John Deere Reman - Creating Value Through Reverse Logistics

John Deere Remanufacturing is an economically favorable, social and environment-friendly closed-loop supply chain solution. Remanufacturing is often a more complex process than manufacturing due to a higher level of uncertainty in processes involved, components owned by suppliers, and most importantly, the supply of cores with the presence of high incentive providing third-party remanufacturers. JDR can improve its core return rate with an active and improved core acquisition process, adopting better consumer policies, spreading consumer awareness, and using third party collectors. Other operational gaps like EOL options, designing, cleaning, and assembly can also be improved. In the future, they can also advance by employing a hybrid system with both manufacturing and remanufacturing platforms working simultaneously to save costs and achieve higher profits.

Value Proposition for JDR

Reduced raw material cost, Environmental sustainability and Energy savings: In the last few years, concern about growing consumption of raw materials, generation of environmental emissions and shortage of energy resources has become particularly critical to manufacturing industries [2]. John Deere's remanufactured parts incur costs that are between 20-40 percent less than new parts with equivalent warranties because most of the raw materials already exist in their final shape requiring a fraction of the material processing. Further, remanufactured engines and components help keep products from ending up in landfills and can have great impact on reducing greenhouse gases, John Deere Reman has prevented over 125 million pounds of landfill wastes in the last five years [3]. It also uses about 85% less energy than mining, refining, melting and machining of new cores from scratch [4]. Thus, John Deere's Reman recovers the whole component with same quality, functionality and warranty when compared to a new one, it can be considered as a very favorable value proposition for environmental, social and economic sustainability.

JDR constraints in obtaining cores and process improvement

Product Mix: Products at John Deere Edmonton plant is a mix of Deere-designed components with intellectual property (IP) owned by Deere, and some components (such as drivetrain, axles and transmissions) with IP owned by suppliers. Supplier owned components are a potential barrier for the remanufacturing process, where JDR might require participation of original suppliers in outsourcing remanufacturing. This dependency leads to strong supplier decision-making in cost decision and supply time span of remanufactured cores. Further, licensing the whole technology might lead to greater litigation risks such as breakdown of license negotiation, product liability suits and diminution in quality and value of product technology [5]. Reverse engineering the most commonly used products and parts for in-house production will be as costly as producing new parts from scratch.

Uncertainties and Dependencies: The issues of unpredictable and extremely long processing and waiting times, unknown number of required operations in process, high level of inventory and lack in information about incoming cores are constraints to make remanufacturing a profitable business. Further, Remanufacturers depends on mature product life-cycle actors, who dictate business rules. Being the last joint actor in the product life-cycle, it has to adapt to the changing market environments and make its processing methodology very agile.

Difficulties in obtaining Cores

Core acquisition and competitions for cores pose difficult challenges for remanufacturers [6]. Below are some difficulties that remanufacturers face in obtaining the cores:

Core return uncertainties: The availability of cores depends on customer returns. Uncertainties that remanufacturers commonly encounter include: the uncertain timing and volume of returns, and the uncertainty in the quality of returned cores [7]. As the core returns rate fluctuates, sometimes when the core is required it may not be available in the inventory.

Relationships between the remanufacturers and customers: For cores that are owned by manufactures and only leased to the customers, the probability of core return is very high. However, core return rate is relatively small when customers own products [7].

Market competition for cores: Other remanufacturers in the market may buy the cores from customers and offer higher core charges. The incentive for customers to return the core to other remanufacturers will be high.

Logistics convenience: Reverse logistics plays an important role in core acquisitions. Inability of manufacturers to provide efficient logistics for easy core return may harm their chances to get their core back.

Dependency on dealers: Dealer channel is the main source for acquiring cores, around 95% of the cores for John Deere come through dealers. Also, the primary source of information about life cycle-stage of cores are the customers' feedbacks given to the dealers.

Seasonal nature of the sales cycle: Inventory gain for certain type of cores due to seasonal nature of sales and return cycle complicates core return process. Excess inventory (lack of space) can adversely impact the financial performance of a remanufacturer; acquiring cores in such a situation is not feasible.

Customers' behavioral aspects: Customers' behavioral aspect may alter the chances of a core return. For example, customers with more environmental awareness and willing to contribute their humble bit for environment protection are more likely to return cores.

Opportunities at JDR to improve its current model

To increase core return rate, JDR can take the following steps:

- Actively manage the process of core acquisition
- Like Caterpillar Inc., adopt a deposit-refund policy with the customers to ensure both the quantity and quality of the returned cores [8]
- Using quality classification methods, grade and categorize the returned cores into different classes based on their quality. ReCellular and Caterpillar, Inc. divide their cores into three classes and then give different incentives based on classes.
- Use services of third-party collectors for effective collection and management of cores [8].
- Use third-party platforms for core supply and demand information [9].
- Ease of core return with efficient reverse logistics can ensure high core return rate.
- Increase environmental awareness among customers with advertising which will motivate customers for recycling their used products
- Use technological advancements like machine learning techniques to predict when a core is going to fail and proactively reach out to the customers. Also, they can find end-of-usage life for a core using analytics than rather than depending on dealers.
- Build a platform model that can integrate suppliers, vendors and end users.

Along with the above discussed solutions to increasing core return rate and acquiring right cores, C. Garrison can also recommend following opportunity areas for improvements:

Design of products: Products can be designed to be easily disassembled and reassembled, leading to efficient and profitable remanufacturing process. Unfortunately for most manufacturing industries, disassembling results in high operational costs or high scrap rates, or both. Lack of focus leads to market conditions in which remanufactured products might not have a significant price advantage over new products, resulting in relatively low demand.
End of Life (EOL) options: Since not all cores can be remanufactured efficiently (such as supplier owned cores) other common EOL options like reconditioning, replacement, repair, salvage, cannibalization, dismantling/ disassembly, resale etc. can be selected. Best EOL options for each component can be derived using advanced algorithms like mixed integer programming (MIP), Genetic Algorithms, Pareto Optimal, Fuzzy Logic etc. Also, PESTEL framework can be studied for best performing operational framework [5].
Level of disassembly: Full disassembly requirement can be case-specific with a trade-off between cost of disassembling and value of remanufactured component. Thus, John Deere should decide the levels of disassembling while taking economic, engineering and environmental factors into consideration.
Cleaning: Cleaning can be a resource as well as labor intensive task. In order to reduce costs and improve cleaning performance, parts of the same category can be sorted with respect to their recovery method, materials, and contamination and then cleaned together [8]. Also, each technique has its own positive and negative impacts on the remanufacturing results, hence decision making is important.
Workforce Planning: Remanufacturing is a dynamic and varied production environment where blue-collar workers require initial training and skills, with the long-term benefit of a higher work satisfaction. Also, retired and laid-off factory workers would be in high demand due to their experience in disassembling and reassembling products. Targeting right workforce can lead to more efficient operational model.

Alternatives to core acquisition

Seeding is an alternative to core acquisition when returned cores are not easily available. “Selling new products as remanufactured at the start of a product cycle” is called seeding. Seeding helps remanufacturing firms in increasing number of core quantities in the early stages of a product’s life-cycle. It also helps in fulfilling the demand for remanufactured products. A numerical study described in [7] concludes that seeding when properly implemented can increase a firm’s remanufacturing profits by 23% on average and 40% maximum over the product's lifecycle [7]. Industries such as automotive parts and heavy equipment reman employ seeding because unavailability of cores can significantly hamper their operations [7].

Another alternative to core acquisition is to use the hybrid system for remanufacturing. In a hybrid system, a company performs both manufacturing and remanufacturing operations. Currently, JDR at Edmonton, Alberta has a non-hybrid system as it is only dedicated to the remanufacturing process. In the hybrid system, manufacturing and remanufacturing operations share the same production facility and resources. Implementing hybrid system has its own challenges like complexity and cannibalization [12] but it can be resolved if only smaller, frequently required and common parts or the parts that are not usable in most core returns can be manufactured.

Closed-Loop or Open-Loop SC

JDR should choose closed loop supply chain management. Closed loop has many benefits. JDR would be able to achieve higher margins as they do not have to pay for the new raw material. It also supports environment sustainability as there is less consumption of raw materials and hence less use of energy and landfill. It would also improve the reputation for JD as sustainability is now a priority for companies. According to [13], it also creates significantly more jobs than waste processing and landfill.

Apart from being compliant to environmental legislations and cost savings, closed loop supply chain for JD will give customers more flexibility to return the product that do not satisfy their demands. Guide and van Wassenhove considered closed-loop supply chain as a means of creating value, as much as possible, by systematic design, control, and operation [14]. In addition, considering the whole life cycle of products, and using different manners of product recycling, are also advantages of a closed-loop supply chain. Closed-loop supply chain management is the design, control, and operation of a system to maximize value creation over the entire life cycle of a product with dynamic recovery of value [14].

The opportunity costs associated with participating in secondary product market is cannibalization. But the loss with not using closed loop for JDR includes the cost of future potentially expensive legislation, the cost of leaving a lucrative market open to a third-party firm who may remanufacture and resell JD's cores, and the reduction in the customers' value for new cores due to the resale value effect [15].

Conclusion

John Deere's Reman is considered as the main source of retaining value from used products, circular consumer engagement, and environmental sustainability. However, its application is more complex than traditional manufacturing due to the volatility associated with the quantity, quality and return timing of used cores. Various methods of optimizing remanufacturing outcomes such as identifying the best EOL options, acquiring the right amounts of cores, deciding best-suited disassembly level, applying cost-efficient cleaning techniques, and considering product commonality across various product lines can be explored. The decision about one remanufacturing activity will greatly impact subsequent activities and final remanufacturing outcome centric to productivity, economic performance, and the proportion of core recovery. Also, the opportunity cost of losing the market to the competitors is very high. Therefore, a holistic approach of integrating different decisions over multiple remanufacturing activities is a key to improve JDR business model.

Appendix B: References

[1] Chandrashekhar, R. (2018) John Deere Reman: Creating Value Through Reverse Logistics. Ivey Business School Foundation

[2] Gunasekaran, A., & Spalanzani, A. (2012). Sustainability of manufacturing and services: Investigations for research and applications. International Journal of Production Economics, 140(1), 35-47. doi:10.1016/j.ijpe.2011.05.011

[3] John Deere. (2019, April 11). Retrieved from https://www.deere.com/en/our-company/news-and-announcements/news-releases/2019/construction/2019apr-11-reman/

[4] Lescohier, J. (2013, January 10). Are Remanufactured Machines Worth a Look? Retrieved July 17, 2019,from https://www.forconstructionpros.com/business/article/10851698/are-remanufactured- machines- worth-a-look-for-your-equipment-rental-business

[5] Sakraan Sitcharangsie, Winifred Ijomah, T.C. Wong, Decision makings in key remanufacturing activities to optimise remanufacturing outcomes: a review, Journal of Cleaner Production (2019), doi: 10.1016/j.jclepro.2019.05.204

[5]https://www.mayerbrown.com/-/media/files/perspectives-events/publications/2018/08/the-pros-and-co ns-of-licensing-technology/files/the-pros-and-cons-of-licensing-technology/fileattachment/the-pros-and-cons-of-licensing-technology.pdf

[6] Seitz, A: A critical assessment of motives for product recovery: the case of engine remanufacturing. J. Clean. Prod. 15, 1147–1157 (2007).

[7] Wei, Shuoguo; Tang, Ou; Sundin, Erik (2015): Core (product) Acquisition Management for remanufacturing: A review, Journal of Remanufacturing, ISSN 2210-4690, Springer, Heidelberg, Vol. 5, Issue 4, pp. 1-27.

[8] Hedal, S., Shinde, Y., Somani, P., (2017). Reverse Logistics and Remanufacturing in Industry, International Research Journal of Engineering and Technology.

[9] Ahmadi, Hossein & Battle, Kimberly & Marwala, Tshildzi & Nelwamondo, Fulufhelo. (2010). Artificial Intelligence in Reverse Supply Chain Management: The State of the Art.

[10] https://www.slideshare.net/TimLewis29/john-deere-final

[11] Fadeyi, J. A., Monplaisir, L. & Aguwa, C. 2017. The integration of core cleaning and product serviceability into product modularization for the creation of an improved remanufacturing- product service system. *Journal of Cleaner Production,* 159**,** 446-455.

[12] https://www.researchgate.net/publication/326726397_Improving_Remanufacturing_ Core_Recovery _and_Profitability_Through_Seeding

[13] https://channels.theinnovationenterprise.com/articles/why-you-should-aim-for-a-closed-loop-supply-chain

[14] https://www.researchgate.net/publication/269828342_The_Carbon_Subsidy_Analysis_in_ Remanufacturing _Closed-Loop_Supply_Chain

[15] Ferguson, M., (2009), Strategic Issues in Closed-Loop Supply Chains with Remanufacturing. https://pdfs.semanticscholar.org/8bd8/197164d8576b51b7de4e07f4fc84b8771d42.pdf