Offshore Remanufacturing

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1. INTRODUCTION

Since many countries are paying more and more attention on environmental and sustainable issues, there are increasing requirements that promote manufacturers are environmentally and friendly to collect, recover, and dispose their end-of-life products and parts. In the light of this statement, *remanufacturing,* which is an industrial process in which worn-out products are restored to like-new condition, thus becomes a matter of strategic importance for manufacturing or service companies (Xing & Gao, 2014). For example, best business practice of companies such as IBM, Xerox and Canon, as well as academic researches (e.g., Ferrer, 1997; Sundin & Bras, 2005) indicate that remanufacturing used products or modules has great economic, environmental and societal benefits. However, remanufacturing is just one of the options, but not the panacea. Cost reduction, competitive pressures, and changing rules (e.g., accessing to new markets and qualified personnel), to name just a few, are factors with the same importance as economics.

Nowadays, the continuing trend towards companies to source processes outside of their organizational boundaries (outsourcing) or abroad (offshoring) is well documented (Beulen, Fenema, & Currie, 2005; Arie Y. Lewin & Volberda, 2011). Offshore remanufacturing is an integral component of future operations strategy (Galbreth & Blackburn, 2010). This has become global in scope, with companies shifting service activities to low-cost economies such as India, China and Eastern Europe (Jahns, Hartmann, & Bals, 2006; Youngdahl & Ramaswamy, 2008). In the meantime, this subject also poses a great challenge in modeling and analysis of offshore remanufacturing decisions. For example, offshore remanufacturing involves higher shipping and handling costs and longer lead times relative to domestic production. To assure success in remanufacturing, the practitioners such as original equipment manufacturers (OEM) must design and implement a reverse logistics (RL) network for recovering and supplying used products or modules to the reproduction chain.

Motivated by these facts, in this work, we attempt to take a preliminary investigation of the offshore remanufacturing regarding the major challenges around. Briefly, the remainder of this article is organized as follows: Subsequent to the introduction in Section 1, the background of offshoring and remanufacturing is briefed in Section 2. Then, the existing challenges faced by offshore remanufacturing are outlined in Section 3 which is followed an illustrative solution regarding the transshipment issue encounter during offshore remanufacturing is given in Section 4. Next, the future research directions in the context of offshore remanufacturing are also provided in Section 5. Finally, the conclusion drawn in Section 6 closes this article.

2. BACKGROUND

2.1 Offshoring vs. Outsourcing

The growing pressure to reduce cost and improve efficiency promotes many organizations to adopt international operations strategy, which means shifting their production/service functions globally. Generally, increasingly companies consider the relocation of high value tasks characterized by a high degree of complexity and knowledge intensity to (a) own plants overseas (captive offshoring), (b) to external services providers overseas (non-captive offshoring or offshore outsourcing), (c) domestic external service providers or alliance partners (outsourcing) (Arie Y. Lewin & Volberda, 2011; Metters, 2008).

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It seemingly, the most distinct choices of offshoring and outsourcing are only focused on the location issue (i.e., a process is performed within the home country or not). However, each of these choices should be tailed depending on its individual objectives desired from a process, such as local image or cheap competence. Usually, firms adopt offshoring strategies (i.e., captive offshoring and/or offshore outsourcing) for a variety of reasons. According to the literature (Honeycutt, Magnini, & Thelen, 2012; Sharma, Iyer, & Raajpoot, 2009), the first reason goes to cost which is often regarded as an overriding factor; then, the second reason is to retain the flexibility, that is, keep staffing and costs in alignment with changing needs and trends; while the third one lies in that firms and investors are offered governmental incentives by the host countries to offshore activities into developing countries; last but not the least, offshoring can add value to a business by using highly educated experts in chosen destinations. Lewin and Couto (2007) suggested the process of offshoring is no longer only about cost-saving in relocating codified tasks, but it is increasingly concerned with strategically important and knowledge intensive tasks. On the other side, DiRomualdo and Gurbaxani (1998) argued that firms use outsourcing commonly based on the following three strategies: business improvement, business impact, and commercial exploitation.

Summarizing these two choices, one of the pervading concepts is that of reducing cost and improving efficiency, focusing on the strategic goal. So far, some companies adopted separated strategies which means either to outsource work but not offshore it (for example, hiring an outside logistic company to transport containers instead of doing in house) or to offshore work but not outsource it (for example, a Dell customer service center in India to serve American clients). However, more recently Metters (2008) pointed out that due to many firms lack the scale necessary to establish a pure offshore unit, so if offshoring is chosen, outsourcing must also be present. In a similar vein, Karmarkar (2004) argued that those two typology should be seen as a spectrum of choices, rather than a categorical variable. As a consequence, combining outsourcing with offshoring into ones (i.e., offshore outsourcing) is becoming more and more popular (i.e., hiring a vendor to do the work offshore). This is especially true in the case of manufacturing - with China being a leader - and information technology services, with India leading that space. The main merit of offshore outsourcing is not only to reduce cost, but also take advantage of the vendor's expertise.

2.2 Remanufacturing

Currently there is no single standard definition of remanufacturing existing in the literature and we have listed some of them as follows:

- **Definition 1:** "Remanufacturing is an end-of-life strategy that reduces the use of raw materials and saves energy while preserving the value added during the design and manufacturing processes (Zwolinski, Lopez-Ontiveros, & Brissaud, 2006)."
- **Definition 2:** "Remanufacturing is an industrial process whereby used products referred to as cores are restored to useful life. During this process, the core passes through a number of remanufacturing operations, e.g. inspection, disassembly, component reprocessing, reassembly, and testing to ensure it meets the desired product standards. This could sometimes mean that the cores need to be upgraded and modernized according to the customer requirements (Östlin, Sundin, & Björkman, 2008)."
- **Definition 3:** "Remanufacturing is the ultimate form of recycling. It conserves not only the raw material content but also much of the value added during the processes required to manufacture new products (Giuntini & Gaudette, 2003)."
- **Definition 4:** "Remanufacturing can be seen then as an advantageous product recovery option. Not only is it the case, as it is with other options e.g. recycling, that less waste must be landfilled and less virgin material consumed in manufacturing but also the value added in the manufacturing of the components is also "recovered." It also saves the energy needed to transform and sort the material in recycling products (Langella, 2007)."