes as long as five months. In addition, the lack of standards (with respect to remanufacturing products quality and functions) makes the remanufactured products less trusted by customers.

The above paradox also exists in other industries in China, such as machinery, electrical and electronic. With a population of around 1.3 billion, the rapid economic growth in China brings enormous pressure on its environment. For instance, air pollution has been a severe nation-wide problem, partly due to the drastically increasing consumption of natural resources during manufacturing. According to official data from the Ministry of Environmental Protection, in 2013, none of China's 74 major cities met the World Health Organization's (WHO) recommendations for particulate matter of 2.5 μm or less (PM2.5). In fact, almost 92% of these cities have average annual PM2.5 air pollution concentrations that fail to reach the national standard (35 μg per cubic meter) (Tan, 2014). Besides, water and soil pollution have also been reported to become very serious in China (Pei, 2014; Kaiman, 2014).

Realizing the importance of remanufacturing for sustainable development in the country, the Chinese government has recently modified a series of policies to promote the remanufacturing industry (Table 1). For example, the restrictions on reusing key parts from automobiles were recently withdrawn so that remanufacturing can become possible. A series of technical standards for remanufactured products have also been drafted (Zhang et al., 2011) to guide and regulate the remanufacturing business.

For setting examples and experimental purposes, 14 companies were certificated as pilot automobile remanufacturers by the National Development and Reform Commission (NDRC) in 2008. Subsequently in 2013, additional 28 pilot car part remanufacturers were certificated. In addition, 33 machinery and electronic remanufacturers were certificated as the pilot remanufacturers by the Ministry of Industry and Information Technology (MIIT). These pilot remanufacturers receive more government supports, such as subsidies and technology guidance. On the other hand, they may be more restricted by the regulations, which will be discussed later in Section 5.4. They can be further categorized by products, as seen in Fig. 1.

Remanufacturing is a labor-intensive industry, due to its various production processes involving manual operations. Thus, a low labor cost brings a great advantage for the developing remanufacturing industry. China has long been well-known for its low labor cost, which is an important reason for China being the world's manufacturing center. Although the labor cost has increased in recent years along with its economic growth, it is still relatively low compared with other industrialized countries.

From a market perspective, despite its huge market China should be aware that its income is still relatively low: the GDP per capita was 6091 USD in 2012, which is less than 1/8 of that in the United States at 51,749 USD (The World Bank, 2014). Consumers in China are often price sensitive; thus, they could be in favor of remanufactured products if the prices are lower than for new ones. Also, with the huge market size there are more cores in the technosphere to be collected. Sufficient volume of cores and potential high demand especially benefit remanufacturers to reach a lower unit cost due to economics of scale. It is interesting to see whether the remanufacturers in China are actually motivated by remanufacturing due to its high profitability.

From our viewpoint, all of the factors above are positive for the profitability of remanufactured products. Nevertheless, also due to the above characteristics, the Chinese remanufacturing industry could behave differently compared with other countries and regions. It is important to understand the motives and barriers from the Chinese remanufacturers' perspective. Chen (2005) describes the situation of ELV recycling in China based on a case study. The author mentions the challenges of technology issues, as well as the government legislation that restricts engine remanufacturing for